CoST
Malawi

CoST ASSURANCE REPORT II For the Year 2021

12 APRIL 2021

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LIST OF ACRONYMS

AGCOM : Agricultural Commercialization Project

BwB : Blantyre Water Board

CERC : Contingency Emergency Response Component

CoST : Construction Sector Transparency Initiative

DoB : Directorate of Buildings

FIDIC : Federation Internationale des Ingenierurs-Conseils (International Federation of Consulting Engineers)

GDP : Gross Domestic Product

IDA : International Development Agency

IDS : Infrastructure Data Standard

IMF : International Monetary Fund

IPC : Interim Payment Certificate

IPDC : Internal Procurement and Disposal Committee

LwB : Lilongwe Water Board

Malawi MSG: Malawi Multi-Stakeholder Group

NCIC : National Construction Industry Council

NRW : Non-Revenue Water

ODPP : Office of the Director of Public Procurement (Now PPDA)

PDE : Procuring and Disposing Entity

PPDA : Public Procurement and Disposal of Assets Authority

RA : Roads Authority

WWTP : Wastewater Treatment Plant

EXECUTIVE SUMMARY

This Assurance Report seeks to assess the levels of compliance by PDEs, carrying out publicly funded projects, with requirements for disclosure of information to the public and measures the transparency of the construction sector. The report makes recommendations for key findings and the responsible agencies are highlighted for them to be aware of the issues and take possible action.

Proactive and Reactive Disclosure of Data

Analysis of disclosure of project information by PDEs has improved taking the 2019 Assurance Report as baseline. This study used 58 data points disclosed proactively. Proactive Disclosure (Which is release of data before it is requested, e.g., data posted on a website) varies from 50% to 64% across all PDEs in this study. This compares favourably with 2019 results which varied between 8% and 11% compliance.

To enhance the level of compliance for the future, this study recommends PDEs should update institutional websites as this is one of the main sources for data collection.

Reactive disclosure (Which is collection of data that the PDE is required to submit to any eligible entity that requests it) had 26 data points required for Disclosure. Compliance across PDEs was a high of 77% and a low of 58% per institution. The 2019 Assurance Report had a range of 2% to 27% compliance; which was low. So there has been an improvement in the compliance in Reactive disclosure of data.

Overall results for proactive and reactive disclosure of data show a similar improvement in compliance as compared to 2019. At Institutional level, compliance with proactive disclosure ranged from 59% to a high of 66%. 2019 results ranged from 10% to 45%.

This study recommends that in compliance with Access to Information Act, which is now operational, there should be enforcement for institutions that fail to comply with a request for disclosure of information.

Chapananga Road and Bridge

The designer of the Chapananga bridge did not have historical Chapananga river flow data to aid in the design. Although this in and of itself is not a problem for the designer as there are other robust methods that he used to design the bridge. This study recommends that the Department of Water should start keeping water flow records on this river as it is more than likely there will be more flooding at this location given the heavy agricultural use of the catchment area for Mwanza River that may affect the bridge at Chapananga.

Chapananga bridge western approach road was damaged during the floods that took place in the 2020/21 rain season. The findings of this study are that the damage to the approach was not caused by workmanship problems but rather due to the nature of the river which shifts course and environmental factors caused by increased agricultural use of land in the catchment area of the river. The flood action undermined the road embankment on the western approach.

Chapananga Bridge is good example of infrastructure in Malawi which has been affected by climate change. For more robust and resilient bridge structures for Malawi, there is a need for the country to prepare for the future in making infrastructure more adaptable to climate change.

Malawi as a country needs to start addressing design of resilient structures to mitigate the effects of climate change. This can be achieved by reviewing Design standards to accommodate the requirements for the changing climate.

This study addressed the question whether Malawi should adapt design of roads favouring asphalt compared with chip seal design requires studies to be conducted.

The question whether Malawi should adapt design of roads favouring asphalt compared with chip seal design requires studies to be conducted. This study recommends research to be conducted which will compare roads built using asphalt road finish specification against double chip seal construction. The research should answer the question whether double chip seal specification is suitable for Malawi road construction. The NCIC and Roads Authority should engage the construction fraternity for this research.

Theft and vandalism of road furniture (e.g., signs) is a major problem in Malawi that requires a multi-pronged attack to resolve. This study found that the 10km stretch on the Chikwawa to Chapananga Road has almost all the signs intact and there is no vandalism. The chiefs in this area and their subjects should be commended for this.

This study proposes that the Government should look at the penalties for theft or vandalizing road infrastructure and if lenient the penalties should be toughened to act as a deterrent against this practice. Secondly, civic education at political rallies aimed at reinforcing community activism to prevent road infrastructure vandalism is necessary. Chiefs also have a role to play. Responsibilities of chiefs need to be performance based with the prevention of vandalism in their areas as one of the key performance indicators. A system can be developed to reward chiefs for meeting set targets for development and sustainability of their communities.

Routine Maintenance Projects

Procurement of Routine Maintenance project is a lifeline for many Malawian Contractors. Most of these Malawian Contractors qualify to undertake works in this niche of road maintenance. However, procurement of Routine Road Maintenance projects was delayed in the 2020/2021 procurement cycle.

Road Maintenance works are supposed to run from June during each financial year for Roads Authority and end by June the following calendar year. During the 2020/21 Financial year, Road Maintenance contracts were awarded in October 2020 with works commencing on 4th October 2020 for the specific project under this study. Effectively, a period of 4 months has been lost due to the late award and commencement. This has resulted in:

- Pothole patching works being undertaken during rainy season.
- Works compressed into 7 months for programmes that are supposed to run for 12 months.
- The Construction sector suffering from huge unemployment due to the lost time and limited budgets.

It is understood that extra layers of vetting have been instituted across all government procurement which has created a backlog in the award of contracts.

This study recommends that ways of speeding up the vetting process for procurement must be implemented as a repeat of the delays in the next procurement cycle for road infrastructure programs shall effectively kill the sector.

Likhubula Blantyre Water Project

The Likhubula source of water project was constructed to improve supply of water to Blantyre City. This study found that the Blantyre Water Board in its 2017 Annual Report stated that it lost 43% (2016 the loss was at 52%) of the water that is pumped from source through illegal water connections and losses due to the age of the system. While this statistic is high, it is a common occurrence in the developing world. However, Blantyre Water Board has made reduction of Non-Revenue Water as a key goal of the institution. The study did not have access to more recent data to see if the situation has improved.

When designing the project, Blantyre Water Board designed the project on the basis of another river with a source from the same catchment area as Likhubula River. This was done because there was no river flow data for Likhubula River.

This study managed to source 50-year historical records for Likhubula River taken downstream of the intake for Blantyre Water Board. The study found that by using the historical data, the Likhubula River should only supply Blantyre Water Board water for 5 months every year instead of 6 as projected in the design. This project from inception was fraught with conflict with the communities surrounding the intake and downstream. The study therefore concludes that conflict with the locals shall be inevitable given that the river has adequate water for everyone only during 5 months in the year. The future is also unpredictable given that the country is suffering from rapid environmental degradation.

Lilongwe Water and Sewerage project

The Lilongwe Sewerage Project which is aimed at upgrading the Kauma WWTP fell into disrepair after only being used for 24 years. This kind of occurrence should never happen to a new infrastructure soon after completion. This study recommends that safeguards must be put in place when operations commence including an enforceable service charter to prevent the same happening again. An investment of US$12 Million is a huge amount to go to waste.

The study found that key personnel were not on the project almost 6 months into the project. A project of this magnitude requires full time presence of key personnel on site. The Assurance Report finds that the Contractor should ensure that all key personnel are available. One of the key requirements and qualification criteria for award of the Contract was the availability of qualified and experienced staff to carry out the works on site.

The Contract was awarded with a budget shortfall of US$ 584,103. The project manager indicated that savings are anticipated from the other components of the master project. The Assurance study recommends that contingency planning should be done early to address this issue in case there are no savings in the other sub-programmes of the Lilongwe Water and Sanitation Project.

Agricultural Commercialization Project

This Assurance Study reviewed one project constructed in Mulanje under the above program. The project is the Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District. The roads at Chenali Irrigation Access Roads Project were not fully completed as funds had to be diverted to Chinama Irrigation Access Roads Project which required more money to complete the bridge due to unforeseen underground conditions. The roads are deteriorating rapidly and shall require constant maintenance. This study recommends that AGCOM finds additional funds to gravel the sections which are not gravelled at Chenali and to re-engineer the steep sections to make the road more accessible; as the objective of improving the access roads has not been met at Chenali Irrigation Scheme.

The Study also recommends that AGCOM should develop training programmes for road maintenance so that when the projects are handed over, the beneficiaries should mobilise and carry out labour based maintenance methods of construction of roads.

Time and Cost Overrun

The study finds that projects were either on-going or and in the case of one project, it was completed but final costs had not been agreed. For the AGCOM project, no data was provided on final costs. Therefore, only one project reported final costs – Likhubula Water Supply Project – and it was constructed within budget and had an extension of time of 4 months with no costs:

Roads Authority

- This PDE has the Chapananga project which was completed in January 2021 and the final account has not been agreed so cost overrun data is not available.
- The Road Patching project in Blantyre City is an on-going contract; data is therefore not yet available.

Blantyre Water Board

- Likhubula Water Supply project was completed and there was no cost overrun.

Lilongwe Water Board

- The Lilongwe Water and Sanitation Project is on-going

AGCOM

- The Rehabilitation of Access Roads Project was completed but the final cost was not disclosed.

1. INTRODUCTION

Construction Sector Transparency Initiative – CoST is a global initiative aimed at improving transparency and accountability in public infrastructure procurement. CoST works in conjunction with stakeholders such as government, industry and civil society to enhance the disclosure, validation and interpretation of data from infrastructure projects.

Malawi was one of the first countries in Africa selected to pilot an Assurance and a baseline study in 2010 and since then, the Secretariat has published numerous reports.

CoST is principally about increasing transparency through the release of project information into the public domain. But it is recognized that the disclosure of this information may not be sufficient on its own to achieve greater accountability. This is because some of the information is likely to be complex and not easily understandable to the public. The CoST Assurance process therefore helps in presenting the acquired data in a format that is clear and helps stakeholders to disseminate the information and are therefore, as a consequence, better equipped to raise pertinent questions with respect to the findings thereof.

The Assurance Consultant obtained project files from the Client, Consultant, and Contractor to undertake a desk study. This was complemented by interviews with the client's project manager, the contractor's supervisor, and residents living in the vicinity of the flooded river who witnessed the collapse of the protection works to the box culvert in order to get first-hand information. This was followed by data analysis and compilation of the report.

1.1 OBJECTIVE

This report assesses how compliant the PDE or Government entity is in the disclosure of information to the public.

The objectives of the Assurance Study are:

1. To Collect, Verify and Analyze the IDS collected from the project under this study.

2. To ensure that the information released by the Procuring and Disposing Entity (PDE) is accurate and is available in a form that can easily be understood by the non-specialist.

3. To capture and disclose the individual significant changes which affect the price or Programme of the selected contract which affect the price or programme and reasons thereof.

Specific tasks undertaken for this study included the following:

- Surfing the CoST Disclosure Portal, reviewing information on the PDE's and the Public Procurement and Disposal of Public Assets Authority[1] (PPDA) websites to ascertain if the PDEs have disclosed the required data;
- Contacting the PDEs for additional data required for disclosure for this report;
- Interviewing the project managers for the client and contractor as well as stakeholders living in the vicinity of the subject projects;
- Analysing the disclosed data;
- Preparing this report

1.2 SCOPE OF SERVICES

This report includes 5 infrastructure projects selected from the following PDEs

- 2 projects from the Roads Authority
- 1 project from Blantyre Water Board
- 1 Project from Lilongwe Water Board
- 1 Project from Agricultural Commercialization Project

[1] The office of the Director of Public Procurement (ODPP) was transformed into the Public Procurement and Disposal of Assets Authority through the enactment of the PPDA Bill of June 2017

2. BACKGROUND

2.1 INFRASTRUCTURE TRANSPARENCY IN MALAWI

The government of Malawi has placed emphasis on infrastructure development as a key element of the Malawi Growth and Development Strategy. Between 1990 and 2015, investment in this sector averaged 5.5% of GDP. In recent years, almost 85% of this, according to the IMF, is externally funded and spending by local authorities represents only between 1.0 and 1.5 percent of the domestically-financed component of public investment.

The local component for investment in infrastructure has seen an increase in the number of roads upgraded to bitumen standard. Studies have shown that this attracts mismanagement of projects. Studies, according to Transparency International (2014) …tailored towards the business community…suggest that corruption in customs, tax administration and public procurement is common and particularly serious (Heritage Foundation 2013). These surveys reveal that corruption in Malawi is not restricted to certain vulnerable sectors, but is a generalised phenomenon in the public sector. CoST Assurance studies therefore are vehicles used to measure whether inroads are being made in the fight against mismanagement of infrastructure projects.

In the effort to stem widespread mismanagement of projects in the public sector involved with public sector procurement, CoST Malawi launched the Disclosure Portal for Public Projects in 2017. With this portal operational, the public shall be able to access project information for public infrastructure. Release of information through this portal shall result in more transparency and accountability by engaging the public in a two way conversation in the discourse of public infrastructure.

In keeping with Section 37 of the Constitution of Malawi and as amplified by the Access to Information Act (2017), which states that any person shall have the right to access information, which is under the control of a public body, the introduction of the portal opens doors for the dissemination of information on infrastructure that was previously not accessible. Further, this translates to the public gaining access to information at little cost.

CoST Malawi has also embarked on media training to equip journalists to report on infrastructure objectively without twisting the facts.

2.2 ASSURANCE – AIMS AND OBJECTIVES

During the 9 years or so that CoST Malawi has been in existence, there has been noticeable positive change in the response by PDEs to requests for disclosure of information on publicly funded projects. While as in the beginning there was lack of complete cooperation by PDEs, by

and large they are proactively providing data and when requested are ready to provide information willingly.

CoST Malawi operates on the following principles which inter alia include:

- The Government is responsible for providing reliable and safe infrastructure which should in turn support sustainable economic growth and development of the country;
- Transparency in the implementation of public infrastructure enables government to be held accountable by citizens;
- Public disclosure of information during the project cycle can provide a means through which the citizens get value for money on publicly funded infrastructure by reducing opportunities for corruption through increased scrutiny;
- Transparency promotes investor confidence. Domestic and foreign direct investment is likely to be increased by transparency in the management of construction projects.
- Multi-stakeholder cooperation reflects shared interest and responsibility, improves transparency and builds confidence that all points of view are being taken into account.

Through the above principles, CoST Malawi acts as a catalyst for PDEs to disclose data on public infrastructure projects so that information on the purpose, scope, costs and execution of projects is disseminated by the public in a timely and understandable manner so that the public can be informed and have a chance to interact with the relevant public authorities to seek more information and clarifications when and where appropriate.

In order to enhance accountability, the data disclosed is reviewed by an independent Assurance Consultant.

2.3 SELECTION OF PROJECTS

This report includes 5 infrastructure projects as follows:

- 2 projects from the Ministry of Transport and Public Works – Roads Authority
- 3 projects from the Ministry of Agriculture, Irrigation and Water Development as follows:
    - Blantyre Water Board
    - Lilongwe Water Board
    - Agriculture Commercialization Project of (AGCOM)Malawi

The projects were selected across a range of sub-sectors, infrastructure type, size, and funding agencies to provide diversity. The map below shows the geographical spread for the location of each project.

Figure 1 – Projects Location Map

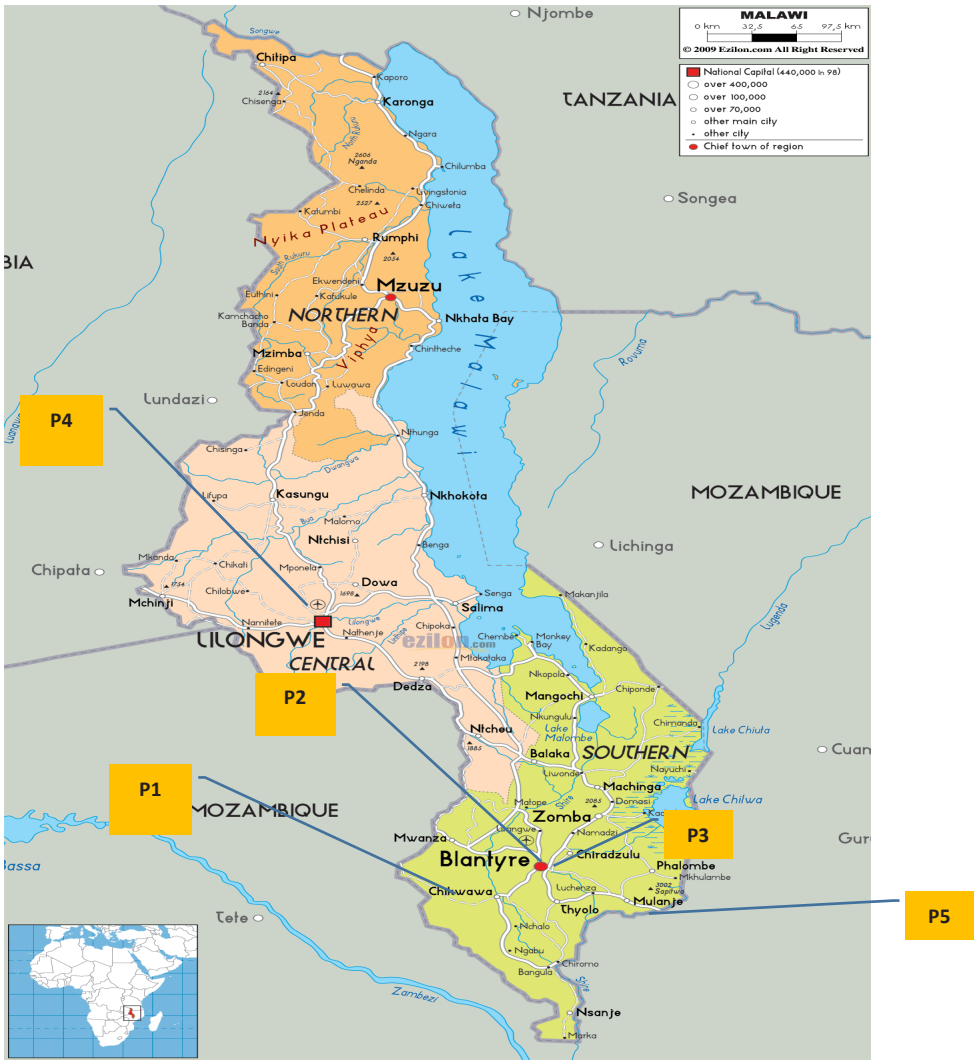


Table 1 - Details of Selected Infrastructure Project for Assurance Process

	Project Reference	Project Name	Project Details	Project Location	Total Project Cost	Project Status	Donor	Start Date	Finish Date	Actual Progress	Date of Site Visit
Ministry of Transport and Public Works (Roads Authority)											
P1	RA/DEV/12/01	Construction of Chikwawa – Chapananga (S136) Road and Bridge	Upgrading to bitumen standard of earth road and construction of 180m span bridge	Chikwawa District	MK 11,470,542,136.29		Roads Fund Administration	1-07-2013	15-01-2021	100%	6-3-2021
P2	6U/PP/SR/BTC/20	Pothole Patching and other Routine Maintenance Works in Blantyre City	Pothole patching	Blantyre City	MK 112,602,609	On-going	Roads Fund Administration	4-10-2020	1-07-2021	56%	5-3-2021
Ministry of Agriculture, Irrigation and Water Development											
P3	**BWB/W/17**	**Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area**	To develop a completely new water supply system that will improve the water supply situation in Blantyre, mostly the hard-hit areas of Limbe, Bangwe, Namiyango and Nguludi.	Mulanje, Thyolo Chiradzulu & Blantyre Districts	US$ 23.5 Million	Completed	Exim Bank of India	1-11-2017	30-6-2019	100%	4-3-2021
P4		Lilongwe Water Sanitation project (Priority Lilongwe City Sewerage Network Rehabilitation and Expansion and Upgrading of Kauma Wastewater Treatment Plan)	Expansion and rehabilitation of network and rehabilitation and improvement of treatment plant at Kauma	Lilongwe City	USD 10,262,980.65 plus, MWK 1,726,619,192.05	On-going	World bank	10-8-2020	9-02-2022	7.21%	29-3-2021

	Project Reference	Project Name	Project Details	Project Location	Total Project Cost	Project Status	Donor	Start Date	Finish Date	Actual Progress	Date of Site Visit
P5	MW/MOAIWD /148241/CW/ RFB-LOT 6	Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District	Improvement to gravel standard access roads to irrigation schemes including associated drainage structures	Mulanje District	MK386, 182, 762.75	Completed	World Bank	2-06-2020	30-9-2020	100%	3-3-2021

3. DISCLOSURE OF INFORMATION

3.1 SUMMARY OF PROJECT INFORMATION DISCLOSED

Disclosed information was analyzed by employing the CoST disclosure levels; first by acquiring data from the PDE which was proactively disclosed, secondly by obtaining data through interviews with stakeholders, and finally soliciting data from the PDE through reactive disclosure.

3.1.1 Proactive Disclosure

Proactive disclosure of data involves release of data before it is requested. To achieve this the Assurance Consultant used multiple means to search for information already disclosed by the PDE on various platforms such as the PDEs website, CoST Disclosure Portal for Public Projects, on site project signboard, and information from any publications by the PDE. The Public Procurement and Disposal of Assets (PPDA) website was also checked to see if there was relevant disclosure information for this report.

The Assurance Consultant used the Infrastructure Data Standard (IDS) Template for proactive as shown in **Annex 1.**

3.1.2 Reactive Disclosure

Once the data collected proactively was disclosed, it was necessary to validate it using data collected using the reactive method. Reactive disclosure concerns the collection of additional information that project owners and Procuring and Disposing Entities (PDEs) are required to submit to any eligible person or entity that requests it. This involved, under this study, making the additional information available to the Assurance Consultant in a usable form, in an accessible place and under a specified set of conditions.

The Assurance Consultant used the Infrastructure Data Standard (IDS) Template for proactive as shown in **Annex 1**

3.1.3 Summary of Disclosed Data

The proactive data disclosure template used for this study had 58 data points. The reactive data disclosure template had 26 data points. In total, the study had a combined total of 84 data points for both the proactive and reactive data. The findings for disclosed information are summarized in **Table 2,** below:

The data shows a positive trend as compared with 2019 Assurance findings. This study finds that the lowest Proactive Disclosure by project is 40% on the Pothole Patching and other Routine Maintenance Works in Blantyre City project and the highest being the Lilongwe Water Sanitation project at 64% compliance rate. The 2019 study had a variance of 10% and 22% from lowest to highest.

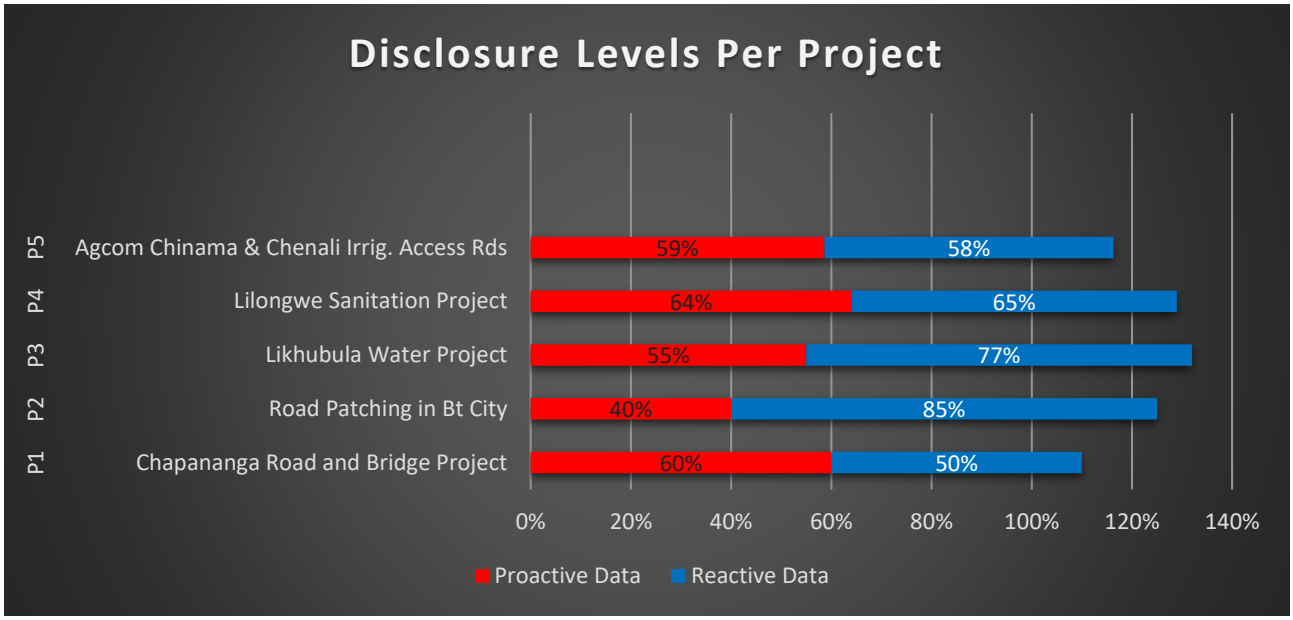
By PDE, the compliance for Proactive Disclosure ranges from 50% (Roads Authority), 55% (Blantyre Water Board), 59% (AGCOM), and 64% (Lilongwe Water Board). The Roads Authority has a website which is not updated constantly, and this has influenced the low score for Proactive Disclosure score. AGCOM, Blantyre Water Board, and Lilongwe Water Board have websites that are current, and a lot of required information was obtained through this method. Further, the projects for these institutions are funded by World Bank and Exim Bank of India. An interview with one of the project managers revealed that the World Bank requires maximum publicity of their projects. The World Bank funded the acquisition of a website for the institution. Overall, there has been an improvement in institutional response to provision of Proactive Disclosure of data.

Table 2 - Summary of Disclosed Data for Each project

IDS Disclosure Items		Ministry of Transport and Public Works (Roads Authority)		Min of Agriculture, Water Development, and Irrigation		
		P1	P2	P3	P4	P5
Proactive Disclosure	**IDS Points**	**Chapananga Rd & Br.**	**Road Patching in Bt. City**	**BwB Likhubula Water Project**	**LwB Lilongwe Water and Sanitation Project**	**Agcom Chinama and Chenali Irrig Access Rds**
				POINTS		
Proactive Disclosure						
Project Identification & Preparation Phase	12	8	2	10	11	12
Project Completion Phase	9	6	9	4	7	5
Procurement and Contract Award Phase	15	5	0	7	7	0
Every 6 Months of Contract Implementation	14	9	8	8	7	10
Contract Completion Phase	8	7	4	3	5	7
Total	**58**	**35**	**23**	**32**	37	**34**
Percentage Proactive Disclosure	**100%**	**60%**	**40%**	**55%**	**64%**	**59%**
Percentage Proactive Disclosure by PDE	**100%**	**50%**		**55%**	**64%**	**59%**
Reactive Disclosure						
Project Identification and Preparation Phase	7	1	3	5	6	7
Project Completion Phase	7	3	7	3	7	2
Contract Procurement Phase	4	1	4	4	4	3
Contract Phase	3	3	3	3	0	2
Contract Implementation	5	5	5	5	0	1
Total	**26**	13	**22**	**20**	17	**15**
Percentage Reactive Disclosure	**100%**	**50%**	**85%**	**77%**	**65%**	**58%**
Percentage Reactive Disclosure by PDE	**100%**	**68%**		**77%**	**65%**	**58%**
Disclosure Rate per PDE	**100%**	**45%**		**66%**	**65%**	**38%**
Combined Overall Disclosure	**100%**	**59%**		**66%**	**65%**	**59%**

Similarly, this current Assurance Study shows that Reactive Disclosure of information has improved when results are compared with the 2019 study. Reactive Disclosure by project in this current study shows the lowest compliance at 50% for Roads Authority, 58% for AGCOM, 65% for Lilongwe Water Board Water and Sanitation Project, the Blantyre Water Board Likhubula Project had 77%, and Road Patching Project in Blantyre City Roads Authority had 85% disclosure rate. In contract, the 2019 study had the lowest score of zero (0) and the highest at 34%.

Figure 2 - Summary of Disclosure Level per Project



Comparison of Proactive Disclosure for PDEs shows that this study has Roads Authority with 50% compliance, Blantyre Water Board at 55%, AGCOM at 59%, and Lilongwe Water Board at 64% compliance. The 2019 Assurance Report has the lowest at 0% and highest at 22%

When PDEs are compared, the same upward trajectory of compliance to Reactive Disclosure emerges. AGCOM is the lowest at 58%, Lilongwe Water Board at 65%, Roads Authority at 68%, and Blantyre Water Board has the highest compliance at 77%.

When compared with 2019 results, the lowest PDE scored 2% while the highest score was 34%.

Overall Disclosure of Information: The results of the study show that projects under Blantyre Water Board had the highest compliance rate at 66% followed by Lilongwe Water Board (65%), Roads Authority and AGCOM were tied at 59 compliance. Compared with the 2019 study, compliance by institution ranged from a low of 10% and highest compliance rate at 45%.

Overall, reactively disclosed information has better compliance. The 2019 Assurance Study recommended that PDEs should migrate to electronic data storage. There has been no achievement towards embracing digital storage of data.

The study found that some of the PDEs did not update their websites and this has a direct bearing on the results highlighted in this report. Further, the data shows that those projects that have a lot of publicity like World Bank projects, automatically lend themselves to proactive disclosure of information.

Now that the Freedom to Information Act is operational, there should be enforcement for institutions that do not comply.

The study finds that there has been an upward trajectory in compliance in submission of information for Assurance study when this study is compared with the study undertaken in 2019. However until total disclosure is achieved, the PDEs should strive to provide as much information as possible.

The study recommends that PDEs should have websites that are updated frequently. This assists the public in disseminating information quickly.

Now that the Freedom to Information Act is operational, there should be enforcement for institutions that fail to comply.

3.2 COMPLETENESS OF THE DISCLOSED INFORMATION

The study finds that disclosure of information on some of the projects selected for review was incomplete. Generally proactive disclosure scored less points than reactive disclosure of information.

Reactive disclosure of information yielded somewhat better results. However, the recurring issue is incomplete project information at the PDEs which affected the completeness of the data. The results show that even the reactive disclosure has gaps in the available information. That said, there has been a marked improvement in the amount of information availed by the PDEs.

3.3 ACCURACY OF THE DISCLOSED INFORMATION

The study finds that the disclosed information was generally accurate. All the sites were visited to verify the data provided by the PDEs. Additional checks on the information provided were made by referring to Government and Donor Agencies' guidelines.

The biggest challenge for this study was obtaining information from the PDEs within the time prescribed for the study. This has been a recurring problem for Assurance Studies. Generally, the Water Boards are very responsive in providing information. This is validated by the overall scores of 66% and 65% by Blantyre Water Board and Lilongwe Water Board respectively.

For PDEs that were responsive, the challenge was to get the head of the institution to delegate this duty to a designated officer. Secondly, it was also difficult to get the designated officer to dedicate their time to providing information for the study. Data collection was therefore the biggest obstacle in achieving timely submission of the report.

4.0 TRANSPARENCY AND ASSURANCE

In this section, the study assesses compliance during various phases of the project cycle including tender management, Cost Control, Safety, Design Studies, time management, and quality control.

4.1 TENDER MANAGEMENT

Although there were very few issues observed by this study arising during the tender management stage, The data collected shows that on average, 7 firms participated in the bidding process among the firms that reported bidding information. Refer to Table 3 below.

Table 3 - Summary of Tender Management

Ref.	Projects	No. Firms Submitted Prequalification	Number of Firms that bid	Best Evaluated Firms	Date of Contract Signing	Date of Site Handover	Procurement Method
P1	Construction of Chikwawa – Chapananga (S136) Road Phase II (Km 5 – Km10)	N/a	Not Disclosed Bids were in 2013 and information is archived after Post Procurement Review by PPDA				
P2	Pothole Patching and other Routine Maintenance Works in Blantyre City	N/a	13	Mungo Civil Engineering	23 Sept 2020	4 October 2020	National Competitive Bidding
P3	**Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area**	10	4	SMC Infrastructures Pvt Ltd	19-Sept-2017	01-Nov-2017	[2]Restricted Tender (for Indian Companies)
P4	Lilongwe Water and Sanitation project		5	UNUK ENG PVT LTD	20 May 2020	10 Aug 2020	International Competitive Bidding
P5	Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District	8	5	Kelch Construction	8 April 2020	1st April 2020	Limited Competitive Bidding

[2] This was a loan requirement by EXIM Bank of India – the financier of the project.

4.1.1 CONSTRUCTION OF CHIKWAWA – CHAPANANGA (S136) ROAD PHASE II (KM 5 – KM10)

1. TRANSPARENCY AND ASSURANCE

This section of the study assesses compliance during various phases of the project cycle including tender management, Cost Control, Safety, Design Studies, time management, and quality control.

2. TENDER MANAGEMENT

This project was procured in 2013. Bidding procedure information was not submitted for this study asit is archived. The PDE advised that they will continue to look for the information, notwithstanding. The Procurement Officer stated that the bid documents and evaluation reports were archived to create space for new procurements in the Roads Authority Head Office. As such they were challenged to meet the deadline for submission of the requested procurement documents. The Roads Authority normally archive documents when they have stayed for more than 5 years and when they have been post-reviewed by the PPDA in accordance with the procurement regulations.

2.1 Scope of Works

The project for Upgrading the Chikwawa – Chapananga Road was awarded to Plem Construction Ltd to construct 23.5 kilometers of the road between Chikwawa and Kakoma at a contract sum of MK 8,080,121,454.83. Due to financial challenges pertaining to cash flow and budgetary limitations, the works were delayed. The Employer and the Contractor agreed to prioritize the completion of the first five kilometers from Chikwawa. The 5km section was completed at a cost of MK 2.1 Billion leaving a balance of about MK 5.9 Billion.

3. PROJECT MANAGEMENT

a) Design Challenges – Chapananga Bridge

The balance on the Contract gave Government the impetus to give new advice that the Roads Authority include the construction of Chapananga bridge to connect the Districts of Mwanza and Chikwawa as it was deemed that the balance of the funds would be adequate to construct the bridge. The Roads Authority therefore engaged the Contractor M/s Plem Construction Ltd into negotiations to construct a 100 metre bridge. The negotiated price for constructing the bridge with pile foundations was MK 2.8 Billion which included construction of approaches and protection works. The price was VAT inclusive and had a 15% Contingency. The rates were based on the existing contract with the exception of new items which had negotiated rates.

Minutes of meeting held on 18th February 2016 held between the Employer and the Consultant show that the Consultant was requested to undertake design review of the Chapananga Bridge. The minutes state in part:

The Terms of Reference considered increasing the number of bridge spans and the corresponding protection measures on the embankment beyond the western abutment of Chapananga Bridge. It is important to note that the western abutment lies in the middle of the river channel as per the current design.[3]

The Bua report states that the riverbed at Chapananga is in an active flood plain extending almost half a kilometer in width. The lowest riverbed is towards the eastern bank which is about 200m wide and it is on this section of the flood plain where the bridge was built. The riverbed towards the western bank is about 2m higher than the channel near eastern bank. The western riverbed mostly runs dry during low river flows and is about 250m wide. During the floods of 2015, this second riverbed was heavily breached.

This active riverbed has a tributary about 300m upstream called Phwete which influences the shifting of the river channel. Therefore, during floods, the riverbed shifting action towards the western bank causes frequent breaching of the bridge approach as happened in 2015.

During the floods of 2020/2021 rain season, the western riverbed was again breached causing widespread damage to the bridge approach. The bridge itself was intact and suffered no damage.

It is seen that the original length of the bridge was 100m. The re-design by Bua, taking into account the findings of the environmental Impact Study carried out for the design review, improved the flow by extending the bridge length by 80m; thus, the new bridge, as constructed, is 180m long which covers most of the 200m wide riverbed which has water running throughout the year. The higher riverbed towards the western bank is where the approach to the bridge is built and this approach is designed to act as a flood relief during flooding. The design proposed protecting the western bank with gabions.

To show the existing situation clearly, the Study obtained a google photo showing the bridge location across the Chapananga River. The yellow border has been superimposed to show the extent of the waterway (Refer to Photo 1) below.

It is seen that because the western bridge abutment was built in the river, the riverbed channel is somewhat restricted. This was considered in the Bua design. However, the Bua report indicated heavy agricultural use of the Mwanza River catchment area has resulted in deforestation and increased ground surface run off during rains. This combined by the shifting nature of the riverbed at the bridge location may have influenced the scouring of the western bridge approach that occurred. The Bua Report did not have historical flood data which could have been used for the design of the bridge. They however used hydrological methods that are widely used and accepted

[3] The original design which was being reviewed by Bua Consulting Engineers was done by Scott Wilson Consulting Engineers in 2004 and 2005, according to the Bua Consulting Engineers Design Report of August 2016.

in the design of structures in waterways in the absence of this data. This study did not have access todata for the flooding that occurred during the 2020/2021 rainy season at Chapananga.

This Study recommends that the Department of Water should start keeping water discharge records at Chapananga as it is more than likely that more intense flooding shall occur given the heavy agricultural use of the catchment area for Mwanza River affecting the bridge at Chapananga.

Climate change and design of climate resilient structures are new buzz words which are gaining traction in Malawi. Existing structures in Malawi including the Chapananga bridge, although designed for extreme weather events, were not designed to address the effects of climate change.

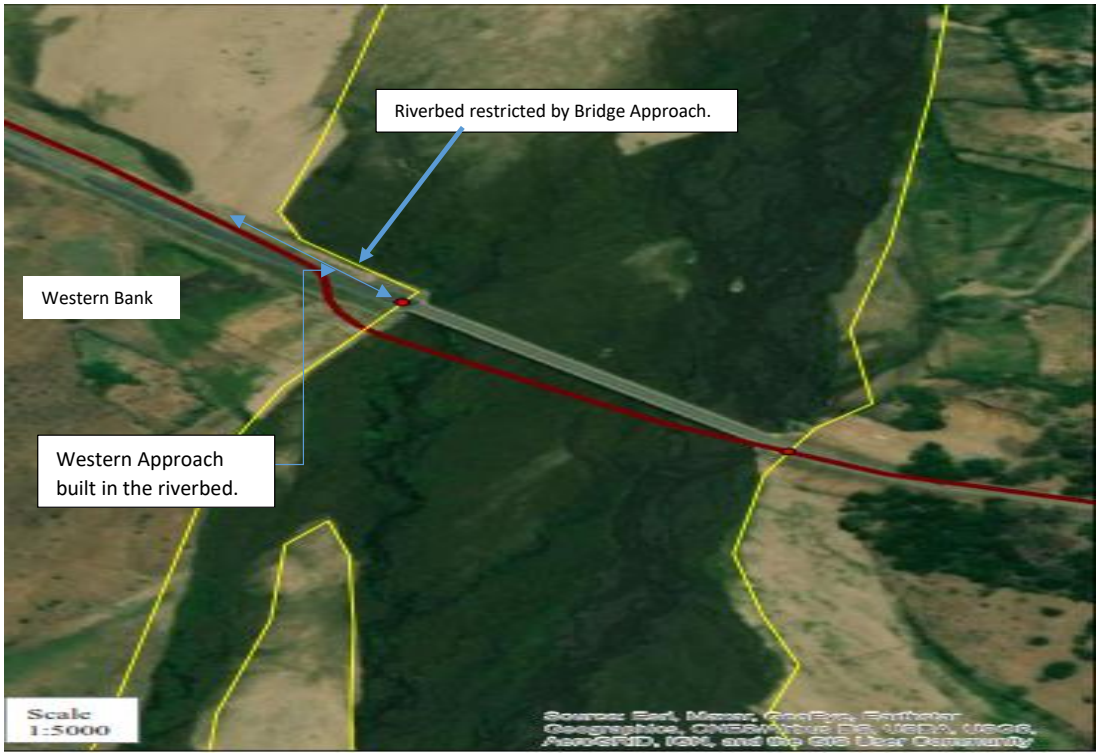
A publication by the United States Agency for International Development (USAID) called A GUIDE FOR USAID PROJECT MANAGERS FOR BRIDGES INCORPORATING CLIMATE CHANGE ADAPTATION IN INFRASTRUCTURE PLANNING AND DESIGN (NOVEMBER 2015) states:

Changes in the pattern of extreme events can directly impact the physical integrity of built structures in a variety of ways, causing loss of service. One way climate change impacts bridges is through flooding and scouring around bridge foundations due to increased intensity and frequency of heavy rainfall. Collapses of bridges due to flooding can also occur. In the future, flooding is expected to occur more frequently and be more destructive in many regions. Current infrastructure design is based on historical data and experience. Most existing infrastructure assets were designed based on historical climate data, such as average rainfall and runoff in an area, or historic flood events. However, the pace of climate change means that historic data may no longer be relevant for longer-term infrastructure performance. Climate change may cause shorter asset life spans or require early rehabilitation as infrastructure degradation accelerates.

Chapananga Bridge is good example of infrastructure in Malawi which has been affected by climate change. For more robust and resilient bridge structures for Malawi, there is a need for the country to prepare for the future in making infrastructure more adaptable to climate change.

Malawi as a country needs to start addressing design of resilient structures to mitigate the effects of climate change. This can be achieved by reviewing Design standards to accommodate the requirements for the changing climate.

Photo 1 - Google Map showing the Chapananga Bridge.



The damage to the bridge approach was widely reported in the media in Malawi. Immediate action was implemented by the Roads Authority who requested the Contractor to carry out emergency repairs. A retaining wall was built on the upstream of the western bridge approach as show in Photo 2, below:

Photo 2 - Protection Works for Western Bridge Approach under Construction

The Assurance Consultant visited the bridge site on 6th March 2021. The bridge approach repair works had at that time been completed as shown in Photo 3, below:

Photo 3 - Chapananga Bridge Approach Repairs Complete

The findings of this study are that the damage to the approach was not caused by workmanship problems but rather due to the nature of the river which shifts course and environmental factors caused by increased agricultural use of land in the catchment area of the river.

b) Design of the Road

The design of the road Chikwawa to Chapananga road comprises a compacted layer of 300mm subbase, on top of which there is a layer of 200mm crushed graded quarry stone. The top is finished by a double seal stone chippings the lower layer 20mm thick topped by a 10mm layer of quarry stone. Compacted layers which form the road subbase and base therefore have a nominal thickness of 530mm.

The M18 road linking Lilongwe to Mchinji Border is an example of a double chip seal road that has been in service for many years. The Lilongwe Salima Road is another example of a similar specification road. The Lilongwe to Santhe (T117) Road which was completed a few years ago is of similar construction. Durability of chip sealed roads is dependent on quality control protocols in spreading the bitumen binder and the spray rates for the chippings and temperature controls. The pictures below show the Chikwawa to Chapananga road.

There is a need to investigate the reasons why roads build recently using chip seal specification have been outlasted by roads built 20 to 30 years ago.

The overriding factor for choosing to construct a double chip seal specification road is cost. Compared with asphalt, the cost of double chip seal roads gives the government the flexibility to open more frontiers; especially roads leading from rural areas to towns.

This study compared rates used on two roads within Malawi which were tendered around the same time and compared the rates applying to a road distance of 50kms. The 50mm asphalt road cost was MK 477,000,000 more than the road using chip seal specification.

This study recommends research to be conducted which will compare roads built using asphalt road finish specification against double chip seal construction. The research should answer the question whether double chip seal specification is suitable for Malawi road construction.

Photo 4 - Chikwawa Chapananga Road

Photo 5 - Chikwawa Chapananga Road (End of Tarmac)

c) Construction Implementation Challenges

The project suffered delays due to funding problems by Government for the project. Originally, the cost of MK 8,080,121,454.83 was to construct 23.5 kilometers of the road between Chikwawa and Kakoma. The Contractor, having been delayed in completing the works due to funding challenges, the government changed its priorities and took advantage of the funds which remained undisbursed on the contract to instruct for the scope to be changed to include the construction of the bridge. At completion of the project, the bridge and about 10kms of road from Chikwawa have been accomplished.

The study noted that the Chikwawa to Chapananga Road section which covers the first 10 kms has little or no signs stolen or vandalised. Theft of road signs in Malawi is a serious problem that requires innovative interventions.

This study proposes that the Government should look at the penalties for theft or vandalizing road infrastructure and if lenient the penalties should be toughened to act as a deterrent against this practice. Secondly, civic education at political rallies aimed at reinforcing community activism to prevent road infrastructure vandalism is necessary. Chiefs also have a role to play. Responsibilities of chiefs need to be performance based with the prevention of vandalism in their areas as one of the key performance indicators. A system can be developed to reward chiefs for meeting set development targets for their areas.

d) Time and Cost Overrun

Time overrun: A study conducted in 2013 by M.J. Kamanga and Wynard JvdnM Steyn found that the top 10 causes of delay in completion of construction projects were:

- shortage of fuel,
- insufficient contractor cash-flow,
- shortage of foreign currency for importation of materials and equipment,
- slow payment procedures adopted by the client in making progress payments,
- insufficient equipment,
- delay in relocating utilities,
- shortage of construction materials,
- delay in paying compensation to land owners,
- shortage of technical personnel, and
- delay in site mobilisation

It is seen in this Assurance study that delay in executing the Contract caused by delayed payments by the Employer – one of the reasons identified in the above study - resulted in changes to the scope of the works being introduced. This change in scope meant that Addenda were issued to cover the revised scope. The project commenced on 1st July 2013 for the original scope covering the improvement of earth road to bitumen standard with planned completion on 30th June 2015. An Addendum for construction of the bridge was issued omitting the road construction works

from 23.5kms to only 5kms. The bridge construction started on 5th October 2015 with planned completion on 31st October 2018. More road works were instructed extending the scope from 5kms to 10kms. This work commenced on 1st January 2019 and the works were completed on 31st December 2020. The bridge was officially completed on 15th January 2021. Currently there are minor repair works outstanding which will be done during the Defects Liability Period. The extensions of time were also influenced by low disbursement of funds to run the project. The project therefore stopped and started several times.

Cost Overrun: The original Contract was for construction of 23.5 kilometers of the road between Chikwawa and Kakoma at a contract sum of MK 8,080,121,454.83. Due to funding challenges, the government changed the scope to include Chapananga Bridge. The original design was extended to cater for revised hydrology analysis which resulted in the bridge being extended by 80m to 180m. The revised scope necessitated revision of the budget to accommodate the additional bridge works. An Addendum of MK 3,390,420,681.46 was issued to cover these works. The revised Contract sum is MK 11,470,542,136.29.

The Final Cost Statement for the project has not been finalized. The Contractor and Employer agreed to wait for the end of the rainy season before sealing the pavement to the western bridge approach which was damaged by the floods of the 2020/2021 rainy season. The Roads Authority project manager stated in an interview that the sum of MK 11,470,542,136.29 is unlikely to be exceeded.

e) Quality of the Works

Quality control and quality assurance protocols were followed during the execution of the project. Technical Specifications of construction materials were constantly reviewed and recommendations made for incorporating the materials into the works by the Consultant. Compliance tests were done on site and checked by the Consultant and if suitable recommended the materials to be incorporated in the permanent works.

f) Progress Photographs

Photo 6 - Chapananga Bridge under Commercial use by a Community Member

Photo 7 - Bridge under use by Community Members

Photo 8 - View of Chapananga Bridge from Western Approach

4.1.2 POTHOLE PATCHING AND OTHER ROUTINE MAINTENANCE WORKS IN BLANTYRE CITY

1. TRANSPARENCY AND ASSURANCE

This section of the study assesses compliance during various phases of the project cycle including tender management, Cost Control, Safety, Design Studies, time management, and quality control.

2. TENDER MANAGEMENT

The Roads Authority issued procurement notice through local newspapers on 6th April 2020 under National Competitive Bidding.

a. Selection of Contractor

The deadline for submission of bids was on10th June 2020 at 10:00 Hours Local time. Thirteen bidders submitted their bids before close of submission time. Late tenders were rejected.

Preliminary examination of the bids which checked for administrative compliance was done and all 13 bidders were in compliance.

When Technical Compliance examination was done, only 4 bidders; Mungo Civil Engineering, Meshozi Construction, Maoni/Horizon JV, and Mbawiri Investment emerged as compliant with requirements.

The next step was Detailed Financial Examination to correct arithmetic errors, evaluate corrected tender totals, compare principal bill item prices, and rank the bids. Mungo Civil Engineering emerged as the lowest ranked evaluated bidder.

Post evaluation assessment was made on all 4 ranked bidders and Mungo Civil Engineering emerged as the lowest evaluated bidder after post qualification examination and was recommended for award at the Contract sum of MK 112,602,609.00.

b. Scope of Works

The main project components are:

- Pothole patching,
- Earthworks,
- Drainage works,
- Concrete works.

3. PROJECT MANAGEMENT

This project is supervised by GK Works. During the site visit conducted on 5th March 2021, the Consulting Engineer for the project was present. The main challenge for this project is the budget. In January 2021 the project manager wrote requesting for an addendum as more than 50% of the contract sum. The Employer responded stating that the Contractor is to work within the approved contract sum. The budget and the amount of work required to repair potholes in the city do not match. The Supervising Consultants are having to prioritize which potholes to repair while leaving others unrepaired.

Photo 9 - Pothole Repairs under limited budget

Photo No. 9 shows a pothole next to cracked road surface. In this case, the priority due to the limited budget is to patch potholes that have developed and are open. In an ideal situation, the cracks are supposed to have been repaired as well. What is likely to happen is rainwater shall seep into the cracks resulting in a bigger pothole developing and undermining the new patch.

Secondly, the Road Maintenance works are supposed to run from June during each financial year and end by June the following calendar year. During the 2020/21 Financial year, Road Maintenance contracts were awarded in October 2020 with works commencing in on 4th October 2020. Effectively, a period of 4 months has been lost due to the late award and commencement. This has resulted in:

- Pothole patching works being undertaken during rainy season.
- Works compressed into 7 months for programmes that are supposed to run for 12 months.

- The Construction sector suffering from huge unemployment due to the lost time and limited budgets.

It is understood that extra layers of vetting have been instituted across all government procurement which has created a backlog in the award of contracts.

This study recommends that ways of speeding up the vetting process for procurement must be implemented as a repeat of the delays in the next procurement cycle for road infrastructure programs shall effectively kill the sector.

Road Maintenance programs require adequate funding to prevent the infrastructure decaying beyond a stage where the only option is to rebuild.

a) Time and Cost Overrun

Time and Cost Overrun: This project is within budget. When the Assurance Consultant visited the project, works done were at 56% complete. The Assurance Consultant took random measurements of potholes and compared these with works paid for under Interim Payment Certificate (IPC) No. 3 certified on 28 January 2021 and the study found that the measurements tallied. The project is therefore within time and cost.

b) Quality of the Works

The Assurance Study had access to Quality Control protocols used for asphalt works including the design of the asphalt mix. It was not possible to witness the actual work in the field as the contractor was not patching potholes that day.

4.1.3 CONSTRUCTION OF NEW WATER SUPPLY SYSTEM FROM LIKHUBULA RIVER TO BLANTYRE WATER SUPPLY AREA

1. TRANSPARENCY AND ASSURANCE

This section of the study assesses compliance during various phases of the project cycle including tender management, Cost Control, Safety, Design Studies, time management, and quality control.

2. TENDER MANAGEMENT

The Government of Malawi (GOM) received a loan from EXIM Bank of India to finance the Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area Project. The amount of the loan was US$23.50 Million.

a. Selection of Consultants

The project was supervised in-house by a team of Blantyre Water Board Engineers. In an interview with one of the managers, Blantyre Water Board received a stop order from the NCIC for contravening one of their regulations requiring that a PDE is not eligible to supervise its own works. Following discussions between BwB and NCIC, the former was allowed to proceed with the supervision as a one-off waiver.

b. Selection of Contractor

Tendering method was restricted International Competitive Bidding. Identification of the contractor followed a two-stage procurement process commencing with prequalification of interested contractors.

EXIM Bank received 10 applications for prequalification. Form interested Indian firms. After examining the 10 applications, EXIM Bank shortlisted 4 contractors to proceed to the next stage to submit bids:

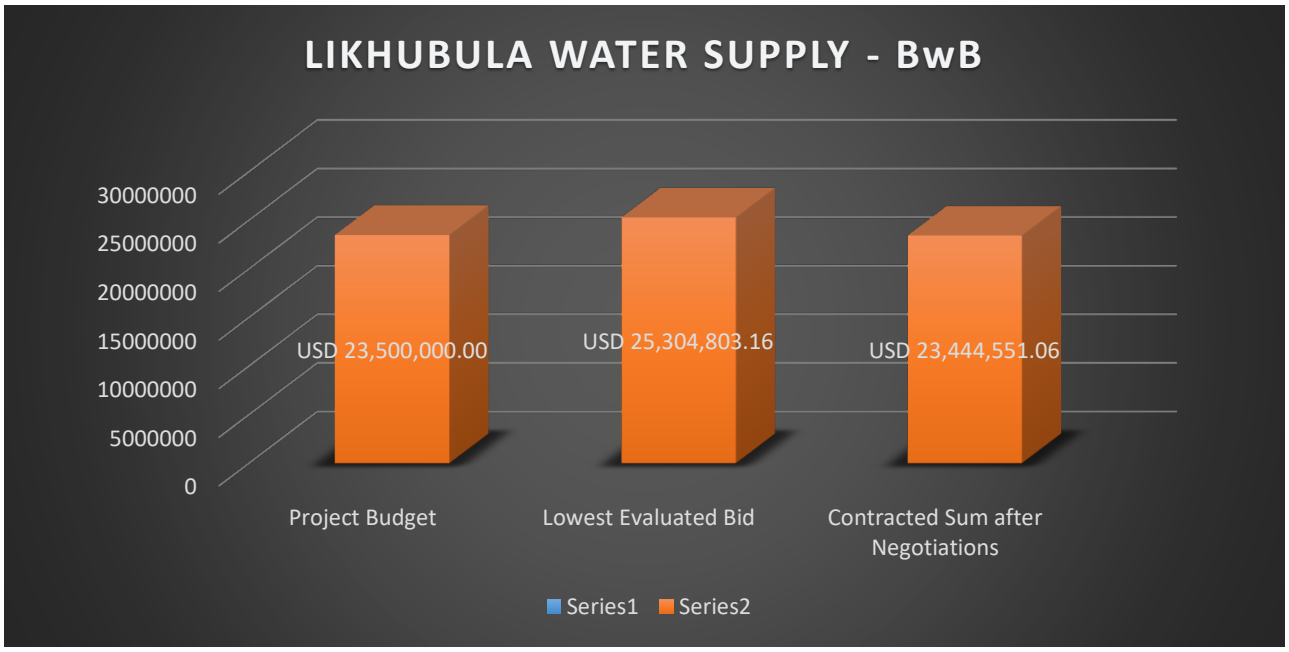
- Megha Engineering and Infrastructure Ltd
- SMC Infrastructure Pvt. Ltd
- Technofab Engineering Ltd
- JV of WPIL Ltd. and SMS Paryavaran Ltd and were responsive.

It should be noted that the procedure for Expression of Interest under stage 1 shortlisting was in accordance with EXIM Bank guidelines requiring only Indian firms. The shortlisting therefore was conducted by EXIM Bank of India in accordance with the terms of the loan. Stage 2 of the procurement procedure was in accordance with Competitive Bidding Procedure specified in Government of Malawi's Public Procurement Act of 2003.

All 4 bidders passed the technical and commercial evaluation of bids. The combined technical and commercial evaluation showed that SMC Infrastructures Pvt. Ltd was the lowest evaluated bidder at US$ 25,304,803.16 and was recommended for award. The award was recommended on the proviso that BwB was to negotiate with the least evaluated bidder as the bid price of US$ 25,304,803.16 was above the available budget of US$ 23.50 Million.

On 25th April 2017, the then ODPP (now PPDA) gave a NO Objection to the procurement of the works contractor. The Contract was subsequently signed at US$ 23,444,551.06 with SMC Infrastructures Pvt. Ltd to undertake Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area Project.

Figure 3 - Comparison of Budget against Lowest Evaluated Bids



c. Scope of Works

The main project components are:

- Construction of intake structure on Likhubula River on Mulanje Mountain
- Pipe laying of 350 mm Diameter twin pipelines from the intake down the mountain
- Laying of 500mm Diameter gravity main pipe from Mulanje to Nguludi (40kms)
- Construction of a conventional treatment plant and pumping station at Nguludi Turn-off
- Laying 500mm Diameter pumping main line to Mpingwe reservoir site (11kms)
- Construction of a circular reinforced concrete storage tank at Mpingwe Hill in Bangwe, and
- Laying 200mm Diameter pipes to interconnection points at Mthandizi and Zomba Road
- Connection main to Malawi University of Science and Technology at Goliati.

The main reasons that were cited as necessitating the execution of the project were:

- Inadequate water supply from the existing sources to meet the demand which was then estimated at 123,000m3/day, and

- High operational costs due to heavy pumping from the existing source on Shire River at Walker's Ferry to Blantyre, which costs over 50% of the total operating costs.

- A third reason not cited in the design report but one which is on BwB website in the 2017 Annual Report is Non-Revenue Water (NRW) which in 2017 was at 43%. In the prior year NRW (2016) was at 52%. This was attributable to the aged network infrastructure and vulnerability of the system to illegal water connections. The study did not have access to current NRW statistics. However, it is an area where the BwB has, as one of the stated objectives in the report, planned to intensify activities under NRW with the aim of reducing this statistic further.

Non-Revenue Water is defined as the difference between the amount of water put into the distribution system and the amount of water billed to consumers.

This Report finds that the BwB should increase its efforts to further reduce the Non-Revenue Water to increase the amount of water it already has to potentially reduce the overall amount of water required from new sources.

3. PROJECT MANAGEMENT

a) Design Challenges

From project inception, it was always known that the Likhubula River project could only extract a limited amount of water in the lean period of summer between the months of July and November each year. The project can extract the maximum of 22,693.44 m3/day after incorporating 20% for losses according to the design report for the project. The BwB water project was therefore designed in such a way that during December to June, the system would abstract the maximum amount of water as designed and scale down the amount of water abstracted to co-exist with the other water users in the local area.

The design of the BwB Likhubula project did not have access to historical data for Likhubula River flow. This study managed to obtain records for the period 1970 to 2020 – a period of 50 years[4].

Analysis of the 50-year data obtained from Water Department shows that daily water flow used for the design, compared with actual flow in cubic metres per day was overestimated for the months of February to September. Refer to Table 3 below (comparison of column a and b).

The data also shows that apart from the months of December to April Likhubula River has no surplus water if the BwB project is to abstract the peak volume of 18,740 CM/Day. The conclusion of this analysis is that BwB cannot abstract the maximum design capacity of water from the

[4] Raw Data obtained from Water Department is included herein under Annex 6

Likhubula River from the month of May to November. The design showed that there would be water available for 7 months based on the data that was available for the design. However, the historical data shows that the river can support the BwB project 5 months out of 12 months each year. Refer to **Annex 7.**

The main conclusion to be drawn from this analysis is that conflict with the local community shall be inevitable given that the river has adequate water for everyone only during 5 months in the year.

Month	Actual Historical Monthly Avg (CM/Day	Design Volumes (CM/Day)	Total Measured Abstaction CM/Day	Blantyre Water Board CM/Day	Total Extraction incl BwB CM/Day	Water Remaining after Extraction CM/Day
	Likhubula River Flow (Cubic Metres Per Day)					
	a	b	c	d	e=c+d	f=a-e
Nov	34,275.72	20,045.00	27,101.00	18,740.00	45,841.00	-11,565.28
Dec	88,568.36	57,784.00	27,101.00	18,740.00	45,841.00	42,727.36
Jan	126,991.28	117,158.00	27,101.00	18,740.00	45,841.00	81,150.28
Feb	141,712.72	158,216.00	27,101.00	18,740.00	45,841.00	95,871.72
Mar	138,998.09	182,131.00	27,101.00	18,740.00	45,841.00	93,157.09
Apr	104,106.43	154,898.00	27,101.00	18,740.00	45,841.00	58,265.43
May	54,239.69	84,326.00	27,101.00	18,740.00	45,841.00	8,398.69
Jun	32,321.96	55,987.00	27,101.00	18,740.00	45,841.00	-13,519.04
Jul	30,109.01	41,265.00	27,101.00	18,740.00	45,841.00	-15,731.99
Aug	22,023.64	30,275.00	27,101.00	18,740.00	45,841.00	-23,817.36
Sep	17,143.43	21,773.00	27,101.00	18,740.00	45,841.00	-28,697.57
Oct	18,126.72	15,759.00	27,101.00	18,740.00	45,841.00	-27,714.28

In 2017, according to the project manager, BwB had already planted 400 hectares of trees. It remains to be seen whether the rate of afforestation shall be greater than the rate of deforestation. During his visit to the intake, the Assurance Consultant observed that there was noticeable tree cutting and charcoal burning. It is however encouraging to note that the BwB from the beginning engaged the community by forming a taskforce comprising all stakeholders affected by the project. It remains to be seen whether the centre will hold as it is likely that the water shall have to be rationed; hence creating conflict.

This report finds the Likhubula source may eventually be unreliable and conflict with villagers shall increase as the water resource dwindles. The Likhubula River taskforce shall increasingly become essential to the survival of the BwB Likhubula Water Project.

b) Construction Implementation Challenges

The project suffered delays as the original site identified as the intake at Dziwe La Nkhalamba is a tourist and heritage site. As such, the community demanded that the intake could not be constructed at this site. From the very beginning the BwB formed a task force comprising all stakeholders and the community affected by the project. This problem was therefore resolved through consultation. However, this necessitated a change in the design of the whole system. The new intake point was at a lower point than the Dziwe La Nkhalamba and therefore the design parameters including expected pressure, yield of water, pump sizes had to be revisited.

Further, because of the terrain, most of the work could not be mechanized. Most of the equipment, tools and materials had to be carried by porters up the mountain. This necessitated the design of the twin pipes of 350mm Diameter – for easy lifting up the mountain - from the intake to the lower slopes of the mountain from where a single 500mm Diameter main was constructed to the treatment and pumping station at Nguludi Turn-off. Thereafter, a pumping main of 500mm Diameter to Mpingwe Hill reservoir for gravity distribution to Limbe. Figure 4 below shows the twin 350mm Diameter gravity intake pipes.

Figure 4 - Twin Gravity 350mm Diameter Pipes from Intake to Lower slopes of Mulanje Mountain

In addition, the project was beset with agitation from the communities surrounding the project. There were many instances when the Contractor was stopped from working by the local community demanding disbursement of compensation for land and crops.

Insurance for the Works: The study found that between the commencement of the project on 1st November 2017 and 24th January 2018 the works were not covered by Contractor's All Risks Insurance. The project managers would have been within their rights to suspend the works or for BwB to obtain the insurance on the Contractors behalf and the due amount charged to the contractor through Interim Payment Certificates. It is too risky for a contractor to work without insurance.

The study finds that the project managers should have been more proactive in forcing the Contractor to obtain insurance for the works.

c) Time and Cost Overrun

It is seen in this Assurance study that delay in paying compensation to land owners – a reason identified in the Kamanga[5] study – had an impact on the delays experienced in the construction of the BwB Likhubula water project. Cyclone Idai also played a significant role in delaying the completion of the project as the Contractor could not work during prolonged rainy periods. The Contractor also face delays in getting the Ministry of Mining approval for blasting a rocky outcrop in Mpingwe. As a result the above delays extended the period of construction by 3 months. Instead of the project completing on 30th June 2019, actual completion was on 30th September 2019.

Cost Overrun: There was no cost overrun on this project. The Contract sum was **US$ 23,444,551.06.** The cost of the project at completion was **US$ 23,440,053.10.** It is seen from the performance that the line of credit of **US$ 23.50 Million** was not fully used.

Based on the above, the extension of time had valid reasons and the contract was delivered within budget.

The study finds that this project was well run with no cost overrun and the extension of time to the period of Contract was justifiable.

d) Quality of the Works

Quality control of imported materials from India was achieved through pre-shipment inspections carried out by delegation led by the BwB Board and team of engineers who witnessed the quality control tests and signed the certification documents.

[5] M.J. Kamanga and Wynard JvdnM Steyn (2013) Causes of Delay in Road Construction Projects in Malawi.

For civil works quality control, samples were collected on site and tested at approved materials testing laboratories.

Quality control and quality assurance protocols were therefore followed on this project.

4.1.4 LILONGWE WATER AND SANITATION PROJECT

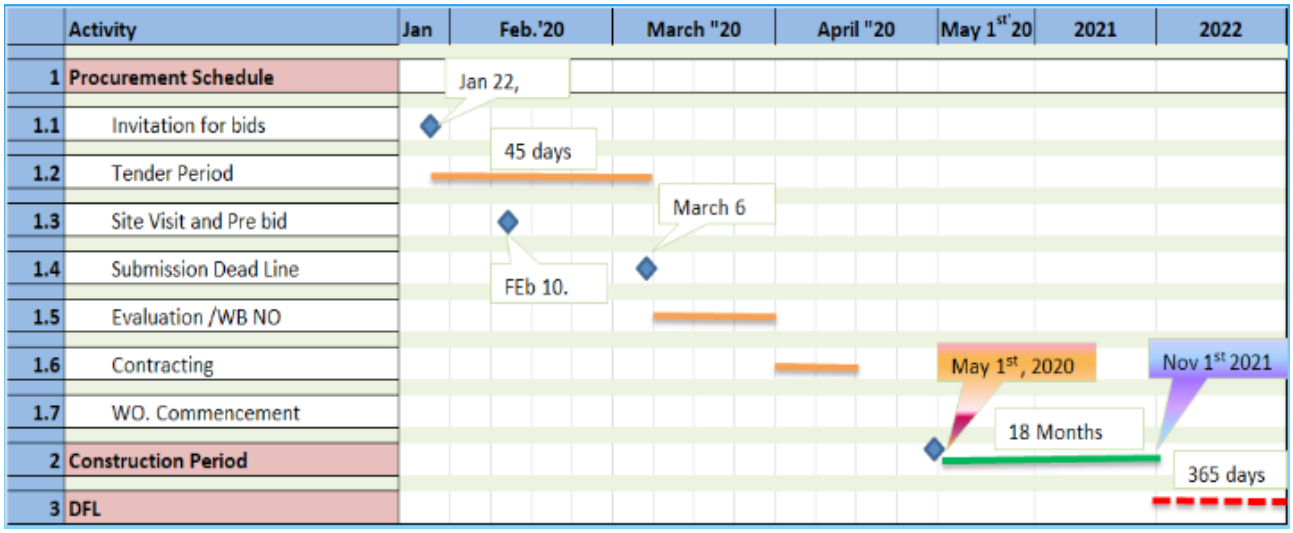
1. TRANSPARENCY AND ASSURANCE

This section of the study assesses compliance during various phases of the project cycle including tender management, Cost Control, Safety, Design Studies, time management, and quality control.

2. TENDER MANAGEMENT

Government of Malawi secured financing from World Bank US$100 Million (US $75 Million loan, US$25 Million grant) to implement a 6-year project aimed at improving water and sanitation affecting half a million residents of Lilongwe City.

The Employer produced a procurement project implementation plan for the project:



a) Selection of Contractor

Tendering method was International Competitive Bidding. Five (5) bidders submitted their bids by 15:00 hours Malawi time on 06 March 2020:

- CHINA GEO ENG Corporation
- China State CONS ENG CORP LTD
- MEECA-SAWA Group

- Sinohydro Corporation
- UNIK ENG PVT LTD

The following Table 4 shows the bids as read out at bid opening:

The Engineer's Estimate for these works was US$ 12,000,000.

Table 4 - Bids as Read out at Bid Opening.

Table 4. Bid Prices (as Read Out)

ID No.	Bidder Identification			Read-out Bid Price(s)		Modifications or Comments
	Name *(a)*	City/State or Province *(b)*	Country *(c)*	Currency(ies) *(d)*	Amount(s) or % *(e)*	*(g)*
1	China Geo-Engineering Corporation (CGC)	Beijing	China	USD	21,968,988.48	None
				MWK	746,971,496.25	
2	China State Construction Engrg. Corp. LTD	Beijing	China	USD	11,960,953.88	None
				MWK	846,537,930.00	
3	Mota Engil Engenharia E Construcao Africa, S.A/ SAWA Group JV	Lisboa/ Lilongwe	Portugal/Malawi	USD	20,018,314.10	None
				MWK	861,620,608.62	
4	Sinohydro Corporation Limited	Beijing	China	USD	8,476,098.72	None
				MWK	2,366,963,987.65	
5	Unik Construction Eng. PTY LTD	Gaborone	Botswana	USD	10,236,401.15	None
				MWK	1,726,573,320.17	

Preliminary examination involved checking of bids for adequacy of information provided, eligibility, bid security, completeness and substantial responsiveness. All 5 bidders passed this stage and were considered for the next step which is the Technical Evaluation of the bids.

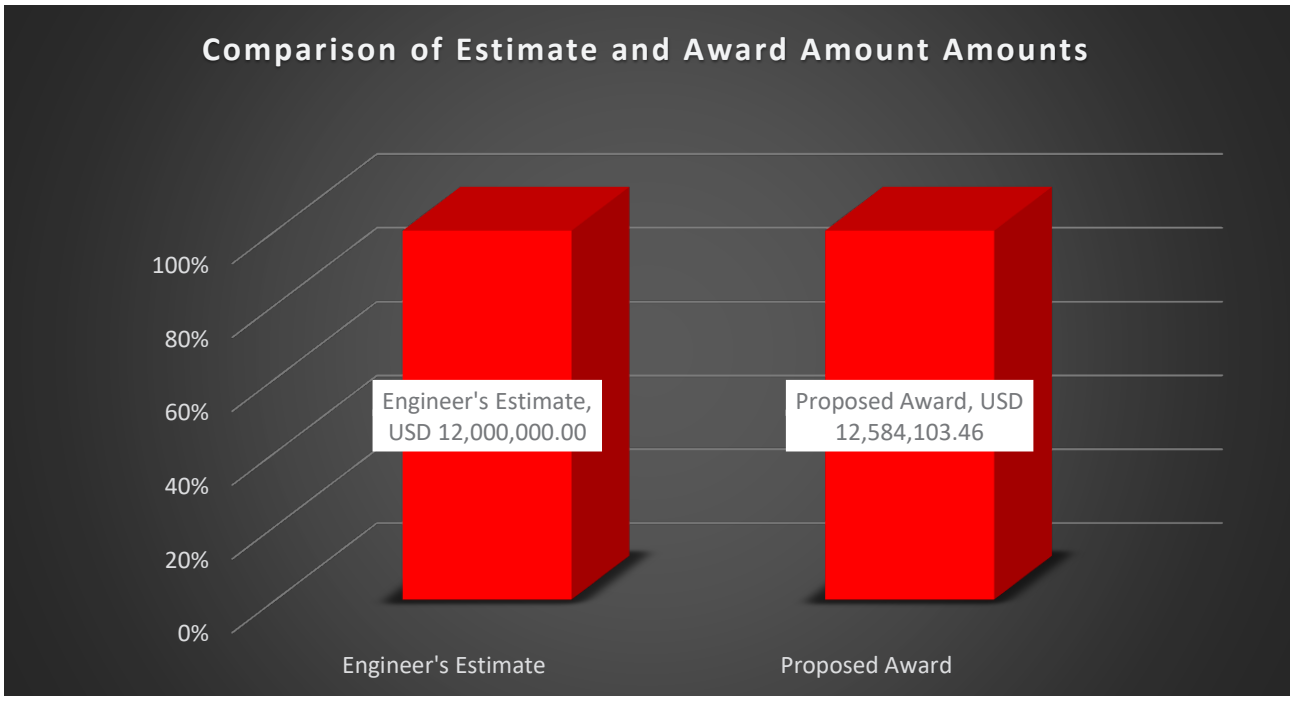
The Technical Evaluation Report shows that 4 bidders did not qualify for the next stage of the evaluation for non-compliance to the bidding requirements.

Hence, only Unik Pvt Ltd was considered for the next stage of the evaluation which is Detailed Examination.

Detailed examination of UNIK bid included correction of arithmetic errors. The bid was corrected from the amounts shown in Table 4 above to **US$ 10,262,980.65** and **MK 1,726,619,192.05.** When these sums are converted to US dollars at the rate ruling in the bid procedure, the price for award is US$ 12,584,103.46 which is higher than the estimated cost for the project at US$ 12Million. The graph in Figure 5 below is a representation of this data.

Bid from UNIK ENG PVT LTD ENG emerged as the lowest evaluated and was therefore assessed to check if the bidder still met the Qualification Criteria as stipulated in the bidding document. Having made the assessment whether Unik met the qualification criteria, UNIK ENG PVT LTD ENG was recommended for award.

Figure 5 - Comparison of Budget against Lowest Evaluated Bid



b) Scope of Works

The main project components are:

- Priority sewerage investments, including rehabilitation and expansion of the sewerage network and of the Kauma wastewater treatment plant:
  - Rehabilitation of inlet structure and replacement of flow control gates,
  - Supply and installation of automatic screen and flow measuring device.
  - Emptying of existing ponds, removal, treatment and disposal of sludge,
  - Installation of baffles in facultative ponds and maturation ponds,
  - Construction of one new anaerobic pond and rehabilitation of existing ones,
  - Construction of rock filter,

- Construction of sludge drying beds.
- Construction of operators' building, and fence.
- Installation of solar panels and electric system

- Sewerage work including supply and laying of sewer pipes, construction of manholes, river crossing with steel structure, and trenchless crossing across main roads and rehabilitation of existing trunk lines.
- Network expansion comprises the following:
  - 43.1 km of new sewers with pipe sizes of DN 160 to 500mm and pipe material and 3,096 household connections
  - 2.3 km new trunk line to connect the proposed network with the existing system.
  - Rehabilitation works including replacement of 320 m of existing trunk sewers as well as repair or replacement of manhole covers and rehabilitation of existing pipe crossing.

3. PROJECT MANAGEMENT

a) Design Challenges

The project feasibility study prepared in August 2019 states:

> **Kauma WWTP is the largest wastewater treatment plant, built in 1997. This treatment plant is made up of series of Waste Stabilization Ponds, three Anaerobic Ponds, four Facultative Ponds and six Maturation Ponds. There are also two septage ponds that receive sewage from septic tanks, with a load capacity of around 75 m/day. The current condition of the treatment plant can be considered deplorable due to the lack of maintenance and poor management. Some of the major drawbacks are poor record keeping, of effluent flow and quality, inadequate repair and maintenance and no security of the plant (no perimeter fences).**

Kauma WWTP currently has a design capacity of 6,100 cubic metres of wastewater per day. The report further states that the treatment plant shall be expanded to handle up to 16,000 cubic metres of wastewater based on the estimated population to be served up to 2035.

The Kauma WWTP fell into a state of dilapidation after only being used for less than 24 years from 1997 when it was built. This study recommends that safeguards must be put in place when operations commence including an enforceable service charter to prevent the same happening again. An investment of US$12 Million is a huge amount to go to waste.

b) Construction Implementation Challenges

The project suffered delays mainly from Resettlement of affected persons and compensation issues.

The budget for the works is US$ 12 Million. The accepted Contract sum is US$ 12,584,103.46 when the Malawi Kwacha element is converted to US Dollars and added to the dollar component of the Contract. There is therefore a funding gap of US$ 584,103.46 when the accepted Contract sum is compared with the budget of US$ 12 Million. The project manager responded, when asked by the Assurance Consultant how this gap is to be plugged, that it is anticipated that the project managers of the other components of the Lilongwe Water and Sanitation programme shall make savings in their projects which will be used to fund the deficit.

The Assurance study recommends that contingency planning should be done early to address this issue in case there are no savings in the other sub-programmes of the Lilongwe Water and Sanitation Project.

Contractor's personnel: The key positions of Project Manager, Site manager 1, and Site Manager 2 have not been filled (according to the Monthly Report of February 2021. The Project Manager is in acting capacity, Project Manager 1 was absent, and Site Manager 2 had not been approved.

A project of this magnitude requires full time presence of key personnel on site. The Assurance Report finds that the Contractor should ensure that all key personnel are available. One of the key requirements and qualification criteria for award of the Contract was the availability of qualified and experienced staff to carry out the works on site.

c) Time and Cost Overrun

Time overrun: This project currently has no time and cost overruns as progress as at the end of February 2021 is around 10%. The works are slightly behind schedule but contractor is expected to catch up.

d) Quality of the Works

Currently the works for rehabilitation of Kauma WWTP have not started except for the operators' building which is almost complete.

Most of the work is being undertaken at Area 49 where pipe trench excavation, laying sewer line, and backfilling of the trenches is being done.

The Contractor has also passed a duct under the dual carriage way through auger boring so as not to cut the highway. This work is complete.

Quality Control and Quality Assurance: Technical Specifications of construction materials are constantly being reviewed and if suitable recommended by the Consultant. Compliance tests are continuously done on site and checked by the Consultant and if suitable recommended by the contractor for the following materials:

The concrete site mix design

- The blocks suppliers test result
- Reinforcement bar suppliers test result
- The HDPE and uPVC suppliers test result
- The quarry dust and aggregate suppliers test result
- The manhole heavy duty cover load bearing test
- The sample concrete cubes taken from the site during concrete casting

The following photos Nos 10 and 11 show progress of the works.

e) Progress Photographs

Photo 10 - Laying Sewer Line in Area 49

Photo 11 - Operators' Building Under Construction at Kauma WWTP

4.1.5 REHABILITATION OF ACCESS ROADS AND DRAINAGE STRUCTURES TO CHENALI AND CHINAMA IRRIGATION SCHEMES IN MULANJE DISTRICT

i. TRANSPARENCY AND ASSURANCE

This section of the study assesses compliance during various phases of the project cycle including tender management, Cost Control, Safety, Design Studies, time management, and quality control.

ii. TENDER MANAGEMENT

Government of Malawi received a World Bank credit of SDR 70 Million to implement a 5-year (2018-2023) programme for Agriculture Commercialization Project (AGCOM) aimed at promoting the commercialization of agriculture value chain products selected under the project. The project has four components namely:

- Component 1: Building Productive Alliances,
- Component 2: Support Investment Enabling Services,
- Component 3: Contingency Emergency Response Component, and
- Component 4: Project Coordination and Management.

The component of road construction was identified under Component 1 for improvement of Last-mile Infrastructure for Productive Alliances for feeder roads to Irrigation schemes.

> **Malawi suffered devastation of infrastructure due to the effects of Tropical Cyclone Idai during the 2018/19 rain season. An estimated 975,600 people were affected, 90,000 displaced, 60 killed and 672 injured. Floods affected 15 districts and 2 cities, namely, are Balaka, Blantyre, Chikwawa, Chiradzulu, Machinga, Mangochi, Mulanje, Mwanza, Neno, Nsanje, Phalombe, Thyolo, Zomba, Zomba City and Blantyre City in the Southern region and Dedza and Ntcheu districts in the Central region** (Ministry of Agriculture, 2019).

Consequently, Malawi Government on the 8th of March 2019 declared a state of disaster in all flood affected geographical areas and appealed for international assistance. It is through this appeal for assistance that Malawi received the IDA loan to repair its infrastructure under Contingency Emergency Response Component (CERC) as one of the conditions of the Financing Agreement between the World Bank and Government of Malawi to implement emergency components of AGCOM.

It is in response to this emergency that a short list of 11 contractors were presented to the Internal Procurement and Disposal Committee (IPDC) of the Ministry of Agriculture, Irrigation and Water Development by AGCOM on 6th December 2019. It is unknown how AGCOM shortlisted these 11 Contractors. In the above meeting, AGCOM requested the IPDC to approve the 11 shortlisted Contractors and to approve a 21-day bidding period due to the emergency nature of the works.

The IPDC approved the 11 Contractors and approved the shortening of the bidding procedure to 21 days as requested by AGCOM.

a) Selection of Contractor

Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation was tendered as Lot 6 under the Rehabilitation of Roads and bridges under Contingency Emergency Response In Chiradzulu, Chikhwawa, Thyolo, Phalombe, Mulanje, Zomba, Balaka, Machinga, Ntcheu and Dedza Districts.

Lot six had 8 Contractors short listed and only 6 submitted bids. The Contractors submitting bids were:

- Meshozi Construction
- Khumbo Civil Contractors
- Chivundiko Civil Engineering Contractors
- Mtalimanja Civil Contractors

- Sempha Investments
- Kelch Construction

The bid evaluation report shows one Contractor – Meshozi Construction - was dropped at the preliminary examination stage as they did not initial every page as required and therefore only 5 were recommended for evaluation at the technical and commercial responsiveness stages.

During bid evaluation, 3 Contractors were not responsive under technical Evaluation and their bids were not considered further. The remaining 2 bidders were evaluated for Commercial Responsiveness and Kelch Construction emerged as the lowest evaluated bidder and was recommended for award at a price of MK 444,110,579.09.

Kelch Construction signed a Contract with the sum of MK 386,182,762.75. The Assurance study has not seen any documents disclosed showing why and how the recommended sum of MK 444,110,579.09 was scaled down to MK 386,182,762.75.

b) Scope of Works

The main project components are:

(i) Develop/rehabilitate small scale irrigation infrastructure benefiting Producer Organizations in productive alliances to accelerate the pace of diversification, intensification and commercialization of agricultural production;

(ii) Construct/rehabilitate feeder roads to access to the production areas;

(iii) Improve the access to electricity in project areas; and

(iv) provide access to clean water for value addition where required.

This Assurance Study concentrated on item (ii) above for construction and rehabilitation of feeder roads for access to the production areas where Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District took place.

iii. PROJECT MANAGEMENT

a) Construction Implementation Challenges

There is little information disclosed for this assurance study on how the project was managed. An interview with the Contractor however revealed that the Bridge on Chinama Irrigation Scheme access road required piling in the foundations as the soil on this site was unsuitable for bridge construction. The foundations therefore required more money. The Contractor stated that project managers decided to reduce the scope at Chenali Irrigation Scheme roads to accommodate the

additional cost of the foundation piling at Chinama.

The Assurance Consultant visited both sites on 3rd March 2021.

Chinama Irrigation Scheme Access Roads: It is understood from an interview with the Contractor that the road required a bridge to be constructed which after the works started, required piling works for the foundations. The excavation to the foundations showed that there was no hard ground upon which the foundations could be built near the surface. Hence a pile is a column inserted in the ground to transmit the weight of a structure like a bridge to a lower level as illustrated below in **Figure 6:**

Figure 6 - Illustration of a Foundation Pile

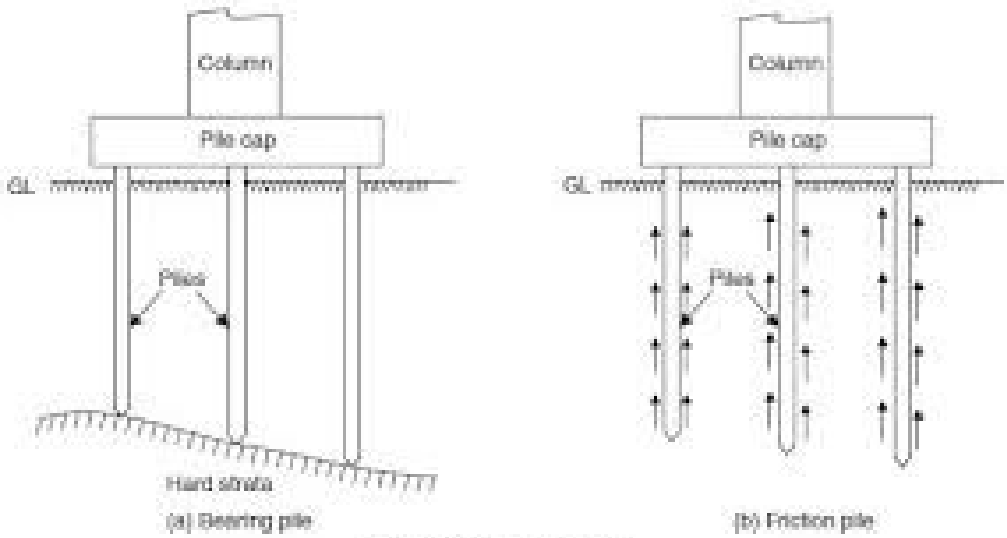


Fig. 7.9. Pile foundations

In the interview with the Assurance Consultant, the Contractor further stated that this work required a bigger budget than originally envisaged. Funds from Chenali were therefore transferred to meet this budget. The scope of work at Chenali was therefore reduced. The Assurance Consultant observed that indeed the road works at Chenali looked incomplete during the site visit.

Chenali Irrigation Scheme Access Roads: It is obvious that the works at Chenali did not achieve stated objective of improving access to the irrigation scheme. It was raining when the site visit was conducted at Chenali and the Assurance Consultant had difficulty going up the steep slopes and coming down even after having engaged four-wheel drive. It remains to be seen whether produce can be transported during the rainy season on this access road. Many sections did not receive gravel and are slippery. The road is also steep in some sections which would make it difficult for trucks to reach the irrigation scheme even during the dry season. Photo No. 12 shows steep slippery slopes with no gravel at Chenali.

Photo 12 – Steep slippery Slope without Gravel

Chinama Irrigation Scheme Access Roads: The site visit showed the completed bridge and the status of the improved and newly constructed roads. Photo 13 and 14 show the bridge and status of the road respectively.

Photo 13 - Chinama Bridge

Photo 14 - Status of road near Chinama Pump Station

The access roads at Chinama irrigation scheme are currently passable. The Assurance Consultant made the site visit after it had rained in the morning of the same day. The Assurance Consultant observed that the roads shall need constant maintenance to prevent rapid deterioration which would make the roads impassable possibly as early as the 2021/22 rainy season. Photo 15 below shows a section of the road at Chinama that has deteriorated.

Photo 15 - Chinama Road Showing a washed Away Section.

This study recommends that AGCOM finds additional funds to gravel the sections with no gravel at Chenali and to re-engineer the steep sections to make the road more accessible; as the objective of improving the access roads has not been met at Chenali Irrigation Scheme.

The Study also recommends that AGCOM should develop training programmes for road maintenance so that when the projects are handed over, the beneficiaries should mobilise and carry out labour based maintenance methods of construction of roads.

b) Time and Cost Overrun

This study did not gain access to time and cost management information.

5.0 OVERALL COST OVERRUN ON PROJECTS IN THE STUDY

Cost overrun information has been summarized in Table 5 below.

Roads Authority

- This PDE has the Chapananga project which was completed in January 2021 and the final account has not been agreed so cost overrun data is not available.
- The Road Patching project in Blantyre City is an on-going contract; data is therefore not yet available.

Blantyre Water Board

- Likhubula Water Supply project was completed and there was no cost overrun.

Lilongwe Water Board

- The Lilongwe Water and Sanitation Project is on-going

AGCOM

- The Rehabilitation of Access Roads Project was completed but the final cost was not disclosed.

Table 5 – Summary of Cost Overrun on Projects in this Study.

Ref	Description	Original Cost	Final Cost	Cost Increase	Percent Increase	Cost Overrun
1	Construction of Chikwawa – Chapananga (S136) Road Phase II (Km 5 – Km10)	MK 8,080,121,454.83				The final cost is yet to be agreed as there are small works yet to be done.
2	Pothole Patching and other Routine Maintenance Works in Blantyre City	MK 112,602,609	On-going project			
3	**Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area**	US$ 23,444,551.06	US$ 23,440,053.10	(US$ 4,497.96)	-0.00%	Project Completed and handed over. Time overrun caused by various delays. Cost was under budget
4	Lilongwe Water and Sanitation project	$10,262,980.65 and MK 1,726,182,726.75	On-going			
5	Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District	MK 386,182,762.75	Not Disclosed	Not Disclosed	Not Disclosed	Not Disclosed

6.0 CONCLUSIONS

6.1 FINDINGS AND RECOMMENDATIONS

Ref	Findings	Recommendations	Responsible Party
	Data Disclosure		
1	• The study finds that there has been an upward trajectory in compliance in submission of information for Assurance study when this study is compared with the study undertaken in 2019. • The study recommends that PDEs should have websites that are updated frequently. This assists the public in disseminating information quickly. However until total disclosure is achieved, the PDEs should strive to provide information.	PDEs should disclose data voluntarily as recommended in the 2019 study. Institutional websites should be updated frequently.	PDEs
2	Overall, reactively disclosed information has better compliance. The 2019 Assurance Study recommended that PDEs should migrate to electronic data storage. There has been no achievement towards embracing digital storage of data.	PDEs should migrate to electronic data storage.	PDEs
3	The Freedom to Information Act is now operational. There are institutions that have low compliance in providing information	Now that the Freedom to Information Act is operational, there should be enforcement for institutions that fail to comply.	CoST/PPDA
	Project Management		
4	The Chapananga Bridge designer had no access to historical data for waterflow at the point where the bridge was to be built. There are no records of the water discharge during the floods that took place in 2015 and 2021. This information is important for decision making.	This Study recommends that the Department of Water should start keeping water discharge records at Chapananga as it is more than likely that more intense flooding shall occur given the heavy agricultural use of the catchment area for Mwanza River affecting the bridge at Chapananga.	CoST/Ministry of Agriculture

Ref	Findings	Recommendations	Responsible Party
5	Chapananga bridge western approach road was damaged during the floods that took place in the 2020/21 rain season. It was observed that the damage to the approach was not caused by workmanship problems but rather due to the nature of the river which shifts course and environmental factors caused by increased agricultural use of land in the catchment area of the river and effects of climate change.	Data on the river flow should constantly be taken and analysed so that the adequacy of the bridge as designed in this environment when the country is facing environmental challenges can be monitored and corrective action taken before disaster strikes. Malawi as a country needs to start addressing design of resilient structures to mitigate the effects of climate change. This can be achieved by reviewing Design standards to accommodate the requirements for the changing climate.	CoST/ Ministry of Agriculture/NCIC
6	The question whether Malawi should adapt design of roads favouring asphalt compared with chip seal design requires studies to be conducted.	This study recommends research to be conducted which will compare roads built using asphalt road finish specification against double chip seal construction. The research should answer the question whether double chip seal specification is suitable for Malawi road construction.	Roads Authority/NCIC
7	It was observed that theft of road infrastructure such as signs is a major problem in Malawi	This study proposes that the Government should look at the penalties for theft or vandalizing road infrastructure such as signs and if lenient the penalties should be toughened to act as a deterrent against this practice. Secondly, civic education at political rallies aimed at reinforcing community activism to prevent road infrastructure vandalism is necessary. Chiefs also have a role to play. Responsibilities of chiefs need to be performance based with the prevention of vandalism in their areas as one of the key performance indicators. A system can be developed to reward chiefs for meeting set development targets for their areas.	Roads Authority/NCIC
8	The procurement of Routine Road Maintenance projects was delayed in the last cycle.	This study recommends that ways of speeding up the vetting process for procurement must be implemented as a repeat of the delays in the next procurement cycle for road infrastructure programs shall effectively kill the sector. Road Maintenance programs require adequate funding to prevent the infrastructure decaying beyond a stage where the only option is to rebuild.	Roads Authority/NCIC/Government

Ref	Findings	Recommendations	Responsible Party
9	Blantyre Water Board, in its 2017 Annual Report stated that it lost 43% of the water it pumped from source through illegal water connections and losses due to the age of the system.	This Report finds that the BwB should increase its efforts to further reduce the Non-Revenue Water to increase the amount of water it already has to potentially reduce the overall amount of water required from new sources.	BwB
10	The Likhubula river has adequate water only between the months of December and April each year.	The main conclusion to be drawn from this analysis is that conflict with the local community shall be inevitable given that the river has adequate water for everyone only during 5 months in the year.	BwB
11	The Lilongwe Sewerage Project which is aimed at upgrading the Kauma WWTP fell into disrepair after only being used for 24 years. This should never happen to the new infrastructure when it is completed.	The Kauma WWTP fell into a state of dilapidation after only being used for less than 24 years from 1997 when it was built. This study recommends that safeguards must be put in place when operations commence including an enforceable service charter to prevent the same happening again. An investment of US$12 Million is a huge amount to go to waste.	Lilongwe City
12	The Kauma WWTP Contract was awarded with a budget short fall of US$ 584,103.46	The Assurance study recommends that contingency planning should be done early to address this issue in case there are no savings in the other sub-programmes of the Lilongwe Water and Sanitation Project.	LwB/Lilongwe City
13	Key Personnel at project management level were either not recruited nor present on site.	A project of this magnitude requires full time presence of key personnel on site. The Assurance Report finds that the Contractor should ensure that all key personnel are available. One of the key requirements and qualification criteria for award of the Contract was the availability of qualified and experienced staff to carry out the works on site.	LWB/Lilongwe City
14	The roads at Chenali Irrigation Access Roads Project were not fully completed as funds had to be diverted to Chinama Irrigation Access Roads Project which required more money to complete the bridge due to unforeseen underground conditions. The roads are deteriorating rapidly and shall require constant maintenance.	This study recommends that AGCOM finds additional funds to gravel the sections with no gravel at Chenali and to re-engineer the steep sections to make the road more accessible; as the objective of improving the access roads has not been met at Chenali Irrigation Scheme. The Study also recommends that AGCOM should develop training programmes for road maintenance so that when the projects are handed over, the beneficiaries should mobilise and carry out labour-based maintenance methods of construction of roads.	AGCOM

ANNEX 1

Disclosed Data for Chikwawa Chapananga Road & bridge Project

ANNEX 1 - Summary of Disclosed Data for Chikwawa Chapananga Road & bridge Project

IDS Disclosure Items		Ministry of Transport & Public Works
Proactive Disclosure		**Upgrading of Chikwawa - Chapananga (S136)Road**
Project Identification & Preparation Phase		8
Project Completion Phase		6
Procurement and Contract Award Phase		5
Every 6 Months of Contract Implementation		9
Contract Completion Phase		7
	Total Points Scored	**35**
	Upgrading of Chikwawa - Chapananga (S136)Road	**58**
	Percentage Proactive Disclosure	**60%**
Reactive Disclosure		
Project Identification and Preparation Phase		1
Project Completion Phase		3
Contract Procurement Phase		1
Contract Phase		3
Contract Implementation		5
	Total Points Scored	**13**
	Upgrading of Chikwawa - Chapananga (S136)Road	**26**
	Percentage Reactive Disclosure	**50%**

ANNEX 1 - Summary of Proactive Disclosure for Chikwawa Chapananga Road & Bridge Project

Project Information			Ministry of Transport & Public Works	Percentage Non Disclosure
Project Identification & Preparation Phase		Disclosure Points	Upgrading of Chikwawa Chapananga (S136)Road	All
1	Method of Project Selection	1	0	100
2	Sector, Subsector	1	1	0
3	Project Title	1	1	0
4	Project Location	1	1	0
5	Project Purpose	1	1	0
6	Project Scope (Main Output)	1	1	0
7	Environmental Impact (If Applicable)	1	0	100
8	Land and Settlement Impact (If Applicable)	1	0	100
9	Funding Source	1	1	0
10	Project Budget Approval Date	1	0	100
11	Project Estimated Value	1	1	0
12	Contact Details	1	1	0
	Sub-Total	12	8	33
Project Completion Phase				
13	Project Title	1	1	0
14	Procuring Entity	1	1	0
15	Completion Cost	1	1	0
16	Completion Date	1	1	0
17	Scope at Completion	1	1	0
18	Reasons for Changes	1	0	100
19	Reference to audit and evaluation report	1	0	100
20	Safety Measures (Incidents and death)	1	0	100
21	Contract Details	1	1	0
	Sub-Total	9	6	33.33
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	1	0
23	Procuring Entity & Contact Details	1	1	0
24	Procurement Proceedings	1	0	100
25	Contract Type	1	0	100
26	Bid Security	1	0	100
27	Number of Firms Tendering	1	0	100
28	Contracted Firm	1	1	0
29	Cost Estimate	1	0	100
30	Contract Price	1	1	0
31	Date of Procurement or Project Announcement	1	0	100
32	Date of Contract Award	1	0	100
33	Contract Scope of Works	1	0	100
34	Contract Start Date and Duration	1	0	100
35	Media used for Procurement Announcement	1	0	100
36	Contact Details	1	1	0
	Sub-Total	15	5	67

Project Information			Ministry of Transport & Public Works	Percentage Non Disclosure
Project Identification & Preparation Phase		Disclosure Points	Upgrading of Chikwawa Chapananga (S136)Road	All
Every 6 Months of Contract Implementation				
37	Contract Title	1	1	0
38	Procuring Entity	1	1	0
39	Contractor/Consultant	1	1	0
40	Contract Start Date	1	0	100
41	Contract Duration	1	0	100
42	Original Contract Price	1	1	0
43	Contract Physical Progress Status (%)	1	1	0
44	Description of Project Component	1	1	0
45	Changes to Contract Scope and Reasons	1	0	100
46	Total Payments Effected	1	0	100
47	Details of Termination (If Applicable)	1	1	0
48	Disputed Issues and Status	1	0	100
49	Safety Measures (Incidents & Deaths)	1	1	0
50	Contact Details	1	1	0
	Sub-Total	14	9	36
Contract Completion Phase				
51	Contract Title	1	1	0
52	Procuring Entity	1	1	0
53	Escalation of Contract Price	1	0	100
54	Variation to Contract Duration	1	1	0
55	Variation to Contract Scope	1	1	0
56	Reason for Price Changes	1	1	0
57	Reason for Scope and Duration Changes	1	1	0
58	Contact Details	1	1	0
	Sub-Total	**8**	**7**	**13**
	Total Scores	**58**	**35**	**40**
	Percentage Score		**60%**	

Project Information				Ministry of Transport and Public Works
Project Identification & Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
1	Method of Project Selection	1	0	**Not Disclosed**
2	Sector, Subsector	1	1	Transport, Roads
3	Project Title	1	1	Construction of Chikwawa – Chapananga (S136) Road and Bridge
4	Project Location	1	1	Chikwawa District
5	Project Purpose	1	1	To link the districts of Mwanza and Chikwawa, access to tourism, export route for sugar
6	Project Scope (Main Output)	1	1	Construction of 23.5km road and 180m long bridge
7	Environmental Impact (If Applicable)	1	0	Not Disclosed
8	Land and Settlement Impact (If Applicable)	1	0	Not Disclosed
9	Funding Source	1	1	Malawi Govt
10	Project Budget Approval Date	1	0	**Not Disclosed**
11	Project Estimated Value	1	1	MK 8 Billion
12	Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
	Sub-Total	12	8	
Project Completion Phase				
13	Project Title	1	1	Construction of Chikwawa – Chapananga (S136) Road and Bridge
14	Procuring Entity	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
15	Completion Cost	1	1	**To Be Concluded**
16	Completion Date	1	1	15-Jan-21
17	Scope at Completion	1	1	Construction of 10km road to bitumen standard and 180m long concrete bridge
18	Reasons for Changes	1	0	**Not Disclosed**
19	Reference to audit and evaluation report	1	0	**Not Disclosed**
20	Safety Measures (Incidents and death)	1	0	**Not Disclosed**
21	Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
	Sub-Total	9	6	
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	1	Upgrading of Chikwawa - Chapananga (S136)Road
23	Procuring Entity & Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
24	Procurement Proceedings	1	0	**Not Disclosed**
25	Contract Type	1	0	**Not Disclosed**
26	Bid Security	1	0	**Not Disclosed**
27	Number of Firms Tendering	1	0	**Not Disclosed**
28	Contracted Firm	1	1	Plem Construction Ltd
29	Cost Estimate	1	0	Not Disclosed
30	Contract Price (MK)	1	1	**KM 8 Billion**
31	Date of Procurement or Project Announcement	1	0	**Not Disclosed**
32	Date of Contract Award	1	0	**Not Disclosed**
33	Contract Scope of Works	1	0	Not Disclosed
34	Contract Start Date and Duration	1	0	Not Disclosed
35	Media used for Procurement Announcement	1	0	**Not Disclosed**
36	Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
	Sub-Total	15	5	
Every 6 Months of Contract Implementation				

Project Information				Ministry of Transport and Public Works
Project Identification & Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
37	Contract Title	1	1	Upgrading of Chikwawa - Chapananga (S136)Road
38	Procuring Entity	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
39	Contractor/Consultant	1	1	Plem Construction Ltd/Bua Consulting Engineers
40	Contract Start Date	1	0	Not disclosed
41	Contract Duration	1	0	Not disclosed
42	Original Contract Price	1	1	**MK 8 Billion**
43	Contract Physical Progress Status (%)	1	1	100%
44	Description of Project Component	1	1	Construction of road to bitumen standard, and construction of bridge
45	Changes to Contract Scope and Reasons	1	0	**Not disclosed**
46	Total Payments Effected	1	0	**Not disclosed**
47	Details of Termination (If Applicable)	1	1	**n/a**
48	Disputed Issues and Status	1	0	**Not disclosed**
49	Safety Measures (Incidents & Deaths)	1	1	**Reported in monthly progress reports**
50	Contact Details	1	1	**Roads Authority, P/Bag B346, Lilongwe 3, Malawi**
	Sub-Total	14	9	
Contract Completion Phase				
51	Contract Title	1	1	Upgrading of Chikwawa - Chapananga (S136)Road
52	Procuring Entity	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
53	Escalation of Contract Price	1	0	Not Disclosed
54	Variation to Contract Duration	1	1	Documented, on file
55	Variation to Contract Scope	1	1	Documented, on file
56	Reason for Price Changes	1	1	Documented, on file
57	Reason for Scope and Duration Changes	1	1	Documented, on file
58	Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
	Sub-Total	8	7	
	Total Scores	58	35	

Project Information		Upgrading of Chikwawa - Chapananga	Ministry of Transport and Public Works	Percentage Non-Disclosure
Project Identification and Preparation Phase		Disclosure Points	Disclosure Score	Upgrading of Chikwawa - Chapananga (S136)Road
1	Multi-Year Programme and Budget	1	0	100
2	Environmental & Social Impact Assessment	1	0	100
3	Resettlement and Compensation Plan	1	0	100
4	Contact Details	1	1	0
5	Financial Agreement	1	0	100
6	Procurement Plan	1	0	100
7	Project Approval Decision	1	0	100
	Sub-Total	**7**	**1**	86
Project Completion Phase				
8	Implementation Progress Reports	1	1	0
9	Budget Amendment Decision	1	1	0
10	Project Evaluation Report	1	0	100
11	Technical Audit Reports	1	0	100
12	Financial Audit Report	1	0	100
13	Project Completion Report	1	0	100
14	Contact Details	1	1	0
	Sub-Total	**7**	**3**	57
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	0	100
16	Tender Documents	1	0	100
17	Tender Evaluation Results	1	0	100
18	Project Design Report	1	1	0
	Sub-Total	**4**	**1**	75
Contract Phase				
19	Contract Agreement and Conditions	1	1	0
20	Contract Firm (Winning Bid)	1	1	0
21	Specifications and Drawings	1	1	0
	Sub-Total	**3**	**3**	0
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	0
23	List of Escalation Approvals	1	1	0
24	Quality Assurance Reports	1	1	0
25	Disbursement Records or Payment Certificates	1	1	0
26	Contract Amendments	1	1	0
	Sub-Total	**5**	**5**	0
	Total Scores	26	13	50

Applicable Data Points 26 100 50

App 1 Proactive Disclosure for Chikwawa - Chapananga Road & Bridge Project

Project Information				Collected Information from Roads Authority
Project Identification and Preparation Phase		Disclosure Points	Disclosure Scores	**Upgrading of Chikwawa - Chapananga (S136)Road**
1	Multi-Year Programme and Budget	1	0	Not Disclosed
2	Environmental & Social Impact Assessment	1	0	Not Disclosed
3	Resettlement and Compensation Plan	1	0	Not Disclosed
4	Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
5	Financial Agreement	1	0	Not Disclosed
6	Procurement Plan	1	0	Not Disclosed
7	Project Approval Decision	1	0	Not Disclosed
	Sub-Total	**7**	**1**	
Project Completion Phase				
8	Implementation Progress Reports	1	1	Disclosed, on File
9	Budget Amendment Decision	1	1	Disclosed, on File
10	Project Evaluation Report	1	0	Not disclosed
11	Technical Audit Reports	1	0	Not disclosed
12	Financial Audit Report	1	0	Not disclosed
13	Project Completion Report	1	0	Not disclosed
14	Contact Details	1	1	Roads Authority, P/Bag B346, Lilongwe 3, Malawi
	Sub-Total	**7**	**3**	
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	0	Not Disclosed
16	Tender Documents	1	0	Not Disclosed
17	Tender Evaluation Results	1	0	Not Disclosed
18	Project Design Report	1	1	Disclosed
	Sub-Total	**4**	**1**	
Contract Phase				
19	Contract Agreement and Conditions	1	1	Malawi Govt Conditions of Contract
20	Contract Firm (Winning Bid)	1	1	Plem Construction Ltd
21	Specifications and Drawings	1	1	Disclosed
	Sub-Total	**3**	**3**	
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	Documented, on file
23	List of Escalation Approvals	1	1	Documented, on file
24	Quality Assurance Reports	1	1	Documented, on file
25	Disbursement Records or Payment Certificates	1	1	Documented, on file
26	Contract Amendments	1	1	Documented, on file
	Sub-Total	**5**	**5**	

ANNEX 2

Pothole Patching and other Routine Maintenance Works in Blantyre City

ANNEX 2 - Summary of Disclosed Data for Pothole Patching and other Routine Maintenance Works in Blantyre City

IDS Disclosure Items		Ministry of Transport & Public Works
Proactive Disclosure		Blantyre City Pothole Patching
Project Identification & Preparation Phase		2
Project Completion Phase		9
Procurement and Contract Award Phase		0
Every 6 Months of Contract Implementation		8
Contract Completion Phase		4
	Total Points Scored	**23**
	Blantyre City Pothole Patching	**58**
	Percentage Proactive Disclosure	**40%**
Reactive Disclosure		
Project Identification and Preparation Phase		3
Project Completion Phase		7
Contract Procurement Phase		4
Contract Phase		3
Contract Implementation		5
	Total Points Scored	**22**
	Blantyre City Pothole Patching	**26**
	Percentage Reactive Disclosure	**85%**

ANNEX 2 - Summary of Proactive Disclosure for Pothole Patching and other Routine Maintenance Works in Blantyre City

Project Information			Ministry of Transport & Public	Percentage Non Disclosure
Project Identification & Preparation Phase		**Disclosure Points**	**Blantyre City**	**All**
1	Method of Project Selection	1	0	100
2	Sector, Subsector	1	0	100
3	Project Title	1	0	100
4	Project Location	1	0	100
5	Project Purpose	1	0	100
6	Project Scope (Main Output)	1	0	100
7	Environmental Impact (If Applicable)	1	1	0
8	Land and Settlement Impact (If Applicable)	1	1	0
9	Funding Source	1	0	100
10	Project Budget Approval Date	1	0	100
11	Project Estimated Value	1	0	100
12	Contact Details	1	0	100
	Sub-Total	12	2	83
Project Completion Phase				
13	Project Title	1	1	0
14	Procuring Entity	1	1	0
15	Completion Cost	1	1	0
16	Completion Date	1	1	0
17	Scope at Completion	1	1	0
18	Reasons for Changes	1	1	0
19	Reference to audit and evaluation report	1	1	0
20	Safety Measures (Incidents and death)	1	1	0
21	Contract Details	1	1	0
	Sub-Total	9	9	-
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	0	100
23	Procuring Entity & Contact Details	1	0	100
24	Procurement Proceedings	1	0	100
25	Contract Type	1	0	100
26	Bid Security	1	0	100
27	Number of Firms Tendering	1	0	100
28	Contracted Firm	1	0	100
29	Cost Estimate	1	0	100
30	Contract Price	1	0	100
31	Date of Procurement or Project Announcement	1	0	100
32	Date of Contract Award	1	0	100
33	Contract Scope of Works	1	0	100
34	Contract Start Date and Duration	1	0	100
35	Media used for Procurement Announcement	1	0	100
36	Contact Details	1	0	100
	Sub-Total	15	0	100
Project Identification & Preparation Phase		**Disclosure Points**	**Blantyre City**	**All**
Every 6 Months of Contract Implementation				
37	Contract Title	1	1	0
38	Procuring Entity	1	1	0
39	Contractor/Consultant	1	1	0
40	Contract Start Date	1	1	0
41	Contract Duration	1	1	0
42	Original Contract Price	1	0	100
43	Contract Physical Progress Status (%)	1	0	100
44	Description of Project Component	1	1	0
45	Changes to Contract Scope and Reasons	1	0	100
46	Total Payments Effected	1	0	100
47	Details of Termination (If Applicable)	1	1	0
48	Disputed Issues and Status	1	0	100
49	Safety Measures (Incidents & Deaths)	1	0	100
50	Contact Details	1	1	0
	Sub-Total	14	8	43
Contract Completion Phase				
51	Contract Title	1	1	0
52	Procuring Entity	1	1	0
53	Escalation of Contract Price	1	1	0
54	Variation to Contract Duration	1	0	100
55	Variation to Contract Scope	1	0	100
56	Reason for Price Changes	1	0	100
57	Reason for Scope and Duration Changes	1	0	100
58	Contact Details	1	1	0
	Sub-Total	**8**	**4**	**50**
	Total Scores	**58**	**23**	**60**
	Percentage Score		**40%**	

ANNEX 2 - Proactive Disclosure for Pothole Patching and other Routine Maintenance Works in Blantyre City

Project Information			Blantyre City Pothole Patching	Ministry of Transport & Public Works
Project Identification & Preparation		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
1	Method of Project Selection	1	0	**Not Disclosed**
2	Sector, Subsector	1	0	Not Disclosed
3	Project Title	1	0	Not Disclosed
4	Project Location	1	0	Not Disclosed
5	Project Purpose	1	0	Not Disclosed
6	Project Scope (Main Output)	1	0	Not Disclosed
7	Environmental Impact (If Applicable)	1	1	N/a
8	Land and Settlement Impact (If	1	1	N/a
9	Funding Source	1	0	Not Disclosed
10	Project Budget Approval Date	1	0	**Not Disclosed**
11	Project Estimated Value	1	0	Not Disclosed
12	Contact Details	1	0	Not Disclosed
	Sub-Total	12	2	
Project Completion Phase				
13	Project Title	1	1	Pothole Patching and other Routine Maintenance Works in Blantyre City
14	Procuring Entity	1	1	Roads Authority
15	Completion Cost	1	1	**N/A**
16	Completion Date	1	1	1st July 2021
17	Scope at Completion	1	1	N/a
18	Reasons for Changes	1	1	**N/a**
19	Reference to audit and evaluation report	1	1	**N/A**
20	Safety Measures (Incidents and death)	1	1	**No Incidents**
21	Contact Details	1	1	**Roads Authority, P/bag B346, Lilongwe 3**
	Sub-Total	9	9	
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	0	Not Disclosed
23	Procuring Entity & Contact Details	1	0	**Not Disclosed**
24	Procurement Proceedings	1	0	**Not Disclosed**
25	Contract Type	1	0	**Not Disclosed**
26	Bid Security	1	0	**Not Disclosed**
27	Number of Firms Tendering	1	0	**Not Disclosed**
28	Contracted Firm	1	0	Not Disclosed
29	Cost Estimate	1	0	Not Disclosed
30	Contract Price (MK)	1	0	**Not Disclosed**
31	Date of Procurement or Project	1	0	**Not Disclosed**
32	Date of Contract Award	1	0	**Not Disclosed**
33	Contract Scope of Works	1	0	Not Disclosed
34	Contract Start Date and Duration	1	0	Not Disclosed
35	Media used for Procurement	1	0	**Not Disclosed**
36	Contact Details	1	0	Not Disclosed
	Sub-Total	15	0	
Every 6 Months of Contract Implementation				

Project Information			Blantyre City Pothole Patching	Ministry of Transport & Public Works
Project Identification & Preparation		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
37	Contract Title	1	1	Pothole Patching and other Routine Maintenance Works in Blantyre City
38	Procuring Entity	1	1	**Roads Authority, P/bag B346, Lilongwe 3**
39	Contractor/Consultant	1	1	Mungo Civil Engineering/GK Works
40	Contract Start Date	1	1	04-Oct-20
41	Contract Duration	1	1	270 Days
42	Original Contract Price	1	0	Not Disclosed
43	Contract Physical Progress Status (%)	1	0	Not Disclosed
44	Description of Project Component	1	1	Pothole Patching and other Routine Maintenance Works in Blantyre City
45	Changes to Contract Scope and Reasons	1	0	**Not Disclosed**
46	Total Payments Effected	1	0	**Not Disclosed**
47	Details of Termination (If Applicable)	1	1	**n/a**
48	Disputed Issues and Status	1	0	**Not Disclosed**
49	Safety Measures (Incidents & Deaths)	1	0	**Not Disclosed**
50	Contact Details	1	1	**Roads Authority, P/bag B346, Lilongwe 3**
	Sub-Total	14	8	
Contract Completion Phase				
51	Contract Title	1	1	Pothole Patching and other Routine Maintenance Works in Blantyre City
52	Procuring Entity	1	1	Roads Authority, P/bag B346, Lilongwe 3
53	Escalation of Contract Price	1	1	N/a
54	Variation to Contract Duration	1	0	not disclosed
55	Variation to Contract Scope	1	0	not disclosed
56	Reason for Price Changes	1	0	not disclosed
57	Reason for Scope and Duration Changes	1	0	not disclosed
58	Contact Details	1	1	Roads Authority, P/bag B346, Lilongwe 3
	Sub-Total	8	4	
	Total Scores	58	23	

ANNEX 2 - Summary of Reactive Disclosure for Pothole Patching and other Routine Maintenance Works in Blantyre City

Project Information			Ministry of Transport & Public Works	Percentage Non-Disclosure
Project Identification and Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Blantyre City Pothole**
1	Multi-Year Programme and Budget	1	0	100
2	Environmental & Social Impact Assessment	1	1	0
3	Resettlement and Compensation Plan	1	1	0
4	Contact Details	1	1	0
5	Financial Agreement	1	0	100
6	Procurement Plan	1	0	100
7	Project Approval Decision	1	0	100
	Sub-Total	**7**	**3**	57
Project Completion Phase				
8	Implementation Progress Reports	1	1	0
9	Budget Amendment Decision	1	1	0
10	Project Evaluation Report	1	1	0
11	Technical Audit Reports	1	1	0
12	Financial Audit Report	1	1	0
13	Project Completion Report	1	1	0
14	Contact Details	1	1	0
	Sub-Total	**7**	**7**	0
	Contract Information			
Contract Procurement Phase				
15	Procurement Method	1	1	0
16	Tender Documents	1	1	0
17	Tender Evaluation Results	1	1	0
18	Project Design Report	1	1	0
	Sub-Total	**4**	**4**	0
19	Contract Agreement and Conditions	1	1	0
Contract Phase				
20	Contract Firm (Winning Bid)	1	1	0
21	Specifications and Drawings	1	1	0
	Sub-Total	**3**	**3**	0
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	0
23	List of Escalation Approvals	1	1	0
24	Quality Assurance Reports	1	1	0
25	Disbursement Records or Payment Certificates	1	1	0
26	Contract Amendments	1	1	0
	Sub-Total	**5**	**5**	0
	Total Scores	26	22	15
	Applicable Data Points 26		100	85

ANNEX 2 – REACTIVE DISCLOSURE DATA SETS FOR POTHOLE PATCHING AND OTHER MAINTENANCE IN BLANTYRE CITY

Project Information				Collected Information from Blantyre Roads Auth Files
Project Identification and Preparation Phase		Disclosure	Disclosure	**Blantyre City Pothole Patching**
1	Multi-Year Programme and Budget	1	0	Not Disclosed
2	Environmental & Social Impact Assessment	1	1	Not Required
3	Resettlement and Compensation Plan	1	1	Not Required
4	Contact Details	1	1	Roads Authority, P/bag B346, Lilongwe 3
5	Financial Agreement	1	0	Not Disclosed
6	Procurement Plan	1	0	Not Disclosed
7	Project Approval Decision	1	0	Not Disclosed
	Sub-Total	**7**	**3**	
Project Completion Phase				
8	Implementation Progress Reports	1	1	Minutes of Meetings seen
9	Budget Amendment Decision	1	1	N/a
10	Project Evaluation Report	1	1	N/a
11	Technical Audit Reports	1	1	Not Audited
12	Financial Audit Report	1	1	Not Audited
13	Project Completion Report	1	1	N/a
14	Contact Details	1	1	Roads Authority, P/bag B346, Lilongwe 3
	Sub-Total	**7**	**7**	
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	1	National Competitive Bidding
16	Tender Documents	1	1	Disclosed
17	Tender Evaluation Results	1	1	Disclosed
18	Project Design Report	1	1	N/a
	Sub-Total	**4**	**4**	
Contract Phase				
19	Contract Agreement and Conditions	1	1	Disclosed
20	Contract Firm (Winning Bid)	1	1	Mungo Civil Engineering/GK Works
21	Specifications and Drawings	1	1	Disclosed
	Sub-Total	**3**	**3**	
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	Disclosed
23	List of Escalation Approvals	1	1	N/a
24	Quality Assurance Reports	1	1	Disclosed
25	Disbursement Records or Payment Certificates	1	1	Disclosed
26	Contract Amendments	1	1	N/a
	Sub-Total	**5**	**5**	

ANNEX 3

Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area

ANNEX 3 - Summary of Disclosed Data for Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area

IDS Disclosure Items	Likhubula Water Project	Ministry of Agriculture, Water Development and Irrigation; National Water Development		
Proactive Disclosure		**Disclosure points**	**Disclosure Score**	**Percentage Disclosure**
Project Identification & Preparation Phase		12	10	83%
Project Completion Phase		9	4	44%
Procurement and Contract Award Phase		15	7	47%
Every 6 Months of Contract Implementation		14	8	57%
Contract Completion Phase		8	3	38%
	Total Points	**58**	32	55%
	Likhubula Water Project			
	Percentage			**55%**
Reactive Disclosure				
Project Identification and Preparation Phase		7	5	5
Project Completion Phase		7	3	57
Contract Procurement Phase		4	4	0
Contract Phase		3	3	0
Contract Implementation		5	5	0
	Total Points	**26**	**20**	**77%**
	Likhubula Water Project			
	Percentage Reactive Disclosure			**77%**

ANNEX 3 - Summary of Proactive Disclosure for Construction of New Water Supply System from Likhubula River to Blantyre Water

	Project Information		Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non Disclosure
Project Identification & Preparation Phase		**Disclosure Points**	**Likhubula**	**All**
1	Method of Project Selection	1	0	100
2	Sector, Subsector	1	1	0
3	Project Title	1	1	0
4	Project Location	1	1	0
5	Project Purpose	1	1	0
6	Project Scope (Main Output)	1	1	0
7	Environmental Impact (If Applicable)	1	1	0
8	Land and Settlement Impact (If Applicable)	1	1	0
9	Funding Source	1	1	0
10	Project Budget Approval Date	1	0	100
11	Project Estimated Value	1	1	0
12	Contact Details	1	1	0
	Sub-Total	12	10	17
Project Completion Phase				
13	Project Title	1	1	0
14	Procuring Entity	1	1	0
15	Completion Cost	1	0	100
16	Completion Date	1	1	0
17	Scope at Completion	1	1	0
18	Reasons for Changes	1	0	100
19	Reference to audit and evaluation report	1	0	100
20	Safety Measures (Incidents and death)	1	0	100
21	Contract Details	1	0	100
	Sub-Total	9	4	55.56
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	1	0
23	Procuring Entity & Contact Details	1	1	0
24	Procurement Proceedings	1	0	100
25	Contract Type	1	0	100
26	Bid Security	1	0	100
27	Number of Firms Tendering	1	0	100
28	Contracted Firm	1	1	0
29	Cost Estimate	1	1	0
30	Contract Price	1	0	100
31	Date of Procurement or Project Announcement	1	0	100
32	Date of Contract Award	1	0	100
33	Contract Scope of Works	1	1	0
34	Contract Start Date and Duration	1	1	0
35	Media used for Procurement Announcement	1	0	100
36	Contact Details	1	1	0
	Sub-Total	15	7	53

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non Disclosure
Project Identification & Preparation Phase		**Disclosure Points**	**Likhubula Water Project**	**All**
Every 6 Months of Contract Implementation				
37	Contract Title	1	1	0
38	Procuring Entity	1	1	0
39	Contractor/Consultant	1	1	0
40	Contract Start Date	1	1	0
41	Contract Duration	1	1	0
42	Original Contract Price	1	0	100
43	Contract Physical Progress Status (%)	1	1	0
44	Description of Project Component	1	1	0
45	Changes to Contract Scope and Reasons	1	0	100
46	Total Payments Effected	1	0	100
47	Details of Termination (If Applicable)	1	0	100
48	Disputed Issues and Status	1	0	100
49	Safety Measures (Incidents & Deaths)	1	0	100
50	Contact Details	1	1	0
	Sub-Total	14	8	43
Contract Completion Phase				
51	Contract Title	1	1	0
52	Procuring Entity	1	1	0
53	Escalation of Contract Price	1	0	100
54	Variation to Contract Duration	1	0	100
55	Variation to Contract Scope	1	0	100
56	Reason for Price Changes	1	0	100
57	Reason for Scope and Duration Changes	1	0	100
58	Contact Details	1	1	0
	Sub-Total	**8**	**3**	**63**
	Total Scores	**58**	**32**	**45**
	Percentage Score		**55%**	

ANNEX 3 - Proactive Disclosure for Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area

Project Information				Ministry of Agriculture, Water Development and Irrigation
Project Identification & Preparation		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
1	Method of Project Selection	1	0	**Not Provided**
2	Sector, Subsector	1	1	Agriculture, Water Development and Irrigation; National Water Development
3	Project Title	1	1	Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area
4	Project Location	1	1	Mulanje and Blantyre Districts
5	Project Purpose	1	1	Increase water availability and reduce cost of electricity for pumping
6	Project Scope (Main Output)	1	1	Add 20 million litres to existing supply, to benefit 300,000 residents
7	Environmental Impact (If Applicable)	1	1	ESIA Completed 2017 (2017 Annual Report)
8	Land and Settlement Impact (If	1	1	Land Resettlement Impact completed 2017 (2017 Annual Report)
9	Funding Source	1	1	Export-Import (EXIM) Bank of India
10	Project Budget Approval Date	1	0	**Not Provided**
11	Project Estimated Value	1	1	US$ 21 Million (2017 Annual Report)
12	Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
	Sub-Total	12	10	
Project Completion Phase				
13	Project Title	1	1	Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area
14	Procuring Entity	1	1	Blantyre Water Board
15	Completion Cost	1	0	**Not provided**
16	Completion Date	1	1	Planned: 30 June 2019
17	Scope at Completion	1	1	Raw water Gravity line (44km), treated water pumped line (11km), treatment plant, storage tanks
18	Reasons for Changes	1	0	**Not provided**
19	Reference to audit and evaluation report	1	0	**Not provided**
20	Safety Measures (Incidents and death)	1	0	**Not provided**
21	Contract Details	1	0	**Not provided**
	Sub-Total	9	4	
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	1	Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area
23	Procuring Entity & Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
24	Procurement Proceedings	1	0	**Not provided**
25	Contract Type	1	0	**Not provided**
26	Bid Security	1	0	**Not provided**
27	Number of Firms Tendering	1	0	**Not provided**
28	Contracted Firm	1	1	SMC Infrastructures Pvt. Ltd.
29	Cost Estimate	1	1	US$ 23.5
30	Contract Price (MK)	1	0	**Not provided**
31	Date of Procurement or Project	1	0	**Not provided**
32	Date of Contract Award	1	0	**Not provided**
33	Contract Scope of Works	1	1	Raw water Gravity line (44km), treated water pumped line (11km), treatment plant, storage tanks
34	Contract Start Date and Duration	1	1	Start: 1st November 2017, Duration: 20 Months
35	Media used for Procurement	1	0	**Not provided**
36	Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
	Sub-Total	15	7	
Every 6 Months of Contract Implementation				
Project Information				**Ministry of Agriculture, Water Development and Irrigation**
Project Identification & Preparation		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
37	Contract Title	1	1	Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area
38	Procuring Entity	1	1	Blantyre Water Board
39	Contractor/Consultant	1	1	Contractor: SMC Infrastructures Pvt. Ltd. Supervision: Blantyre Water Board In-house Experts
40	Contract Start Date	1	1	1st November 2017
41	Contract Duration	1	1	20 Months
42	Original Contract Price	1	0	**Not provided**
43	Contract Physical Progress Status (%)	1	1	100%
44	Description of Project Component	1	1	Raw water Gravity line (44km), treated water pumped line (11km), treatment plant, storage tanks
45	Changes to Contract Scope and Reasons	1	0	**Not provided**
46	Total Payments Effected	1	0	**Not provided**
47	Details of Termination (If Applicable)	1	0	**Not provided**
48	Disputed Issues and Status	1	0	**Not provided**
49	Safety Measures (Incidents & Deaths)	1	0	**Not provided**
50	Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
	Sub-Total	14	8	
Contract Completion Phase				
51	Contract Title	1	1	Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area
52	Procuring Entity	1	1	Blantyre Water Board
53	Escalation of Contract Price	1	0	Not Disclosed
54	Variation to Contract Duration	1	0	Not Disclosed
55	Variation to Contract Scope	1	0	Not Disclosed
56	Reason for Price Changes	1	0	Not Disclosed
57	Reason for Scope and Duration Changes	1	0	Not Disclosed
58	Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
	Sub-Total	**8**	**3**	
	Total Scores	**58**	**32**	

ANNEX 3 - Summary of Reactive Disclosure for Construction of New Water Supply System from Likhubula River to Blantyre Water Supply A

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non-Disclosure
Project Identification and Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Likhubula Water Project**
1	Multi-Year Programme and Budget	1	0	100
2	Environmental & Social Impact Assessment	1	1	0
3	Resettlement and Compensation Plan	1	1	0
4	Contact Details	1	1	0
5	Financial Agreement	1	1	0
6	Procurement Plan	1	0	100
7	Project Approval Decision	1	1	0
	Sub-Total	**7**	**5**	29
Project Completion Phase				
8	Implementation Progress Reports	1	1	0
9	Budget Amendment Decision	1	1	0
10	Project Evaluation Report	1	0	100
11	Technical Audit Reports	1	0	100
12	Financial Audit Report	1	0	100
13	Project Completion Report	1	0	100
14	Contact Details	1	1	0
	Sub-Total	**7**	**3**	57
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	1	0
16	Tender Documents	1	1	0
17	Tender Evaluation Results	1	1	0
18	Project Design Report	1	1	0
	Sub-Total	**4**	**4**	0
Contract Phase				
19	Contract Agreement and Conditions	1	1	0
20	Contract Firm (Winning Bid)	1	1	0
21	Specifications and Drawings	1	1	0
	Sub-Total	**3**	**3**	0
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	0
23	List of Escalation Approvals	1	1	0
24	Quality Assurance Reports	1	1	0
25	Disbursement Records or Payment Certificates	1	1	0
26	Contract Amendments	1	1	0
	Sub-Total	**5**	**5**	0
	Total Scores	26	20	23
				23
	Applicable Data Points 26	100	77	

ANNEX 3 – Reactive Disclosure Data Sets for Likhubula River To Blantyre

ANNEX 3 - Reactive Disclosure Data Sets for Construction of New Water Supply System from Likhubula River to Blantyre Water Supply Area				
Project Information				**Collected Information from Blantyre Water Board Files**
Project Identification and Preparation Phase		Disclosure Points	Disclosure Scores	**Likhubula Water Project**
1	Multi-Year Programme and Budget	1	0	Not Seen
2	Environmental & Social Impact Assessment	1	1	Approved 1st Sept 2017 by Environmental affairs
3	Resettlement and Compensation Plan	1	1	Approved 1st Sept 2017 by Environmental affairs
4	Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
5	Financial Agreement	1	1	Malawi Govt and EXIM Bank of India
6	Procurement Plan	1	0	Not Seen
7	Project Approval Decision	1	1	Application to Line Ministry
	Sub-Total	**7**	**5**	
Project Completion Phase				
8	Implementation Progress Reports	1	1	Monthly Reports available and seen
9	Budget Amendment Decision	1	1	Lowest evaluated bidder was higher than budget; negotiated contract to fit budget
10	Project Evaluation Report	1	0	Not seen
11	Technical Audit Reports	1	0	Not seen
12	Financial Audit Report	1	0	Not seen
13	Project Completion Report	1	0	Not seen
14	Contact Details	1	1	Blantyre Water Board, PO Box 30369, Chichiri Blantyre 3
	Sub-Total	**7**	**3**	
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	1	International Restricted Tender (Indian Firms Only)
16	Tender Documents	1	1	Expression of interest: 10 bidders, out of which 4 bidders were short-
17	Tender Evaluation Results	1	1	SMC Infrastructures Pvt. Ltd. Was the lowest evaluated tenderer
18	Project Design Report	1	1	Design of the scheme was for a yield of 20 million litres per day; cost
	Sub-Total	**4**	**4**	
Contract Phase				
19	Contract Agreement and Conditions	1	1	FIDIC Conditions of Contract
20	Contract Firm (Winning Bid)	1	1	SMC Infrastructures Pvt. Ltd.
21	Specifications and Drawings	1	1	Full set seen and As-Built Drawings including Operational Manuals
	Sub-Total	**3**	**3**	
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	Variations were made and all were within budget
23	List of Escalation Approvals	1	1	Not Part of Contract
24	Quality Assurance Reports	1	1	Foreign Goods inspected at factory and quality assurance for in-situ works was carried out throughout construction
25	Disbursement Records or Payment Certificates	1	1	69 Payment Certificates issued
26	Contract Amendments	1	1	None
	Sub-Total	**5**	**5**	

ANNEX 4

Disclosed Data for Lilongwe Sanitation Project

ANNEX 4 - Summary of Disclosed Data for Lilongwe Sanitation Project

IDS Disclosure Items		Ministry of Agriculture, Water Development and Irrigation; National Water Development
Proactive Disclosure		**Lilongwe Sanitation Project**
Project Identification & Preparation Phase		11
Project Completion Phase		7
Procurement and Contract Award Phase		7
Every 6 Months of Contract Implementation		7
Contract Completion Phase		5
	Total Points Scored	**37**
	Lilongwe Sanitation Project	**58**
	Percentage Proactive Disclosure	**64%**
Reactive Disclosure		
Project Identification and Preparation Phase		6
Project Completion Phase		7
Contract Procurement Phase		4
Contract Phase		0
Contract Implementation		0
	Total Points Scored	**17**
	Lilongwe Sanitation Project	**26**
	Percentage Reactive Disclosure	**65%**

ANNEX 4 - Summary of Proactive Disclosure for Lilongwe Sanitation Project

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non Disclosure
Project Identification & Preparation Phase		**Disclosure Points**	**Lilongwe Sanitation Project**	**All**
1	Method of Project Selection	1	0	100
2	Sector, Subsector	1	1	0
3	Project Title	1	1	0
4	Project Location	1	1	0
5	Project Purpose	1	1	0
6	Project Scope (Main Output)	1	1	0
7	Environmental Impact (If Applicable)	1	1	0
8	Land and Settlement Impact (If Applicable)	1	1	0
9	Funding Source	1	1	0
10	Project Budget Approval Date	1	1	0
11	Project Estimated Value	1	1	0
12	Contact Details	1	1	0
	Sub-Total	12	11	8
Project Completion Phase				
13	Project Title	1	1	0
14	Procuring Entity	1	1	0
15	Completion Cost	1	1	0
16	Completion Date	1	1	0
17	Scope at Completion	1	1	0
18	Reasons for Changes	1	1	0
19	Reference to audit and evaluation report	1	0	100
20	Safety Measures (Incidents and death)	1	0	100
21	Contract Details	1	1	0
	Sub-Total	9	7	22.22
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	1	0
23	Procuring Entity & Contact Details	1	1	0
24	Procurement Proceedings	1	1	0
25	Contract Type	1	0	100
26	Bid Security	1	0	100
27	Number of Firms Tendering	1	0	100
28	Contracted Firm	1	0	100
29	Cost Estimate	1	1	0
30	Contract Price	1	0	100
31	Date of Procurement or Project Announcement	1	0	100
32	Date of Contract Award	1	0	100
33	Contract Scope of Works	1	1	0
34	Contract Start Date and Duration	1	0	100
35	Media used for Procurement Announcement	1	1	0
36	Contact Details	1	1	0
	Sub-Total	15	7	53

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non Disclosure
Project Identification & Preparation Phase		**Disclosure Points**	**Lilongwe Sanitation Project**	**All**
Every 6 Months of Contract Implementation				
37	Contract Title	1	1	0
38	Procuring Entity	1	1	0
39	Contractor/Consultant	1	1	0
40	Contract Start Date	1	1	0
41	Contract Duration	1	1	0
42	Original Contract Price	1	0	100
43	Contract Physical Progress Status (%)	1	0	100
44	Description of Project Component	1	1	0
45	Changes to Contract Scope and Reasons	1	0	100
46	Total Payments Effected	1	0	100
47	Details of Termination (If Applicable)	1	1	0
48	Disputed Issues and Status	1	0	100
49	Safety Measures (Incidents & Deaths)	1	0	100
50	Contact Details	1	0	100
	Sub-Total	14	7	50
Contract Completion Phase				
51	Contract Title	1	1	0
52	Procuring Entity	1	1	0
53	Escalation of Contract Price	1	1	0
54	Variation to Contract Duration	1	1	0
55	Variation to Contract Scope	1	0	100
56	Reason for Price Changes	1	0	100
57	Reason for Scope and Duration Changes	1	0	100
58	Contact Details	1	1	0
	Sub-Total	**8**	**5**	**38**
	Total Scores	**58**	**37**	**36**
	Percentage Score		**64%**	

ANNEX 4 - Proactive Disclosure for Lilongwe Sanitation Project

Project Information				Ministry of Agriculture, Water Development and Irrigation
Project Identification & Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
1	Method of Project Selection	1	0	**Not Disclosed**
2	Sector, Subsector	1	1	Water Development, Urban Development, Sanitation
3	Project Title	1	1	Lilongwe Water and Sanitation Project
4	Project Location	1	1	Lilongwe City
5	Project Purpose	1	1	It will help reduce the challenges of water and sanitation in the City and enhance socio-economic development in the
6	Project Scope (Main Output)	1	1	To connect 500,000 residents to
7	Environmental Impact (If Applicable)	1	1	Disclosed 30 October 2017
8	Land and Settlement Impact (If Applicable)	1	1	Disclosed 30 October 2017
9	Funding Source	1	1	$100 Millon comprising $75 Million World Bank credit, $25 Million International Development Agency Grant; Malawi
10	Project Budget Approval Date	1	1	**20th December 2017**
11	Project Estimated Value	1	1	$115 Million
12	Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
	Sub-Total	12	11	
Project Completion Phase				
13	Project Title	1	1	Lilongwe Water and Sanitation Project
14	Procuring Entity	1	1	Lilongwe Water Board
15	Completion Cost	1	1	**N/a**
16	Completion Date	1	1	6 Years after Commencement
17	Scope at Completion	1	1	N/a
18	Reasons for Changes	1	1	**N/a**
19	Reference to audit and evaluation report	1	0	**Not Disclosed**
20	Safety Measures (Incidents and death)	1	0	**Not Disclosed**
21	Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
	Sub-Total	9	7	
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	1	Priority Lilongwe City Sewerage Network Rehabilitation and Expansion and Upgrading of Kauma Wastewater Treatment Plant
23	Procuring Entity & Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
24	Procurement Proceedings	1	1	**International Competitive Procurement**
25	Contract Type	1	0	**Not disclosed**
26	Bid Security	1	0	**Not disclosed**
27	Number of Firms Tendering	1	0	**Not disclosed**
28	Contracted Firm	1	0	Not disclosed
29	Cost Estimate	1	1	US$ 12 Million
30	Contract Price (MK)	1	0	**Not disclosed**
31	Date of Procurement or Project Announcement	1	0	**Not disclosed**
32	Date of Contract Award	1	0	**Not disclosed**
33	Contract Scope of Works	1	1	Expansion and upgrading of sewerage plant at Kauma
34	Contract Start Date and Duration	1	0	Not disclosed
35	Media used for Procurement Announcement	1	1	**Newspapers**
36	Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
	Sub-Total	15	7	
Every 6 Months of Contract Implementation				
Project Information				**Ministry of Agriculture, Water Development and Irrigation**
Project Identification & Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Website)**
37	Contract Title	1	1	Priority Lilongwe City Sewerage Network Rehabilitation and Expansion and Upgrading of Kauma Wastewater Treatment Plant
38	Procuring Entity	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
39	Contractor/Consultant	1	1	Contractor: Unik Construction Engineering Ltd
40	Contract Start Date	1	1	26-Mar-18
41	Contract Duration	1	1	20-Jun-23
42	Original Contract Price	1	0	**Not disclosed**
43	Contract Physical Progress Status (%)	1	0	Not disclosed
44	Description of Project Component	1	1	Expansion and upgrading of sewerage plant at Kauma
45	Changes to Contract Scope and Reasons	1	0	**Not disclosed**
46	Total Payments Effected	1	0	**Not disclosed**
47	Details of Termination (If Applicable)	1	1	**N/a**
48	Disputed Issues and Status	1	0	**Not disclosed**
49	Safety Measures (Incidents & Deaths)	1	0	**Not disclosed**
50	Contact Details	1	0	**Not disclosed**
	Sub-Total	14	7	
Contract Completion Phase				
51	Contract Title	1	1	Priority Lilongwe City Sewerage Network Rehabilitation and Expansion and Upgrading of Kauma Wastewater Treatment Plant
52	Procuring Entity	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
53	Escalation of Contract Price	1	1	N/a
54	Variation to Contract Duration	1	1	N/a
55	Variation to Contract Scope	1	0	Not disclosed
56	Reason for Price Changes	1	0	Not disclosed
57	Reason for Scope and Duration Changes	1	0	Not disclosed
58	Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
	Sub-Total	8	5	
	Total Scores	58	37	

ANNEX 4 - Summary of Reactive Disclosure for Lilongwe Sanitation Project

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non-Disclosure
Project Identification and Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Lilongwe Sanitation**
1	Multi-Year Programme and Budget	1	1	0
2	Environmental & Social Impact Assessment	1	1	0
3	Resettlement and Compensation Plan	1	1	0
4	Contact Details	1	1	0
5	Financial Agreement	1	1	0
6	Procurement Plan	1	0	100
7	Project Approval Decision	1	1	0
	Sub-Total	**7**	**6**	14
Project Completion Phase				
8	Implementation Progress Reports	1	1	0
9	Budget Amendment Decision	1	1	0
10	Project Evaluation Report	1	1	0
11	Technical Audit Reports	1	1	0
12	Financial Audit Report	1	1	0
13	Project Completion Report	1	1	0
14	Contact Details	1	1	0
	Sub-Total	**7**	**7**	0
	Contract Information			
Contract Procurement Phase				
15	Procurement Method	1	1	0
16	Tender Documents	1	1	0
17	Tender Evaluation Results	1	1	0
18	Project Design Report	1	1	0
	Sub-Total	**4**	**4**	0
Contract Phase				
19	Contract Agreement and Conditions	1	0	100
20	Contract Firm (Winning Bid)	1	0	100
21	Specifications and Drawings	1	0	100
	Sub-Total	**3**	**0**	100
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	0
23	List of Escalation Approvals	1	1	0
24	Quality Assurance Reports	1	1	0
25	Disbursement Records or Payment Certificates	1	1	0
26	Contract Amendments	1	1	0
	Sub-Total	**5**	**5**	0
	Total Scores	26	22	15
	Appplicable Data Points 26	100	85	

ANNEX 4 – REACTIVE DISCLOSURE DATA SETS FOR LILONGWE SANITATION PROJECT

ANNEX 4 - Reactive Disclosure Data Sets for Lilongwe Sanitation Project

Project Information				Collected Information from Blantyre Water Board & Lilongwe City Files
Project Identification and Preparation Phase		Disclosure Points	Disclosure Scores	**Lilongwe Sanitation Project**
1	Multi-Year Programme and Budget	1	1	$100 Millon comprising $75 Million World Bank credit, $25 Million International Development Agency Grant
2	Environmental & Social Impact Assessment	1	1	Disclosed 30 October 2017
3	Resettlement and Compensation Plan	1	1	Disclosed 27 October 2020
4	Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
5	Financial Agreement	1	1	Disclosed 29 November 2017
6	Procurement Plan	1	0	Not disclosed
7	Project Approval Decision	1	1	Disclosed
	Sub-Total	**7**	**6**	
Project Completion Phase				
8	Implementation Progress Reports	1	1	Disclosed, up to Report No. 4
9	Budget Amendment Decision	1	1	N/a
10	Project Evaluation Report	1	1	World bank Missions every 6 months on site
11	Technical Audit Reports	1	1	World bank Missions every 6 months on site
12	Financial Audit Report	1	1	World bank Missions every 6 months on site
13	Project Completion Report	1	1	N/a
14	Contact Details	1	1	Lilongwe Water Board Madzi House, Off Likuni Road P.O Box 96 Lilongwe
	Sub-Total	**7**	**7**	
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	1	International Bidding
16	Tender Documents	1	1	Disclosed
17	Tender Evaluation Results	1	1	Lowest evaluated bidder, Unik Construction Engineering (PTY) Ltd
18	Project Design Report	1	1	Disclosed
	Sub-Total	**4**	**4**	
Contract Phase				
19	Contract Agreement and Conditions	1		FIDC Contract
20	Contract Firm (Winning Bid)	1		Unik Construction Engineering (PTY) Ltd
21	Specifications and Drawings	1		Disclosed
	Sub-Total	**3**	**0**	
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	1	N/a
23	List of Escalation Approvals	1	1	N/a
24	Quality Assurance Reports	1	1	Disclosed
25	Disbursement Records or Payment Certificates	1	1	Disclosed, certified up to IPC No. 3, No. 4 with Consultants being checked
26	Contract Amendments	1	1	Miniimum interim Paymet revised from 5% to 2.5% to improve cashflow
	Sub-Total	**5**	**5**	

ANNEX 5

Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District

ANNEX 5 - Summary of Disclosed Data for Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District

IDS Disclosure Items	Chenali & Chinama Access Roads	Ministry of Agriculture, Water Development and Irrigation; National Water Development		
Proactive Disclosure		**Disclosure points**	**Disclosure Score**	**Percentage Disclosure**
Project Identification & Preparation Phase		12	12	100%
Project Completion Phase		9	5	56%
Procurement and Contract Award Phase		15	0	0%
Every 6 Months of Contract Implementation		14	10	71%
Contract Completion Phase		8	7	88%
	Total Points	**58**	34	59%
	0			
	Percentage			**59%**
Reactive Disclosure				
Project Identification and Preparation Phase		7	7	7
Project Completion Phase		7	2	71
Contract Procurement Phase		4	3	25
Contract Phase		3	2	33
Contract Implementation		5	1	80
	Total Points	**26**	**15**	**58%**
	0			
	Percentage Reactive Disclosure			**58%**

ANNEX 5 - Summary of Proactive Disclosure for Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non-Disclosure
Project Identification & Preparation Phase		**Disclosure Points**		**All**
1	Method of Project Selection	1	1	0
2	Sector, Subsector	1	1	0
3	Project Title	1	1	0
4	Project Location	1	1	0
5	Project Purpose	1	1	0
6	Project Scope (Main Output)	1	1	0
7	Environmental Impact (If Applicable)	1	1	0
8	Land and Settlement Impact (If Applicable)	1	1	0
9	Funding Source	1	1	0
10	Project Budget Approval Date	1	1	0
11	Project Estimated Value	1	1	0
12	Contact Details	1	1	0
	Sub-Total	12	12	0
Project Completion Phase				
13	Project Title	1	1	0
14	Procuring Entity	1	1	0
15	Completion Cost	1	0	100
16	Completion Date	1	1	0
17	Scope at Completion	1	1	0
18	Reasons for Changes	1	0	100
19	Reference to audit and evaluation report	1	0	100
20	Safety Measures (Incidents and death)	1	0	100
21	Contract Details	1	1	0
	Sub-Total	9	5	44.44
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	0	100
23	Procuring Entity & Contact Details	1	0	100
24	Procurement Proceedings	1	0	100
25	Contract Type	1	0	100
26	Bid Security	1	0	100
27	Number of Firms Tendering	1	0	100
28	Contracted Firm	1	0	100
29	Cost Estimate	1	0	100
30	Contract Price	1	0	100
31	Date of Procurement or Project Announcement	1	0	100
32	Date of Contract Award	1	0	100
33	Contract Scope of Works	1	0	100
34	Contract Start Date and Duration	1	0	100
35	Media used for Procurement Announcement	1	0	100
36	Contact Details	1	0	100
	Sub-Total	15	0	100

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non-Disclosure
Project Identification & Preparation Phase		**Disclosure Points**		**All**
Every 6 Months of Contract Implementation				
37	Contract Title	1	1	0
38	Procuring Entity	1	1	0
39	Contractor/Consultant	1	1	0
40	Contract Start Date	1	1	0
41	Contract Duration	1	1	0
42	Original Contract Price	1	1	0
43	Contract Physical Progress Status (%)	1	1	0
44	Description of Project Component	1	1	0
45	Changes to Contract Scope and Reasons	1	0	100
46	Total Payments Effected	1	0	100
47	Details of Termination (If Applicable)	1	1	0
48	Disputed Issues and Status	1	0	100
49	Safety Measures (Incidents & Deaths)	1	0	100
50	Contact Details	1	1	0
	Sub-Total	14	10	29
Contract Completion Phase				
51	Contract Title	1	1	0
52	Procuring Entity	1	1	0
53	Escalation of Contract Price	1	0	100
54	Variation to Contract Duration	1	1	0
55	Variation to Contract Scope	1	1	0
56	Reason for Price Changes	1	1	0
57	Reason for Scope and Duration Changes	1	1	0
58	Contact Details	1	1	0
	Sub-Total	**8**	**7**	**13**
	Total Scores	**58**	**34**	**41**
	Percentage Score		**59%**	

ANNEX 5 - Proactive Disclosure AGCOM

Project Information				Ministry of Agriculture, Water Development and Irrigation
Project Identification & Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Internet websites)**
1	Method of Project Selection	1	1	**Disclosed**
2	Sector, Subsector	1	1	Agriculture, Irrigation
3	Project Title	1	1	Agriculture Commercialization Project
4	Project Location	1	1	Mulanje District
5	Project Purpose	1	1	Increase capacity of 650,000 farm households to improve production and marketing of legumes and hortcultural crops for better livelihoods in the face of dwindling income from tobacco which is Malawi's main cash crop
6	Project Scope (Main Output)	1	1	To empower farmers with good financing for agriculture investment, access markets through feeder roads for easy transport of produce and organize farmers into associations to maximise production.
7	Environmental Impact (If Applicable)	1	1	March 2017, Environmental & Social management Framework issued
8	Land and Settlement Impact (If Applicable)	1	1	March 2017, Environmental & Social management Framework issued
9	Funding Source	1	1	World Bank Credit
10	Project Budget Approval Date	1	1	23-May-17
11	Project Estimated Value	1	1	US$95 Million
12	Contact Details	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
	Sub-Total	12	12	
Project Completion Phase				
13	Project Title	1	1	Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District
14	Procuring Entity	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
15	Completion Cost	1	0	**Not Disclosed**
16	Completion Date	1	1	Not Applicable
17	Scope at Completion	1	1	Not Applicable
18	Reasons for Changes	1	0	**Not Disclosed**
19	Reference to audit and evaluation report	1	0	**Not Disclosed**
20	Safety Measures (Incidents and death)	1	0	**Not Disclosed**
21	Contract Details	1	1	**Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District**
	Sub-Total	9	5	
Contract Information				
Procurement and Contract Award Phase				
22	Contract Title	1	0	Not Disclosed
23	Procuring Entity & Contact Details	1	0	Not Disclosed
24	Procurement Proceedings	1	0	**Not Disclosed**
25	Contract Type	1	0	**Not Disclosed**
26	Bid Security	1	0	**Not Disclosed**
27	Number of Firms Tendering	1	0	**Not Disclosed**
28	Contracted Firm	1	0	Not Disclosed
29	Cost Estimate	1	0	Not Disclosed
30	Contract Price (MK)	1	0	**Not Disclosed**
31	Date of Procurement or Project	1	0	**Not Disclosed**
32	Date of Contract Award	1	0	**Not Disclosed**
33	Contract Scope of Works	1	0	Not Disclosed
34	Contract Start Date and Duration	1	0	Not Disclosed
35	Media used for Procurement Announcement	1	0	**Not Disclosed**
36	Contact Details	1	0	Not Disclosed
	Sub-Total	15	0	
Every 6 Months of Contract Implementation				
Project Information				**Ministry of Agriculture, Water Development and Irrigation**
Project Identification & Preparation Phase		**Disclosure Points**	**Disclosure Score**	**Collected Information (Mostly from Internet websites)**
37	Contract Title	1	1	Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mulanje District
38	Procuring Entity	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
39	Contractor/Consultant	1	1	Kelch Construction/GK Works
40	Contract Start Date	1	1	2nd June 2020
41	Contract Duration	1	1	120 Daya
42	Original Contract Price	1	1	**MK 386, 182, 762.75**
43	Contract Physical Progress Status (%)	1	1	100%
44	Description of Project Component	1	1	Improvement of Access Roads and Construction of associated Drainage Structures
45	Changes to Contract Scope and Reasons	1	0	**Not Disclosed**
46	Total Payments Effected	1	0	**Not Disclosed**
47	Details of Termination (If Applicable)	1	1	**Not Applicable**
48	Disputed Issues and Status	1	0	**Not Disclosed**
49	Safety Measures (Incidents & Deaths)	1	0	**Not Disclosed**
50	Contact Details	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
	Sub-Total	14	10	
Contract Completion Phase				
51	Contract Title	1	1	Improvement of Access Roads and Construction of associated Drainage Structures
52	Procuring Entity	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
53	Escalation of Contract Price	1	0	**Not Disclosed**
54	Variation to Contract Duration	1	1	Not Provided
55	Variation to Contract Scope	1	1	Not Provided
56	Reason for Price Changes	1	1	Not Provided
57	Reason for Scope and Duration Changes	1	1	Not Provided
58	Contact Details	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
	Sub-Total	**8**	**7**	
	Total Scores	**58**	**34**	

ANNEX 5 - Summary of Reactive Disclosure for Rehabilitation of Access Roads and Drainage Structures to Chenali and Chinama Irrigation Schemes in Mula

Project Information			Ministry of Agriculture, Water Development and Irrigation; National Water Development	Percentage Non-Disclosure
Project Identification and Preparation Phase		**Disclosure Points**	**Disclosure Score**	**0**
1	Multi-Year Programme and Budget	1	1	0
2	Environmental & Social Impact Assessment	1	1	0
3	Resettlement and Compensation Plan	1	1	0
4	Contact Details	1	1	0
5	Financial Agreement	1	1	0
6	Procurement Plan	1	1	0
7	Project Approval Decision	1	1	0
	Sub-Total	**7**	**7**	0
Project Completion Phase				
8	Implementation Progress Reports	1	1	0
9	Budget Amendment Decision	1	0	100
10	Project Evaluation Report	1	0	100
11	Technical Audit Reports	1	0	100
12	Financial Audit Report	1	0	100
13	Project Completion Report	1	0	100
14	Contact Details	1	1	0
	Sub-Total	**7**	**2**	71
	Contract Information			
Contract Procurement Phase				
15	Procurement Method	1	1	0
16	Tender Documents	1	1	0
17	Tender Evaluation Results	1	1	0
18	Project Design Report	1	0	100
	Sub-Total	**4**	**3**	25
Contract Phase				
19	Contract Agreement and Conditions	1	1	0
20	Contract Firm (Winning Bid)	1	1	0
21	Specifications and Drawings	1	0	100
	Sub-Total	**3**	**2**	33
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	0	100
23	List of Escalation Approvals	1	0	100
24	Quality Assurance Reports	1	1	0
25	Disbursement Records or Payment Certificates	1	0	100
26	Contract Amendments	1	0	100
	Sub-Total	**5**	**1**	80
	Applicable Data Points 26	100	58	

ANNEX 5 – REACTIVE DISCLOSURE DATA SETS AGCOM

ANNEX 5 - Reactive Disclosure Data Sets AGCOM				
Project Information				
Project Identification and Preparation Phase		Disclosure	Disclosure	
1	Multi-Year Programme and Budget	1	1	Disc
2	Environmental & Social Impact Assessment	1	1	Environmental Management Plan given
3	Resettlement and Compensation Plan	1	1	Not
4	Contact Details	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
5	Financial Agreement	1	1	Disc
6	Procurement Plan	1	1	Disc
7	Project Approval Decision	1	1	Disc
	Sub-Total	**7**	**7**	
Project Completion Phase				
8	Implementation Progress Reports	1	1	Seen and
9	Budget Amendment Decision	1	0	Not
10	Project Evaluation Report	1	0	Not
11	Technical Audit Reports	1	0	Not
12	Financial Audit Report	1	0	Not
13	Project Completion Report	1	0	Not
14	Contact Details	1	1	Ministry of Agriculture, Water Development and Irrigation, PO box 30134, Lilongwe 3
	Sub-Total	**7**	**2**	
Contract Information				
Contract Procurement Phase				
15	Procurement Method	1	1	National Competitive
16	Tender Documents	1	1	Disc
17	Tender Evaluation Results	1	1	Disc
18	Project Design Report	1	0	Not
	Sub-Total	**4**	**3**	
Contract Phase				
19	Contract Agreement and Conditions	1	1	Disc
20	Contract Firm (Winning Bid)	1	1	Kelch
21	Specifications and Drawings	1	0	Not
	Sub-Total	**3**	**2**	
Contract Implementation				
22	List of Variations, Changes, and Amendments	1	0	Not
23	List of Escalation Approvals	1	0	Not
24	Quality Assurance Reports	1	1	Disc
25	Disbursement Records or Payment Certificates	1	0	Not
26	Contract Amendments	1	0	Not
	Sub-Total	**5**	**1**	

ANNEX 6

RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1970/1971

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)
Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.225	0.425	1.535	1.168	1.799	1.148	0.484	0.386	0.302	0.271	0.182	0.424
3	0.176	0.551	1.493	1.056	1.677	1.124	0.483	0.387	0.302	0.265	0.182	0.171
4	0.158	0.677	1.452	2.861	1.6	1.061	0.474	0.395	0.302	0.255	0.182	0.15
5	0.153	0.803	1.41	2.295	1.579	1.023	0.464	0.403	0.302	0.25	0.182	0.15
6	0.15	0.929	1.369	1.984	1.507	0.99	0.458	0.396	0.302	0.244	0.182	0.146
7	0.345	2.555	1.327	1.781	1.445	0.957	0.448	0.395	0.302	0.238	0.179	0.145
8	0.192	2.411	1.286	1.819	1.413	0.924	0.443	0.395	0.302	0.237	0.173	0.147
9	0.149	2.237	1.244	1.784	1.399	0.887	0.442	0.395	0.298	0.237	0.167	0.168
10	1.186	2.192	1.203	1.724	1.36	0.794	0.434	0.386	0.294	0.233	0.168	0.166
11	0.797	1.967	1.161	1.738	1.321	0.76	0.433	0.378	0.294	0.225	0.166	0.16
12	0.644	1.926	3.21	2.402	1.285	0.739	0.433	0.377	0.294	0.224	0.166	0.156
13	0.499	1.778	2.749	2.586	1.364	0.718	0.429	0.377	0.287	0.224	0.166	0.174
14	0.387	1.63	3.039	2.676	3.133	0.698	0.423	0.373	0.287	0.218	0.163	0.326
15	0.276	1.611	2.6	2.232	3.078	0.678	0.556	0.368	0.287	0.218	0.16	0.243
16	0.219	0.797	2.52	1.685	2.539	0.653	1.542	0.36	0.283	0.217	0.16	0.228
17	0.212	0.902	2.518	1.923	2.332	0.627	1.378	0.359	0.279	0.212	0.16	0.208
18	0.208	2.611	2.51	1.967	1.703	0.609	1.214	0.352	0.279	0.211	0.16	0.174
19	0.185	2.744	2.665	2.011	1.596	0.598	0.741	0.35	0.28	0.206	0.16	0.158
20	0.158	2.742	2.631	2.055	1.541	0.59	0.636	0.342	0.289	0.205	0.16	0.151
21	0.158	2.052	2.907	2.664	1.387	0.639	0.58	0.334	0.286	0.205	0.16	0.148
22	0.257	1.993	3.275	2.554	1.283	1.244	0.564	0.326	0.279	0.2	0.16	0.145
23	0.361	2.73	2.897	1.844	1.222	0.788	0.616	0.325	0.272	0.199	0.16	0.141
24	0.293	1.786	2.671	1.135	1.184	0.634	0.567	0.318	0.271	0.193	0.16	0.141
25	0.503	0.902	2.066	2.893	1.147	0.603	0.524	0.318	0.265	0.188	0.16	0.141
26	0.336	2.533	1.954	2.705	1.185	0.573	0.499	0.314	0.264	0.188	0.156	0.156
27	1.533	1.558	1.841	2.38	1.27	0.544	0.475	0.31	0.258	0.187	0.155	0.294
28	0.492	1.841	1.729	2.135	1.289	0.522	0.451	0.31	0.262	0.182	0.155	0.209
29	0.853	1.746	1.617		1.27	0.501	0.406	0.31	0.274	0.182	0.155	0.159
30	1.052	1.765	1.505		1.242	0.489	0.396	0.309	0.272	0.182	0.176	0.148
31		1.485	1.392		1.211		0.391		0.272	0.182		0.145
Mean	0.414	1.683	2.035	2.048	1.59	0.776	0.576	0.358	0.285	0.218	0.167	0.19
Flow (MCM)	1.072	4.508	5.451	4.954	4.259	2.012	1.544	0.927	0.764	0.583	0.432	0.509
Maximum	1.533	2.744	3.275	2.893	3.133	1.244	1.542	0.403	0.303	0.272	0.182	0.424
Minimum	0.149	0.299	1.161	1.056	1.147	0.489	0.391	0.309	0.258	0.182	0.155	0.141
Runoff (mm)	32.397	136.202	164.678	149.661	128.685	60.792	46.649	28.019	23.087	17.618	13.054	15.39

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 27. Runoff : 820.999 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1971/1972

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.147	0.22	0.485	2.283	2.924	1.897	0.777	0.4	0.409	0.279	0.193	0.158
3	0.203	0.187	1.118	2.394	2.589	1.925	0.798	0.395	0.404	0.268	0.185	0.155
4	0.203	0.174	0.811	2.506	3.175	0.889	0.774	0.387	0.396	0.258	0.18	0.155
5	0.357	0.166	0.974	2.617	2.831	2.454	0.747	0.382	0.409	0.251	0.22	0.156
6	0.298	0.179	1.468	2.728	2.27	1.496	0.73	0.376	0.419	0.25	0.272	0.16
7	0.243	0.518	1.8	2.839	2.123	1.104	0.69	0.368	0.413	0.275	0.218	0.16
8	0.215	0.473	2.034	2.95	2.148	2.851	0.642	0.36	0.405	0.327	0.197	0.16
9	0.267	0.623	2.18	2.097	1.973	2.673	0.615	0.359	0.4	0.35	0.191	0.16
10	0.689	0.547	2.174	1.806	1.798	2.511	0.598	0.359	0.39	0.319	0.185	0.16
11	0.334	0.479	2.53	1.688	1.623	2.385	0.597	0.352	0.371	0.31	0.182	0.161
12	0.249	0.4	1.886	1.601	2.304	2.101	0.596	0.351	0.344	0.293	0.182	0.165
13	0.216	0.332	1.243	1.416	2.133	2.462	0.58	0.351	0.331	0.265	0.177	0.165
14	0.197	0.315	0.758	1.282	1.59	2.48	0.565	0.347	0.322	0.248	0.176	0.161
15	0.19	0.371	2.528	1.18	1.454	2.22	0.54	0.342	0.315	0.244	0.176	0.16
16	0.18	0.34	0.666	1.292	1.591	2.185	0.532	0.335	0.301	0.24	0.176	0.16
17	0.176	0.321	1.421	1.172	2.087	2.148	0.517	0.334	0.349	0.234	0.176	0.156
18	0.171	0.349	2.176	1.052	1.628	2.01	0.516	0.333	0.644	0.231	0.176	0.153
19	0.166	0.891	2.931	0.932	2.104	1.8	0.516	0.326	0.473	0.227	0.176	0.15
20	0.16	0.675	2	2.676	2.263	1.644	0.518	0.326	0.396	0.224	0.176	0.15
21	0.58	0.804	1.632	0.784	2.243	1.563	0.535	0.325	0.341	0.224	0.176	0.148
22	1.292	0.669	1.412	0.834	2.023	1.456	0.517	0.318	0.326	0.224	0.176	0.145
23	0.707	0.614	1.656	0.884	1.811	1.306	0.5	0.318	0.322	0.224	0.171	0.145
24	0.419	0.578	1.379	0.934	1.737	1.233	0.479	0.318	0.318	0.224	0.168	0.141
25	0.321	0.534	1.102	0.984	2.651	1.184	0.464	0.314	0.318	0.218	0.166	0.195
26	0.298	0.553	1.55	1.033	2.415	1.145	0.458	0.499	0.317	0.218	0.166	0.725
27	0.284	1.045	1.997	1.083	2.073	1.067	0.453	0.998	0.31	0.218	0.165	0.262
28	0.273	0.791	1.727	1.133	1.85	0.973	0.448	2.781	0.309	0.218	0.161	0.161
29	0.23	0.521	1.839	1.183	1.91	0.909	0.438	0.748	0.303	0.218	0.16	0.153
30	0.195	0.479	1.95		0.881	0.86	0.429	0.441	0.301	0.214	0.156	0.148
31		0.449	2.061		2.473		0.419		0.295	0.205		0.145
Mean	0.314	0.479	1.61	1.639	2.13	1.771	0.574	0.475	0.367	0.251	0.183	0.179
Flow (MCM)	0.813	1.283	4.313	4.107	5.705	4.589	1.536	1.231	0.982	0.673	0.474	0.478
Maximum	1.292	1.045	2.931	2.95	3.355	2.851	0.798	2.781	0.644	0.35	0.272	0.725
Minimum	0.145	0.166	0.429	0.784	0.881	0.86	0.419	0.314	0.295	0.205	0.156	0.141
Runoff (mm)	24.553	38.771	130.296	124.074	172.361	138.651	46.419	37.198	29.668	20.329	14.31	14.455

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 26. Runoff : 793.786 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1972/1973

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.141	0.268	1.23	1.276	0.72	1.016	0.499	0.294	0.226	0.201	0.139	0.114
3	0.141	0.258	0.794	1.476	0.678	1.092	0.648	0.287	0.206	0.188	0.136	0.23
4	0.152	0.296	0.688	1.968	0.683	2.602	1.318	0.282	0.2	0.176	0.131	0.153
5	0.175	0.75	0.632	1.451	0.723	2.122	0.814	0.265	0.2	0.166	0.126	0.126
6	0.172	0.752	0.568	1.309	0.787	1.852	0.708	0.255	0.205	0.16	0.123	0.122
7	0.176	0.549	0.551	1.386	1.02	1.784	0.613	0.257	0.21	0.151	0.123	0.118
8	0.389	0.42	0.657	1.508	0.62	1.567	0.582	0.251	0.214	0.145	0.12	0.134
9	1.255	0.327	0.476	1.607	0.535	1.488	0.589	0.256	0.355	0.141	0.118	0.286
10	0.615	0.26	0.561	1.527	0.511	1.652	0.568	0.307	0.426	0.137	0.118	0.239
11	0.263	0.234	2.196	1.949	0.489	1.56	0.549	0.369	0.344	0.143	0.114	0.229
12	0.229	0.225	2.618	1.538	0.469	1.403	0.532	0.766	0.266	0.154	0.112	0.238
13	0.182	0.347	2.422	1.458	0.444	1.299	0.512	0.507	0.212	0.151	0.108	0.231
14	0.175	0.397	1.842	1.935	0.428	1.214	0.489	0.329	0.205	0.15	0.106	0.224
15	0.157	0.311	0.514	1.566	0.42	1.122	0.463	0.306	0.202	0.15	0.106	0.211
16	0.15	0.25	1.853	1.256	0.662	1.087	0.421	0.295	0.196	0.15	0.106	0.199
17	0.146	0.254	1.755	1.163	2.468	1.133	0.404	0.294	0.191	0.15	0.109	0.176
18	0.146	0.664	1.178	2.331	2.536	1.132	0.392	0.287	0.188	0.15	0.11	0.123
19	0.149	2.776	0.988	2.925	2.269	0.964	0.382	0.279	0.192	0.15	0.118	0.107
20	0.145	2.648	0.869	3.045	2.136	0.914	0.372	0.265	0.188	0.149	0.12	0.105
21	0.141	0.91	0.768	2.532	0.853	0.926	0.355	0.249	0.18	0.141	0.118	0.102
22	0.14	2.364	1.866	2.498	1.834	0.917	0.338	0.25	0.178	0.189	0.114	0.102
23	0.136	1.376	1.408	1.924	1.308	0.76	0.323	0.25	0.192	0.684	0.114	0.102
24	0.136	0.856	0.951	1.496	1.144	0.679	0.326	0.244	0.199	0.237	0.11	0.098
25	0.178	1.859	1.816	1.326	0.965	0.611	0.329	0.248	0.199	0.199	0.11	0.098
26	0.475	1.124	1.882	1.268	0.841	0.577	0.326	0.286	0.193	0.185	0.108	0.098
27	0.285	0.804	1.949	1.2	1.157	0.621	0.322	0.253	0.188	0.172	0.106	0.107
28	0.411	0.613	2.237	0.984	1.25	0.898	0.313	0.244	0.182	0.152	0.106	0.247
29	0.644	0.504	1.615		1.114	0.761	0.301	0.243	0.18	0.15	0.106	0.251
30	0.341	0.635	1.314		1.059	0.588	0.289	0.238	0.251	0.15	0.105	0.244
31		0.887	0.877		0.864		0.294		0.332	0.146		0.237
Mean	0.266	0.781	1.336	1.678	1.026	1.176	0.481	0.298	0.224	0.181	0.116	0.166
Flow (MCM)	0.69	2.091	3.578	4.059	2.748	3.048	1.287	0.773	0.6	0.485	0.301	0.445
Maximum	1.255	2.776	2.618	3.045	2.536	2.602	1.318	0.766	0.426	0.684	0.145	0.286
Minimum	0.136	0.225	0.476	0.984	0.42	0.577	0.289	0.238	0.178	0.137	0.105	0.098
Runoff (mm)	20.856	63.162	108.107	122.631	83.025	92.087	38.89	23.362	18.112	14.641	9.093	13.452

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 20. Runoff : 613.636 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1973/1974

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.208	0.216	1.566	1.467	0.336	1.011	2.07	0.472	0.429	0.316	0.205	0.137
3	0.193	0.682	1.256	0.822	0.24	1.117	2.208	0.454	0.429	0.35	0.172	0.125
4	0.171	1.147	0.946	0.799	0.525	1.223	1.104	0.442	0.391	0.358	0.184	0.121
5	0.111	0.367	2.928	1.281	2.083	1.33	0.597	0.425	0.368	0.333	0.209	0.114
6	0.101	0.932	2.249	1.186	2.264	0.905	1.093	0.424	0.379	0.335	0.199	0.117
7	0.147	1.496	1.8	0.737	1.93	2.162	0.708	0.423	0.362	0.306	0.191	0.119
8	0.181	2.061	2.034	1.041	0.946	0.89	0.774	0.415	0.349	0.297	0.193	0.141
9	0.147	1.879	2.18	1.354	2.524	1.463	2.237	0.412	0.333	0.303	0.189	0.123
10	0.141	0.651	0.713	1.652	2.448	2.082	2.077	0.397	0.343	0.279	0.189	0.121
11	0.141	0.589	0.98	2.639	1.014	2.701	1.464	0.39	0.318	0.294	0.179	0.12
12	0.148	0.599	1.248	2.158	0.901	0.358	2.057	0.379	0.336	0.272	0.168	0.121
13	0.194	0.769	1.515	1.245	2.364	2.197	0.89	0.372	0.345	0.271	0.165	0.119
14	0.178	0.639	1.782	2.327	1.612	2.038	0.739	0.355	0.326	0.259	0.167	0.121
15	0.144	0.573	1.606	2.598	2.078	1.722	0.758	0.351	0.323	0.259	0.156	0.132
16	0.121	0.739	1.258	1.313	2.545	1.837	0.592	0.351	0.316	0.266	0.173	0.109
17	0.108	0.282	1.226	0.995	2.124	1.816	0.711	0.351	0.264	0.253	0.163	0.122
18	0.102	0.422	1.195	1.523	2.668	2.304	0.735	0.349	0.27	0.245	0.162	0.13
19	0.096	0.562	1.867	1.863	2.5	2.132	0.838	0.337	0.358	0.261	0.156	0.116
20	0.089	0.702	2.894	0.954	1.869	1.018	0.723	0.345	0.438	0.238	0.152	0.117
21	0.087	0.842	1.778	2.492	1.884	1.153	0.641	0.347	0.436	0.251	0.155	0.122
22	0.084	0.982	2.138	1.614	2.341	1.811	0.605	0.36	0.349	0.236	0.14	0.04
23	0.099	2.603	2.093	1.437	2.799	1.873	2.361	0.362	0.342	0.231	0.145	0.775
24	0.164	2.297	2.106	2.258	2.731	1.466	1.868	0.352	0.607	0.214	0.141	0.307
25	0.263	1.845	1.039	1.913	2.663	1.583	0.847	0.347	1.129	0.233	0.132	0.247
26	0.181	1.652	1.245	1.495	0.919	1.228	0.705	0.333	1.65	0.214	0.132	0.187
27	0.167	1.22	1.756	1.491	0.918	1.251	0.931	0.358	1.116	0.233	0.145	0.154
28	0.202	0.615	0.672	1.746	1.902	2.326	0.847	0.364	0.873	0.186	0.143	0.138
29	1.098	0.746	0.867		1.561	2.576	0.565	0.341	0.677	0.177	0.146	0.129
30	1.868	0.803	2.055		1.22	0.972	0.511	0.331	0.51	0.188	0.133	0.127
31		1.216	2.683		0.879		0.48		0.354	0.19		0.141
Mean	0.238	1.003	1.672	1.545	1.722	1.582	1.105	0.38	0.487	0.264	0.166	0.156
Flow (MCM)	0.618	2.685	4.478	3.737	4.612	4.1	2.96	0.986	1.303	0.707	0.429	0.417
Maximum	1.868	2.603	2.928	2.639	2.799	2.701	2.361	0.474	1.65	0.358	0.209	0.775
Minimum	0.084	0.216	0.672	0.737	0.24	0.358	0.48	0.331	0.264	0.177	0.132	0.04
Runoff (mm)	18.674	81.122	135.276	112.904	139.341	123.853	89.424	29.79	39.372	21.353	12.961	12.605

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 27. Runoff : 819.238 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1974/1975

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.127	0.17	0.429	0.819	1.778	0.668	0.427	0.266	0.288	0.186	0.151	0.101
3	0.128	0.174	0.431	0.709	2.479	0.683	0.429	0.276	0.211	0.244	0.157	0.379
4	0.118	0.484	0.546	0.645	2.465	0.693	0.422	0.325	0.208	0.225	0.153	0.571
5	0.127	1.76	0.554	0.607	2.33	0.795	0.393	0.725	0.221	0.299	0.141	0.762
6	0.122	0.853	0.794	0.599	1.776	0.799	0.389	0.357	0.222	0.264	0.132	0.89
7	0.137	2.814	1.198	0.553	1.608	1.035	0.361	0.301	0.198	0.209	0.126	0.354
8	0.14	2.194	0.739	0.488	1.91	0.866	0.351	0.283	0.201	0.196	0.135	0.223
9	0.128	1.752	0.568	0.455	2.03	1.08	0.352	0.267	0.2	0.183	0.131	0.196
10	0.136	1.158	0.519	0.448	1.98	1.053	0.331	0.266	0.068	0.176	0.127	0.178
11	0.141	1.329	0.506	0.588	0.743	0.854	0.326	0.261	0.419	0.171	0.131	0.171
12	0.144	1.5	0.557	0.718	1.644	0.907	0.324	0.248	0.191	0.176	0.127	0.177
13	0.145	0.884	1.334	0.639	2.041	0.833	0.335	0.248	0.189	0.173	0.115	0.191
14	0.148	0.663	1.139	0.578	1.9	0.742	0.33	0.258	0.202	0.163	0.116	0.179
15	0.184	0.949	0.693	0.589	2.023	0.639	0.418	0.244	0.209	0.155	0.119	0.169
16	0.329	0.981	0.684	0.632	2.052	0.477	1.902	0.252	0.212	0.159	0.123	0.156
17	0.172	1.013	0.636	0.703	1.871	0.451	2.056	0.255	0.203	0.175	0.12	0.148
18	0.152	2.12	0.613	1.808	1.76	0.447	1.951	0.244	0.195	0.179	0.117	0.141
19	0.145	1.126	0.625	1.795	1.804	0.436	1.983	0.242	0.196	0.188	0.123	0.142
20	0.136	0.732	0.887	1.782	1.813	0.471	2.368	0.227	0.194	0.165	0.117	0.134
21	0.143	0.652	0.775	1.708	1.529	0.46	2.316	0.222	0.189	0.153	0.123	0.131
22	0.152	0.644	1.201	1.369	1.289	0.453	2.283	0.231	0.183	0.15	0.118	0.119
23	0.145	0.959	1.364	1.03	1.316	0.457	2.205	0.21	0.179	0.155	0.113	0.109
24	0.153	0.783	1.488	2.714	1.226	0.817	2.146	0.202	0.189	0.153	0.116	0.112
25	0.143	0.599	1.321	2.497	1.184	0.795	2.071	0.198	0.257	0.148	0.109	0.116
26	0.133	0.545	1.221	2.11	1.374	0.75	1.36	0.209	0.25	0.153	0.115	0.12
27	0.138	0.487	1.008	2.148	1.412	0.733	0.475	0.221	0.249	0.152	0.113	0.116
28	0.181	0.435	1.083	2.288	1.304	0.679	0.331	0.232	0.224	0.148	0.112	0.139
29	0.164	0.413	1.042		1.288	0.647	0.301	0.218	0.178	0.153	0.11	0.157
30	0.178	0.443	0.976		1.338	0.533	0.28	0.204	0.179	0.153	0.114	0.148
31		0.454	0.866		1.277		0.285		0.191	0.151		0.138
Mean	0.151	0.943	0.847	1.137	1.686	0.7	0.966	0.266	0.21	0.179	0.125	0.219
Flow (MCM)	0.391	2.527	2.268	2.752	4.515	1.814	2.586	0.688	0.563	0.48	0.325	0.586
Maximum	0.329	2.814	1.488	2.714	2.479	1.08	2.368	0.725	0.419	0.299	0.157	0.89
Minimum	0.118	0.17	0.429	0.448	0.743	0.436	0.28	0.198	0.068	0.148	0.109	0.101
Runoff (mm)	11.802	76.332	68.521	83.131	136.409	54.792	78.135	20.797	16.995	14.5	9.808	17.694

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 19. Runoff : 589.754 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1975/1976

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.112	0.263	1.173	1.022	1.763	2.519	1.603	0.599	0.579	0.434	0.222	0.154
3	0.107	1.01	1.118	1.016	2.708	2.93	1.513	0.567	0.557	0.352	0.22	0.15
4	0.101	2.847	1.024	3.208	0.902	1.878	1.383	0.545	0.543	0.323	0.215	0.148
5	0.098	2.106	0.807	2.824	2.826	1.932	1.264	0.53	0.522	0.314	0.214	0.15
6	0.109	0.671	3.012	2.328	2.782	1.987	1.197	0.503	0.5	0.314	0.203	0.15
7	0.177	0.847	2.323	1.796	2.57	2.041	1.314	0.517	0.473	0.313	0.197	0.145
8	0.236	0.88	1.81	1.632	2.823	2.095	1.474	0.589	0.444	0.306	0.201	0.143
9	0.221	0.912	1.611	0.831	2.964	2.149	1.455	0.533	0.429	0.306	0.196	0.148
10	0.148	0.945	1.748	1.793	2.768	2.269	1.35	0.515	0.418	0.305	0.191	0.151
11	0.129	0.977	1.885	1.667	2.803	2.388	1.166	0.486	0.403	0.298	0.185	0.159
12	0.12	1.985	2.417	1.779	2.809	2.508	1.071	0.472	0.419	0.291	0.18	0.157
13	0.112	1.151	1.977	1.746	2.815	2.628	0.952	0.456	0.422	0.303	0.181	0.155
14	0.106	0.931	1.828	1.714	2.822	2.748	0.864	0.466	0.408	0.313	0.193	0.151
15	0.115	0.826	1.629	1.681	2.828	2.868	0.986	0.448	0.391	0.297	0.195	0.166
16	0.207	0.74	1.407	1.826	2.834	2.572	0.952	0.428	0.391	0.284	0.189	0.16
17	0.345	0.965	1.676	1.859	2.841	2.392	0.936	0.401	0.511	0.276	0.195	0.636
18	0.205	1.523	2.159	1.891	2.847	2.11	0.986	0.382	0.476	0.269	0.191	1.186
19	0.169	2.082	2.641	1.924	2.854	1.961	0.925	0.36	0.421	0.268	0.188	1.736
20	0.148	1.357	3.123	1.956	2.86	1.785	0.885	0.338	0.392	0.261	0.182	0.707
21	0.146	1.64	2.679	1.989	2.866	0.745	0.805	0.383	0.381	0.254	0.179	0.463
22	0.292	1.685	2.421	2.021	2.873	1.291	0.824	1.07	0.365	0.248	0.179	0.341
23	1.603	1.73	2.211	2.054	2.879	1.837	0.923	1.07	0.355	0.248	0.177	0.316
24	0.835	1.413	2.02	2.754	2.885	2.388	0.874	1.295	0.347	0.253	0.181	0.281
25	0.434	1.353	1.83	1.813	2.892	2.111	0.879	1.519	0.345	0.247	0.18	0.265
26	0.31	1.602	1.697	1.379	2.898	1.971	0.779	1.231	0.331	0.24	0.184	0.261
27	0.336	1.831	1.057	0.946	2.905	2.183	0.735	1.239	0.327	0.234	0.18	0.344
28	0.315	2.06	1.051	1.42	2.911	2.003	0.666	1.511	0.329	0.233	0.179	1.275
29	0.232	2.289	1.045	1.895	2.917	1.836	0.646	1.043	0.324	0.228	0.176	0.628
30	0.221	1.63	1.039		2.924	1.712	0.664	0.893	0.377	0.233	0.171	0.473
31		1.27	1.033		2.93		0.815		0.469	0.228		0.366
Mean	0.26	1.347	1.763	1.786	2.714	2.159	1.052	0.703	0.429	0.287	0.192	0.378
Flow (MCM)	0.675	3.609	4.722	4.475	7.269	5.596	2.818	1.823	1.149	0.77	0.497	1.014
Maximum	1.603	2.847	3.123	3.208	2.964	2.936	1.734	1.519	0.65	0.438	0.232	1.736
Minimum	0.098	0.249	0.807	0.831	0.902	0.745	0.646	0.338	0.324	0.228	0.171	0.143
Runoff (mm)	20.386	109.033	142.672	135.185	219.595	169.074	85.14	55.089	34.718	23.262	15.027	30.627

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 1.0 cumecs
Total : 34. Runoff : 1040.723 mm Possible
data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1976/1977

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.313	0.24	2.001	2.279	0.658	1.834	0.715	0.351	0.252	0.188	0.173	0.179
3	0.296	0.217	1.813	2.006	0.795	1.705	0.638	0.351	0.244	0.184	0.169	0.174
4	0.279	0.22	1.178	0.831	0.932	2.027	0.627	0.351	0.237	0.182	0.166	0.171
5	0.366	0.242	1.399	1.406	2.447	1.825	0.615	0.351	0.231	0.197	0.163	0.167
6	0.314	0.534	2.873	2.278	0.774	1.505	0.602	0.351	0.227	0.193	0.158	0.178
7	0.296	0.549	0.932	1.854	0.88	1.394	0.585	0.351	0.225	0.188	0.156	0.225
8	0.403	1.324	2.401	1.681	0.987	1.441	0.571	0.351	0.231	0.191	0.157	0.224
9	1.835	0.633	2.164	0.575	2.907	1.313	0.542	0.351	0.242	0.191	0.153	0.213
10	2.181	1.217	2.382	1.749	2.663	1.441	0.53	0.351	0.239	0.185	0.152	0.188
11	1.359	0.999	2.131	1.973	2.385	1.18	0.491	0.351	0.229	0.184	0.16	0.175
12	1.107	1.953	1.824	1.633	2.264	0.919	0.447	0.422	0.233	0.18	0.27	0.171
13	1.022	1.501	1.596	1.473	2.094	2.277	0.443	0.347	0.231	0.185	0.209	0.166
14	0.898	1.382	1.386	1.313	1.938	2.076	0.443	0.312	0.228	0.187	0.207	0.167
15	0.61	1.205	1.259	1.153	1.854	1.928	0.443	0.305	0.233	0.179	0.193	0.163
16	0.598	0.782	1.147	0.993	1.934	1.752	0.443	0.302	0.227	0.175	0.172	0.163
17	0.452	0.641	0.36	1.814	0.619	1.618	0.443	0.298	0.222	0.178	0.344	0.165
18	0.388	0.777	2.282	1.437	0.892	1.636	0.443	0.285	0.227	0.175	0.261	0.161
19	0.348	0.8	2.324	1.059	0.975	1.215	0.443	0.286	0.224	0.176	0.185	0.165
20	0.317	0.823	2.213	2.839	1.059	1.077	0.433	0.317	0.218	0.178	0.259	0.16
21	0.292	0.845	2.584	2.388	2.976	1.013	0.414	0.31	0.215	0.172	0.283	0.157
22	0.346	0.868	2.433	2.182	2.342	0.975	0.404	0.303	0.22	0.178	0.191	0.148
23	0.326	0.891	2.229	2.204	2.003	1.151	0.396	0.308	0.212	0.176	0.175	0.141
24	0.304	0.914	2.279	1.961	1.836	1.035	0.395	0.296	0.205	0.172	0.171	0.141
25	0.268	0.936	1.76	1.852	1.712	0.951	0.395	0.301	0.199	0.181	0.168	0.137
26	0.332	0.959	1.637	1.736	1.901	0.909	0.395	0.305	0.194	0.179	0.164	0.129
27	1.156	2.59	0.633	1.755	0.87	0.867	0.391	0.293	0.194	0.172	0.165	0.125
28	0.944	2.041	0.976	2.039	1.784	0.82	0.369	0.285	0.195	0.178	0.163	0.122
29	0.357	2.397	1.414		2.796	0.935	0.351	0.294	0.191	0.172	0.197	0.117
30	0.287	0.874	1.852		2.547	0.932	0.351	0.287	0.189	0.178	0.421	0.12
31		2.532	2.126		2.118		0.351		0.195	0.174		0.118
Mean	0.611	1.037	1.798	1.723	1.736	1.39	0.484	0.324	0.222	0.181	0.199	0.162
Flow (MCM)	1.583	2.778	4.817	4.168	4.651	3.602	1.297	0.839	0.595	0.486	0.516	0.434
Maximum	2.181	2.59	2.873	2.839	2.976	2.277	0.895	0.422	0.277	0.197	0.421	0.225
Minimum	0.268	0.217	0.36	0.575	0.619	0.82	0.351	0.285	0.189	0.172	0.152	0.117
Runoff (mm)	47.834	83.919	145.521	125.926	140.507	108.821	39.173	25.361	17.978	14.677	15.594	13.124

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 25. Runoff : 783.489 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1977/1978

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.111	0.355	2.183	0.964	2.418	2.216	2.104	0.71	0.396	0.297	0.199	0.148
3	0.113	0.302	1.837	0.932	2.271	2.301	1.885	0.66	0.426	0.283	0.196	0.147
4	0.108	0.305	1.248	2.418	2.157	2.387	1.75	0.619	0.393	0.269	0.192	0.143
5	0.128	0.376	1.248	2.277	2.173	2.472	1.621	0.619	0.378	0.268	0.196	0.143
6	0.125	0.485	2.373	2.15	1.458	2.558	1.517	0.609	0.363	0.262	0.196	0.147
7	0.126	0.392	1.662	1.992	1.489	2.643	1.383	0.721	0.345	0.258	0.193	0.148
8	0.122	0.653	1.311	1.249	1.519	2.728	1.267	0.973	0.342	0.251	0.191	0.147
9	0.118	0.455	2.229	1.983	1.55	2.814	1.239	0.965	0.337	0.244	0.188	0.143
10	0.114	0.338	1.95	2.717	1.58	2.899	1.198	1.077	0.44	0.24	0.185	0.143
11	0.113	0.325	1.74	2.783	1.611	2.985	1.129	0.988	0.434	0.234	0.185	0.143
12	0.121	0.333	1.648	1.695	1.641	3.07	1.074	0.679	0.418	0.231	0.193	0.138
13	0.118	0.504	1.761	1.591	1.672	3.103	1.069	0.597	0.4	0.228	0.199	0.134
14	0.121	0.497	2.152	1.488	1.703	2.859	1.018	0.619	0.396	0.233	0.197	0.129
15	0.114	0.619	1.971	1.384	1.733	2.769	0.987	0.697	0.46	0.231	0.193	0.129
16	0.126	0.879	2.092	1.28	1.764	2.825	0.939	0.63	0.456	0.228	0.191	0.129
17	0.133	0.643	2.531	1.177	1.794	2.783	0.896	0.596	0.433	0.233	0.191	0.129
18	0.129	0.537	2.388	1.073	1.825	3.099	0.879	0.562	0.401	0.228	0.193	0.136
19	0.151	2.181	2.246	2.977	1.855	2.795	0.87	0.527	0.379	0.224	0.191	0.161
20	0.157	1.092	2.384	2.406	1.886	2.671	0.853	0.492	0.363	0.221	0.185	0.203
21	0.146	1.605	0.94	2.208	1.917	2.483	0.825	0.484	0.339	0.218	0.185	0.632
22	0.143	1.514	1.546	2.207	1.947	2.276	0.798	0.464	0.323	0.215	0.184	0.463
23	0.141	1.179	2.151	2.558	1.978	2.155	0.729	0.448	0.32	0.214	0.182	0.281
24	0.138	0.794	2.756	2.546	2.008	2.123	0.686	0.425	0.307	0.208	0.18	0.262
25	0.155	0.725	0.753	2.416	2.039	1.999	0.666	0.42	0.317	0.205	0.179	0.254
26	0.15	1.722	0.961	2.331	2.069	1.262	0.683	0.475	0.318	0.2	0.179	0.246
27	0.174	1.286	2.281	2.645	2.1	1.391	0.916	0.454	0.311	0.203	0.171	0.238
28	0.514	1.14	2.003	2.675	2.131	1.521	0.87	0.438	0.32	0.208	0.158	0.23
29	0.816	2.038	1.902		2.161	1.651	0.795	0.425	0.317	0.208	0.157	0.211
30	1.933	2.325	2.117		2.192	2.372	0.707	0.415	0.307	0.203	0.153	0.191
31		2.115	0.853		2.045		0.635		0.306	0.202		0.182
Mean	0.226	0.909	1.856	2.015	1.912	2.445	1.112	0.613	0.37	0.234	0.186	0.196
Flow (MCM)	0.586	2.436	4.972	4.874	5.12	6.336	2.977	1.59	0.99	0.626	0.482	0.526
Maximum	1.933	2.325	2.756	2.977	2.577	3.103	2.472	1.077	0.46	0.305	0.199	0.632
Minimum	0.108	0.302	0.753	0.932	1.458	1.262	0.635	0.415	0.306	0.2	0.153	0.129
Runoff (mm)	17.692	73.581	150.221	147.244	154.689	191.433	89.946	48.039	29.902	18.924	14.563	15.884

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 1.0 cumecs

Total : 31. Runoff : 958.567 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1978/1979

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.174	0.519	1.014	1.65	1.096	1.762	0.547	0.338	0.357	0.265	0.143	0.104
3	0.173	0.376	0.952	2.088	1.175	1.681	0.528	0.338	0.609	0.258	0.143	0.099
4	0.168	0.283	1.194	2.527	1.254	1.593	0.521	0.397	0.589	0.254	0.165	0.098
5	0.165	0.261	1.438	2.965	1.334	1.459	0.513	0.352	0.543	0.255	0.383	0.096
6	0.203	0.922	1.185	2.523	1.413	1.326	0.52	0.351	0.541	0.257	0.212	0.096
7	0.488	0.259	1.015	2.099	1.492	1.262	0.511	0.394	0.525	0.252	0.212	0.095
8	0.504	1.628	0.727	1.936	1.571	1.215	0.5	0.389	0.637	0.252	0.18	0.094
9	0.443	1.592	0.656	1.974	1.65	1.196	0.515	0.362	2.163	0.24	0.13	0.093
10	0.422	1.607	0.61	0.959	1.729	1.127	0.763	0.354	0.858	0.237	0.137	0.092
11	0.386	0.621	0.628	2.664	1.808	1.062	0.6	0.347	1.675	0.234	0.276	0.094
12	0.347	1.587	0.6	2.242	1.887	1.033	0.646	0.341	1.274	0.231	0.208	0.093
13	0.213	1.013	0.547	2.003	1.966	1.013	0.615	0.318	0.947	0.227	0.198	0.093
14	0.196	0.975	0.521	1.871	2.046	0.988	0.617	0.317	0.676	0.222	0.197	0.092
15	0.207	1.333	0.546	1.712	2.125	0.958	0.834	0.428	0.578	0.201	0.196	0.092
16	0.555	1.69	0.525	1.136	2.204	1.012	0.783	0.615	0.472	0.199	0.194	0.091
17	2.024	1.213	1.109	0.983	2.283	1.491	0.628	0.594	0.415	0.198	0.186	0.091
18	1.971	1.546	1.542	0.918	2.157	0.955	0.622	0.677	0.386	0.196	0.164	0.102
19	1.624	1.879	0.927	0.855	2.032	0.885	0.618	0.527	0.356	0.195	0.159	0.103
20	0.471	2.211	1.34	0.982	3.118	0.81	0.595	0.482	0.34	0.194	0.157	0.101
21	0.361	2.544	1.752	1.848	2.703	0.795	0.558	0.442	0.334	0.19	0.156	0.1
22	0.37	2.877	2.164	1.042	2.599	0.772	0.486	0.437	0.328	0.188	0.155	0.099
23	0.475	3.209	2.115	0.966	2.05	0.734	0.439	0.417	0.308	0.182	0.153	0.098
24	0.407	3.001	2.066	0.622	2.02	0.721	0.406	0.421	0.312	0.181	0.136	0.098
25	0.568	2.795	2.017	0.701	1.99	0.668	0.385	0.401	0.306	0.18	0.123	0.097
26	0.474	2.659	2.816	0.78	1.96	0.629	0.357	0.387	0.302	0.176	0.039	0.097
27	0.332	2.254	2.38	0.859	2.677	0.589	0.347	0.375	0.295	0.173	0.474	0.095
28	0.434	2.099	2.217	0.938	2.382	0.651	0.342	0.349	0.297	0.149	0.115	0.091
29	0.322	2.047	2.046		2.217	0.603	0.338	0.342	0.291	0.146	0.114	0.089
30	0.294	1.99	1.181		2.099	0.559	0.334	0.335	0.287	0.145	0.113	0.088
31		1.811	1.361		2.047		0.328		0.282	0.145		0.085
Mean	0.498	1.589	1.306	1.538	1.939	1.047	0.529	0.406	0.569	0.209	0.179	0.096
Flow (MCM)	1.292	4.256	3.499	3.72	5.193	2.715	1.416	1.052	1.523	0.561	0.463	0.256
Maximum	2.024	3.209	2.816	2.965	3.118	1.875	0.834	0.677	2.163	0.269	0.474	0.11
Minimum	0.165	0.259	0.521	0.622	1.017	0.559	0.328	0.317	0.282	0.145	0.039	0.085
Runoff (mm)	39.033	128.568	105.707	112.383	156.879	82.026	42.773	31.772	46.013	16.942	13.991	7.746

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 26. Runoff : 786.355 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1979/1980

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.094	1.051	0.405	0.79	1.318	0.726	0.603	0.309	0.188	0.187	0.13	0.159
3	0.091	0.462	0.932	0.7	1.223	0.683	0.601	0.349	0.184	0.181	0.129	0.139
4	0.092	0.733	0.444	0.61	1.386	0.643	0.597	0.359	0.182	0.24	0.128	0.121
5	0.126	0.598	0.363	0.927	0.434	0.621	0.593	0.559	0.182	0.989	0.128	0.117
6	0.125	0.966	0.452	1.244	0.523	0.601	0.581	0.319	0.181	0.324	0.129	0.117
7	0.532	1.334	1.464	1.56	0.613	0.625	0.566	0.296	0.18	0.284	0.128	0.133
8	0.041	1.021	1.634	0.817	0.702	1.198	0.555	0.285	0.18	0.248	0.125	0.129
9	0.122	1.309	1.049	0.444	0.791	2.467	0.533	0.279	0.233	0.227	0.13	0.118
10	0.121	1.596	2.327	2.139	0.881	1.762	0.519	0.275	0.627	0.217	0.121	0.116
11	0.119	1.884	0.479	1.205	0.97	1.807	0.475	0.268	0.401	0.201	0.117	0.115
12	0.118	1.427	0.959	1.023	1.059	1.901	0.44	0.264	1.126	0.192	0.115	0.115
13	0.119	1.322	0.765	1.089	1.149	1.696	0.426	0.262	0.642	0.181	0.115	0.114
14	0.119	2.239	0.61	1.019	0.975	1.491	0.413	0.25	0.335	0.169	0.114	0.112
15	0.118	1.249	0.664	0.964	2.534	2.252	0.398	0.253	0.307	0.158	0.112	0.111
16	0.039	1.058	0.722	0.908	2.244	2.123	0.384	0.253	0.284	0.152	0.111	0.11
17	0.727	0.692	0.702	1.15	1.813	1.424	0.377	0.254	0.265	0.151	0.11	0.11
18	0.754	0.524	0.635	1.007	1.598	0.725	0.348	0.251	0.263	0.146	0.109	0.107
19	0.647	0.474	0.594	0.796	1.474	1.241	0.36	0.25	0.261	0.143	0.108	0.105
20	0.594	0.446	0.51	0.707	1.407	1.757	0.355	0.251	0.259	0.142	0.107	0.196
21	0.576	0.4	0.457	0.684	1.385	1.959	0.347	0.251	0.247	0.141	0.108	1.648
22	0.181	0.363	0.414	0.875	1.359	1.68	0.34	0.249	0.227	0.139	0.107	0.89
23	1.204	0.329	0.357	1.365	1.249	1.451	0.337	0.162	0.217	0.138	0.128	0.261
24	1.728	0.384	0.34	1.372	1.124	1.197	0.33	0.076	0.224	0.137	0.324	0.199
25	1.519	0.396	0.484	1.38	1.338	1.072	0.326	0.22	0.218	0.136	0.15	0.181
26	0.516	0.355	1.375	2.097	1.141	0.966	0.314	0.21	0.218	0.135	0.118	0.173
27	0.704	0.31	1.723	1.419	1.032	0.904	0.309	0.2	0.219	0.134	0.115	0.208
28	0.969	0.3	0.608	1.42	0.965	0.809	0.29	0.199	0.245	0.133	0.133	0.287
29	1.529	0.329	0.418	1.599	0.941	0.717	0.289	0.198	0.241	0.131	0.306	0.227
30	1.257	0.319	0.357		0.872	0.635	0.294	0.195	0.236	0.13	0.178	0.188
31		0.409	0.322		0.809		0.279		0.22	0.13		0.181
Mean	0.499	0.854	0.74	1.09	1.186	1.263	0.425	0.261	0.29	0.201	0.135	0.223
Flow (MCM)	1.293	2.287	1.982	2.731	3.176	3.273	1.139	0.676	0.776	0.537	0.351	0.598
Maximum	1.728	2.239	2.327	2.139	2.534	2.467	0.608	0.559	1.126	0.989	0.324	1.648
Minimum	0.039	0.3	0.322	0.303	0.434	0.601	0.279	0.076	0.18	0.13	0.107	0.105
Runoff (mm)	39.073	69.08	59.885	82.521	95.958	98.882	34.418	20.415	23.434	16.236	10.61	18.072

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.5 cumecs

Total : 18. Runoff : 570.553 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1980/1981

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	0.181	0.176	1.476	1.187	2.014	1.732	0.746	0.3	0.146	0.147	0.132	0.117
2	0.174	0.141	1.233	1.566	2.244	1.398	0.782	0.277	0.132	0.147	0.132	0.117
3	0.179	0.132	0.99	1.945	1.915	1.197	1.088	0.265	0.121	0.141	0.132	0.117
4	0.164	0.451	1.979	1.648	1.085	1.045	0.643	0.265	0.146	0.146	0.132	0.117
5	0.147	0.593	2.002	1.913	1.24	0.939	0.569	0.265	0.165	0.147	0.132	0.117
6	0.132	0.734	1.978	2.178	1.395	0.908	0.494	0.265	0.196	0.149	0.132	0.117
7	0.118	0.876	1.752	2.443	1.55	1.34	0.062	0.263	0.174	0.155	0.132	0.117
8	0.117	1.014	1.526	2.708	2.153	0.262	0.476	0.256	0.164	0.154	0.132	0.117
9	0.117	0.706	1.573	2.973	1.987	0.817	0.489	0.361	0.164	0.147	0.132	0.117
10	0.111	0.649	1.889	3.238	2.316	1.281	0.36	0.353	0.157	0.147	0.132	0.117
11	0.104	0.647	2.204	2.962	2.645	1.136	0.228	0.202	0.162	0.147	0.132	0.117
12	0.104	1.19	2.52	2.559	2.131	1.063	0.636	0.184	0.162	0.147	0.132	0.117
13	0.098	0.276	2.373	2.151	1.845	0.913	0.15	0.28	0.149	0.147	0.132	0.117
14	0.092	0.584	1.541	2.041	1.745	0.833	0.143	0.224	0.147	0.147	0.132	0.117
15	0.092	1.267	0.71	1.932	1.604	0.785	0.175	0.377	0.147	0.139	0.132	0.117
16	0.11	0.525	1.813	1.823	1.549	0.742	0.201	0.223	0.149	0.127	0.132	0.117
17	0.31	0.419	1.61	1.882	1.984	0.716	0.367	0.193	0.161	0.145	0.132	0.117
18	0.251	1.094	1.626	1.94	2.089	0.676	0.172	0.294	0.15	0.139	0.132	0.117
19	0.093	1.14	2.208	1.999	2.195	0.649	0.321	0.33	0.161	0.133	0.132	0.117
20	0.139	1.606	1.928	2.057	2.301	0.652	0.33	0.277	0.142	0.138	0.132	0.117
21	0.133	1.187	1.751	2.116	2.406	1.314	0.337	0.321	0.146	0.132	0.132	0.117
22	0.132	1.063	1.598	2.174	1.913	1.39	0.317	0.319	0.147	0.132	0.132	0.117
23	0.132	0.991	1.443	2.233	1.732	1.466	0.315	0.346	0.147	0.132	0.132	0.117
24	0.126	0.537	1.202	2.291	1.771	1.101	0.315	0.179	0.147	0.132	0.13	0.143
25	0.123	0.661	1.072	2.35	1.68	1.043	0.315	0.149	0.147	0.132	0.118	0.274
26	0.117	0.785	1.237	2.408	1.623	0.953	0.315	0.139	0.147	0.132	0.117	0.117
27	0.105	0.909	1.396	3.377	1.466	0.77	0.315	0.146	0.147	0.132	0.117	0.117
28	0.263	1.033	1.346	2.417	1.379	0.673	0.312	0.149	0.147	0.132	0.117	0.117
29	0.265	0.977	1.285		1.249	0.614	0.291	0.161	0.147	0.132	0.117	0.113
30	0.248	0.921	0.428		1.181	0.615	0.289	0.149	0.149	0.132	0.117	0.109
31		2.516	0.808		1.863		0.291		0.154	0.132		0.117
Flow (MCM)	0.387	2.229	4.19	5.401	4.86	2.507	1.024	0.649	0.408	0.375	0.334	0.329
Maximum	0.31	2.516	2.52	3.377	2.645	1.732	1.088	0.377	0.196	0.155	0.132	0.274
Minimum	0.092	0.132	0.428	1.187	1.085	0.262	0.062	0.139	0.121	0.127	0.117	0.109
Runoff (mm)	11.683	67.344	126.598	163.165	146.817	75.754	30.922	19.613	12.323	11.328	10.087	9.932

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.7 cumecs

Total : 22. Runoff : 693.649 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1981/1982

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.117	0.156	2.212	1.826	2.524	0.669	0.604	0.265	0.146	0.304	0.123	0.092
3	0.117	0.164	2.219	1.593	2.262	0.655	0.591	0.265	0.406	0.302	0.117	0.092
4	0.117	0.164	2.212	1.273	2.346	0.687	0.575	0.265	1.733	0.312	0.112	0.091
5	0.117	0.164	2.228	0.387	2.329	0.655	0.553	0.265	0.759	0.315	0.117	0.081
6	0.117	0.164	2.378	0.562	2.24	0.634	0.516	0.256	0.993	0.312	0.123	0.089
7	0.117	0.164	3.027	0.737	2.419	0.628	0.498	0.252	0.67	0.291	0.116	0.18
8	0.117	0.168	3.137	0.913	2.429	0.611	0.498	0.244	0.55	0.289	0.106	0.176
9	0.117	0.225	3.1	1.088	1.566	0.614	0.513	0.254	0.421	0.287	0.116	0.196
10	0.117	0.232	3.139	2.004	1.28	0.624	0.481	0.254	0.372	0.233	0.112	0.182
11	0.117	0.223	0.976	2.07	1.196	0.575	0.418	0.263	0.37	0.174	0.116	0.164
12	0.117	0.221	2.97	2.135	1.17	0.615	0.385	0.254	0.37	0.156	0.112	0.15
13	0.117	0.221	2.222	2.2	1.181	1.053	0.37	0.242	0.385	0.147	0.109	0.154
14	0.117	0.221	1.969	2.266	1.106	0.83	0.37	0.242	0.628	0.139	0.104	0.146
15	0.117	0.221	1.913	2.331	1.072	0.758	0.37	0.242	0.451	0.132	0.104	0.133
16	0.117	0.211	1.838	2.396	1.03	0.694	0.367	0.24	0.442	0.132	0.104	0.132
17	0.117	0.201	1.711	2.462	0.843	0.655	0.344	0.223	0.396	0.132	0.104	0.154
18	0.117	0.201	1.871	2.527	0.72	0.217	0.339	0.221	0.202	0.124	0.104	0.151
19	0.117	0.199	1.818	2.592	0.81	1.581	0.33	0.221	0.35	0.117	0.104	0.154
20	0.117	0.193	1.635	2.658	0.896	0.766	0.328	0.211	0.377	0.117	0.104	0.147
21	0.117	0.199	1.495	2.723	1.215	1.315	0.315	0.199	0.388	0.117	0.104	0.2
22	0.117	0.183	1.413	0.921	1.338	1.929	0.315	0.183	0.286	0.195	0.104	0.993
23	0.117	0.182	1.366	0.813	1.46	1.642	0.315	0.18	0.547	0.327	0.099	2.149
24	0.117	0.19	0.831	3.316	1.582	2.431	0.315	0.165	0.428	0.22	0.098	1.132
25	0.117	0.306	1.251	3.546	1.705	2.017	0.315	0.164	0.263	0.164	0.103	0.614
26	0.117	0.591	1.67	1.108	1.827	0.965	0.315	0.164	0.248	0.141	0.098	0.457
27	0.117	0.913	2.089	2.296	1.95	0.702	0.312	0.164	0.323	0.132	0.092	0.398
28	0.117	1.129	2.833	3.255	1.271	0.655	0.291	0.162	0.342	0.124	0.092	0.34
29	0.117	1.318	2.718		0.878	0.652	0.289	0.149	0.342	0.124	0.092	0.283
30	0.118	1.448	2.666		0.777	0.631	0.289	0.147	0.342	0.124	0.092	0.244
31		1.519	2.64		0.72		0.277		0.328	0.117		0.173
Mean	0.117	0.381	2.114	1.943	1.518	0.905	0.4	0.221	0.452	0.197	0.107	0.314
Flow (MCM)	0.304	1.022	5.661	4.701	4.066	2.345	1.071	0.572	1.21	0.529	0.276	0.841
Maximum	0.118	1.519	3.139	3.546	2.916	2.431	0.604	0.265	1.733	0.327	0.123	2.149
Minimum	0.117	0.138	0.831	0.387	0.72	0.217	0.277	0.147	0.146	0.117	0.092	0.081
Runoff (mm)	9.187	30.866	171.029	142.016	122.828	70.843	32.343	17.281	36.552	15.97	8.346	25.413

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.7 cumecs

Total : 22. Runoff : 688.214 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1982/1983

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.154	0.282	0.392	1.04	1.781	0.904	0.283	0.244	0.146	0.224	0.104	0.07
3	0.147	0.242	0.346	0.934	1.538	0.744	0.256	0.223	0.136	0.208	0.104	0.07
4	0.146	0.211	0.382	0.841	1.414	0.625	0.246	0.209	0.16	0.167	0.098	0.07
5	0.133	0.182	0.4	0.168	1.297	0.519	0.275	0.183	0.147	0.156	0.092	0.07
6	0.132	0.165	0.656	0.624	1.175	0.464	0.277	0.18	0.133	0.147	0.092	0.07
7	0.13	0.164	0.421	1.079	0.671	0.505	0.285	0.165	0.133	0.146	0.092	0.07
8	0.04	0.53	0.367	2.799	1.094	0.447	0.267	0.167	0.146	0.133	0.092	0.07
9	0.449	0.516	0.344	2.643	1.46	0.415	0.265	0.188	0.147	0.132	0.093	0.07
10	0.172	1.289	0.342	1.08	0.979	0.395	0.265	0.182	0.147	0.132	0.103	0.07
11	0.137	1.5	0.335	2.004	1.477	0.467	0.287	0.182	0.139	0.132	0.103	0.071
12	0.046	1.4	0.38	2.927	1.974	0.434	0.515	0.173	0.132	0.132	0.093	0.079
13	0.968	0.613	0.404	2.394	2.471	0.415	0.572	0.164	0.13	0.138	0.092	0.08
14	0.428	1.569	0.593	1.354	2.968	0.382	0.457	0.165	0.126	0.133	0.092	0.081
15	1.149	1.863	0.454	1.321	2.192	0.344	0.301	0.18	0.13	0.124	0.086	0.086
16	1.485	0.892	0.372	1.288	1.863	0.328	0.267	0.18	0.118	0.117	0.08	0.086
17	1.335	0.898	0.344	1.255	1.525	0.355	0.265	0.165	0.475	0.117	0.08	0.092
18	1.055	2.219	0.328	1.222	1.316	0.37	0.265	0.165	0.043	0.117	0.08	0.101
19	0.879	2.413	0.315	1.189	1.572	0.344	0.254	0.171	0.257	0.111	0.079	0.092
20	0.743	1.562	0.302	3.275	1.827	0.342	0.242	0.164	0.332	0.104	0.071	0.082
21	0.659	0.81	0.287	3.015	2.043	0.328	0.233	0.164	0.27	0.104	0.07	0.08
22	1.058	0.455	0.265	2.396	1.641	0.312	0.239	0.164	0.187	0.104	0.07	0.08
23	1.313	0.4	0.529	1.558	1.262	0.291	0.223	0.156	0.165	0.105	0.07	0.08
24	1.568	0.372	0.849	1.287	1.068	0.293	0.221	0.147	0.156	0.117	0.07	0.08
25	0.866	0.356	1.674	1.05	0.939	0.335	0.221	0.147	0.139	0.502	0.07	0.079
26	0.793	0.342	2.417	0.913	0.878	0.317	0.211	0.139	0.132	0.27	0.07	0.071
27	0.762	0.328	2.667	0.886	0.781	0.302	0.201	0.133	0.132	0.039	0.07	0.081
28	0.717	0.312	1.835	1.339	0.642	0.289	0.193	0.168	0.132	0.117	0.07	0.08
29	0.6	0.291	1.466		0.656	0.277	0.197	0.146	0.626	0.111	0.07	0.056
30	0.342	0.289	2.064		1.281	0.265	0.183	0.153	2.516	0.104	0.07	0.092
31		0.307	1.753		0.778		0.204		1.15	0.104		0.097
Mean	0.619	0.745	0.771	1.539	1.413	0.427	0.272	0.178	0.288	0.15	0.084	0.078
Flow (MCM)	1.604	1.994	2.065	3.723	3.784	1.106	0.728	0.46	0.771	0.401	0.218	0.21
Maximum	1.568	2.413	2.667	3.275	2.968	0.995	0.572	0.359	2.516	0.502	0.104	0.101
Minimum	0.04	0.164	0.265	0.168	0.642	0.265	0.183	0.133	0.043	0.039	0.07	0.056
Runoff (mm)	48.458	60.252	62.397	112.486	114.313	33.422	21.996	13.903	23.306	12.113	6.59	6.331

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.5 cumecs

Total : 17. Runoff : 521.039 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1983/1984

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.088	1.612	0.388	0.508	0.786	2.043	0.415	0.462	0.202	0.374	0.104	0.097
3	0.062	2.026	0.318	0.734	0.422	2.893	0.423	0.413	0.201	0.22	0.104	0.08
4	0.12	1.084	0.289	1.022	0.754	2.087	0.363	0.372	0.201	0.183	0.103	0.071
5	0.106	0.359	1.029	2.04	1.048	1.819	0.328	0.356	0.211	0.173	0.094	0.071
6	0.086	0.216	1.707	2.547	1.341	1.478	0.312	0.328	0.211	0.162	0.097	0.079
7	0.075	0.165	0.931	0.633	1.634	1.385	0.306	0.302	0.269	0.15	0.092	0.072
8	0.082	0.141	0.682	1.295	1.928	1.318	0.348	0.277	0.309	0.174	0.092	0.067
9	0.09	0.13	0.404	0.622	2.132	1.243	0.442	0.265	0.226	0.206	0.086	0.074
10	0.057	0.132	0.29	0.746	1.791	1.092	0.377	0.265	0.202	0.182	0.08	0.079
11	0.079	0.269	0.326	0.869	1.673	0.892	0.356	0.265	0.201	0.157	0.08	0.075
12	0.071	0.251	1.093	2.025	1.611	0.785	0.339	0.277	0.201	0.139	0.08	0.07
13	0.07	0.367	1.126	1.59	1.274	0.698	0.317	0.287	0.221	0.133	0.076	0.069
14	0.07	0.298	1.043	1.041	1.491	0.635	0.312	0.267	0.24	0.138	0.079	0.061
15	0.076	0.213	0.936	0.862	1.737	0.607	0.291	0.781	0.219	0.132	0.08	0.06
16	0.111	0.15	0.833	0.79	1.148	0.553	0.289	1.481	0.406	0.132	0.076	0.061
17	0.081	0.139	0.766	0.564	1.072	0.501	0.287	1.462	0.491	0.132	0.075	0.061
18	0.08	0.138	0.735	0.453	2.155	0.484	0.292	1.118	0.291	0.133	0.075	0.035
19	0.075	0.265	0.694	0.415	2.605	0.478	0.312	0.653	0.242	0.138	0.074	0.034
20	0.07	1.506	0.635	0.426	0.895	0.464	0.302	0.488	0.224	0.132	0.086	0.066
21	0.069	0.922	0.598	0.607	1.91	0.464	0.307	0.342	0.24	0.124	0.095	0.069
22	0.061	0.782	0.441	0.73	2.556	0.592	0.479	0.315	0.232	0.117	0.092	0.063
23	0.078	0.224	0.356	0.854	2.492	1.02	0.481	0.291	0.221	0.117	0.09	0.073
24	0.244	1.89	0.3	1.206	1.042	0.662	0.484	0.287	0.212	0.117	0.081	0.07
25	0.233	0.828	0.244	1.836	2.111	0.538	0.909	0.271	0.209	0.111	0.071	0.065
26	0.12	1.873	0.212	1.74	1.471	0.481	0.93	0.298	0.201	0.104	0.071	0.262
27	0.098	1.951	0.193	1.456	1.391	0.447	0.787	0.277	0.201	0.104	0.079	0.379
28	0.093	1.325	0.19	1.422	0.399	0.42	0.579	0.254	0.199	0.104	0.081	0.174
29	0.172	0.9	0.182	1.357	0.984	0.472	0.447	0.242	0.183	0.104	0.085	0.117
30	0.18	0.813	0.244		0.93	0.557	0.49	0.232	0.173	0.035	0.139	0.104
31		0.754	0.279		1.772		2.08		0.164	0.296		0.093
Mean	0.101	0.705	0.581	1.058	1.466	0.991	0.481	0.46	0.233	0.152	0.096	0.093
Flow (MCM)	0.261	1.889	1.557	2.651	3.927	2.569	1.288	1.192	0.624	0.407	0.248	0.25
Maximum	0.244	2.026	1.707	2.547	2.605	2.893	2.08	1.481	0.491	0.374	0.359	0.379
Minimum	0.057	0.13	0.182	0.295	0.399	0.42	0.287	0.232	0.164	0.035	0.071	0.034
Runoff (mm)	7.881	57.057	47.037	80.099	118.653	77.617	38.922	36.013	18.852	12.29	7.504	7.555

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.5 cumecs

Total : 16. Runoff : 510.928 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1984/1985

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.075	0.23	1.806	1.42	1.486	1.656	1.016	0.385	0.296	0.147	0.237	0.117
3	0.093	0.201	1.462	1.313	1.244	1.567	0.961	0.358	0.263	0.147	0.292	0.117
4	0.288	0.182	0.598	1.205	1.002	1.477	0.908	0.356	0.242	0.149	0.216	0.117
5	0.163	0.164	1.493	1.098	0.983	1.388	0.854	0.353	0.223	0.154	0.191	0.12
6	0.322	0.05	1.694	1.04	1.012	1.298	0.762	0.328	0.211	0.149	0.173	0.13
7	1.378	1.207	0.496	1.048	1.041	1.209	0.673	0.302	0.199	0.154	0.162	0.112
8	0.597	1.588	1.64	1.055	1.069	1.12	0.611	0.279	0.183	0.147	0.17	0.038
9	0.344	1.195	1.753	1.063	1.478	2.818	0.568	0.289	0.174	0.147	0.356	0.408
10	0.913	1.173	1.865	1.071	1.886	0.895	0.501	0.3	0.182	0.147	0.456	0.109
11	1.381	0.492	1.483	1.079	2.294	0.837	0.469	0.277	0.191	0.141	0.347	0.117
12	0.428	0.576	1.101	1.087	2.703	0.779	0.495	0.257	0.199	0.146	0.193	0.131
13	0.313	1.04	2.76	1.095	3.111	0.795	0.498	0.273	0.201	0.141	0.197	0.211
14	0.258	2.512	2.731	1.103	2.516	0.956	0.498	0.254	0.201	0.146	0.182	0.126
15	0.232	1.43	2.264	1.111	0.779	1.117	0.498	0.242	0.193	0.141	0.164	0.117
16	0.211	1.558	3.116	1.119	1.108	3.196	0.481	0.232	0.209	0.139	0.193	0.111
17	0.193	1.33	3.142	1.17	2.08	2.844	0.453	0.223	0.221	0.138	0.535	0.104
18	0.135	1.588	2.387	1.221	2.431	2.239	0.489	0.242	0.211	0.152	0.232	0.104
19	0.575	1.723	2.625	1.272	2.783	1.886	0.464	0.252	0.201	0.275	0.214	0.109
20	1.014	1.589	2.337	1.323	3.134	1.79	0.431	0.235	0.191	0.165	0.218	0.142
21	0.392	1.456	1.771	1.375	2.678	1.712	0.402	0.261	0.183	0.147	0.191	0.133
22	0.262	1.322	1.957	1.426	1.458	1.598	0.385	0.265	0.19	0.139	0.182	0.137
23	0.344	1.189	1.633	1.477	1.707	1.454	0.367	0.256	0.182	0.132	0.182	0.118
24	0.328	1.577	1.63	1.528	1.957	1.287	0.342	0.261	0.182	0.132	0.173	0.117
25	0.29	1.966	2.63	1.579	2.207	1.161	0.33	0.256	0.182	0.139	0.162	0.111
26	0.254	2.354	2.819	1.631	2.457	1.357	0.346	0.265	0.174	0.211	0.149	0.035
27	0.241	2.743	0.803	1.682	2.707	1.318	0.38	0.243	0.18	0.573	0.147	0.98
28	0.305	2.184	0.803	1.969	2.64	1.254	0.356	0.219	0.174	0.571	0.139	0.317
29	0.277	1.758	0.922		0.938	1.191	0.356	0.202	0.171	0.366	0.132	0.235
30	0.256	1.635	1.042		2.762	1.131	0.356	0.218	0.164	0.33	0.13	0.219
31		1.602	1.635		2.601		0.346		0.156	0.318		0.202
Mean	0.398	1.286	1.822	1.289	1.935	1.512	0.538	0.276	0.207	0.198	0.218	0.17
Flow (MCM)	1.032	3.444	4.881	3.118	5.182	3.918	1.44	0.715	0.554	0.53	0.564	0.455
Maximum	1.381	2.743	3.142	1.969	3.134	3.196	1.072	0.395	0.492	0.573	0.535	0.98
Minimum	0.075	0.05	0.496	1.04	0.779	0.779	0.33	0.202	0.156	0.132	0.13	0.035
Runoff (mm)	31.187	104.06	147.458	94.203	156.564	118.378	43.504	21.606	16.751	16.001	17.052	13.734

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 25. Runoff : 781.870 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1985/1986

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.18	0.221	3.18	0.631	1.517	1.091	1.496	0.328	0.246	0.23	0.126	0.117
3	0.161	0.232	2.703	3.057	2.16	1.062	1.287	0.315	0.273	0.221	0.123	0.117
4	0.122	0.232	0.795	2.268	1.785	1.034	1.102	0.315	0.265	0.219	0.118	0.117
5	0.13	0.415	2.045	1.209	1.344	1.005	0.992	0.315	0.263	0.202	0.124	0.112
6	0.132	1.098	2.217	3.369	1.882	0.977	0.957	0.342	0.244	0.201	0.123	0.111
7	0.124	0.25	2.206	2.887	1.865	0.948	0.883	0.637	0.242	0.201	0.117	0.109
8	0.117	2.695	2.194	1.825	2.086	2.362	0.813	0.648	0.242	0.191	0.117	0.099
9	0.117	1.609	1.746	1.934	1.9	2.219	0.762	0.604	0.242	0.182	0.117	0.103
10	0.124	0.303	1.495	2.044	1.666	2.092	0.716	0.471	0.242	0.174	0.117	0.107
11	0.212	1.267	1.357	2.268	2.201	2.033	0.669	0.4	0.232	0.173	0.117	0.155
12	0.265	0.473	1.593	2.493	1.696	1.89	0.614	0.37	0.221	0.171	0.117	0.197
13	0.693	1.573	1.891	2.717	1.513	1.57	0.611	0.33	0.221	0.164	0.117	0.188
14	0.298	1.035	2.646	2.942	1.324	1.777	0.591	0.312	0.221	0.164	0.111	0.142
15	0.25	1.636	2.293	3.167	1.191	1.538	0.568	0.291	0.219	0.164	0.104	0.124
16	0.204	1.037	1.677	2.615	1.072	1.391	0.537	0.295	0.202	0.156	0.104	0.117
17	0.191	1.57	2.091	2.368	0.961	1.318	0.516	0.449	0.201	0.147	0.104	0.111
18	0.188	1.259	2.298	2.174	0.891	1.456	0.498	0.338	0.201	0.147	0.104	0.105
19	0.28	1.276	2.119	2.048	0.961	1.707	0.498	0.302	0.201	0.147	0.104	0.109
20	0.52	2.116	1.534	1.97	1.53	1.958	0.484	0.277	0.201	0.147	0.104	0.104
21	0.613	2.747	0.949	1.624	1.825	2.806	0.478	0.267	0.201	0.147	0.105	0.105
22	0.419	0.695	1.12	1.525	1.777	2.962	0.464	0.275	0.201	0.147	0.109	0.117
23	0.999	2.115	1.118	1.454	2.59	2.594	0.447	0.284	0.201	0.147	0.104	0.228
24	0.939	1.971	1.116	1.385	1.951	2.185	0.428	0.333	0.201	0.147	0.104	1.635
25	0.45	1.777	1.114	1.416	1.712	2.873	0.402	0.279	0.201	0.147	0.104	0.399
26	0.315	1.684	1.112	2.069	1.775	2.666	0.402	0.265	0.201	0.139	0.369	0.215
27	0.287	1.452	1.11	1.68	1.268	2.548	0.426	0.265	0.206	0.133	1.756	0.183
28	0.244	0.682	1.108	1.598	0.942	2.321	0.402	0.254	0.252	0.138	1.599	0.171
29	0.221	1.965	2.939		1.998	2.167	0.385	0.242	0.273	0.132	0.701	0.141
30	0.206	1.94	2.368		1.79	1.998	0.37	0.242	0.263	0.132	0.388	0.126
31		3.068	2.057		1.148		0.356		0.244	0.132		0.124
Mean	0.307	1.31	1.849	2.105	1.619	1.856	0.675	0.346	0.228	0.167	0.255	0.191
Flow (MCM)	0.794	3.509	4.952	5.093	4.336	4.81	1.809	0.897	0.61	0.447	0.66	0.512
Maximum	0.999	3.068	3.18	3.369	2.59	2.962	1.786	0.648	0.273	0.233	1.756	1.635
Minimum	0.117	0.218	0.795	0.631	0.891	0.948	0.356	0.242	0.201	0.132	0.104	0.099
Runoff (mm)	24.002	106.005	149.601	153.881	130.999	145.311	54.655	27.112	18.435	13.507	19.946	15.47

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.9 cumecs

Total : 28. Runoff : 866.016 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1986/1987

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.299	0.979	0.45	1.191	1.519	0.447	0.211	0.147	0.174	0.093	0.07	0.405
3	0.197	0.739	0.88	1.243	1.263	0.415	0.22	0.139	0.141	0.092	0.07	0.589
4	0.156	0.677	0.759	1.191	1.031	0.4	0.223	0.132	0.132	0.092	0.07	0.772
5	0.157	0.631	0.638	1.131	1.234	0.413	0.221	0.132	0.124	0.087	0.07	0.934
6	0.211	0.588	1.446	1.072	0.999	0.55	0.211	0.13	0.124	0.052	0.07	0.52
7	0.225	0.519	1.05	1.016	0.83	0.504	0.253	0.122	0.124	0.084	0.07	0.321
8	0.211	0.651	0.858	0.961	0.677	0.478	0.258	0.151	0.117	0.037	0.07	0.235
9	0.218	0.742	0.696	0.9	0.611	0.431	0.24	0.147	0.117	0.114	0.07	0.208
10	0.152	1.017	0.575	0.77	0.591	0.4	0.221	0.141	0.117	0.111	0.07	0.167
11	0.836	1.291	0.519	0.799	0.547	0.372	0.202	0.138	0.117	0.104	0.07	0.156
12	1.519	1.566	0.498	1.672	0.594	0.356	0.199	0.126	0.117	0.104	0.07	0.145
13	0.543	2.219	0.507	1.635	0.522	0.342	0.174	0.138	0.117	0.099	0.069	0.12
14	0.361	2.092	0.601	1.561	0.495	0.328	0.164	0.147	0.117	0.103	0.061	0.117
15	0.279	1.97	0.607	1.483	0.464	0.312	0.162	0.147	0.117	0.099	0.06	0.112
16	0.299	1.497	0.538	1.282	0.418	0.291	0.15	0.139	0.118	0.098	0.06	0.115
17	0.863	1.033	0.487	1.017	0.385	0.582	0.154	0.132	0.123	0.097	0.06	0.105
18	0.657	0.891	0.544	0.83	0.38	0.845	0.149	0.132	0.117	0.092	0.063	0.098
19	0.359	0.904	0.644	0.646	0.448	0.896	0.162	0.133	0.117	0.092	0.083	0.093
20	0.32	0.904	0.317	0.611	0.372	0.774	0.156	0.232	0.111	0.087	0.079	0.097
21	0.326	0.854	1.645	0.607	0.373	0.386	0.15	0.339	0.103	0.086	0.071	0.092
22	0.289	0.717	1.181	0.553	0.701	0.328	0.17	0.342	0.094	0.085	0.065	0.092
23	0.282	0.576	0.588	0.943	0.709	0.312	0.162	0.342	0.103	0.08	0.06	0.087
24	0.414	0.481	0.929	1.127	0.592	0.32	0.151	0.339	0.104	0.08	0.06	0.085
25	0.423	0.418	2.826	1.311	0.501	0.611	0.179	0.313	0.104	0.08	0.06	0.08
26	0.375	0.4	0.973	1.632	0.464	0.575	0.173	0.265	0.105	0.08	0.06	0.081
27	0.344	0.514	1.797	1.303	0.464	0.547	0.172	0.214	0.109	0.08	0.06	0.085
28	0.326	0.466	1.63	1.465	0.484	0.432	0.252	0.224	0.104	0.08	0.06	0.08
29	0.277	0.475	1.786		0.612	0.329	0.295	0.283	0.104	0.08	0.061	0.08
30	0.258	0.572	1.52		0.55	0.234	0.172	0.254	0.104	0.08	0.068	0.075
31		0.504	1.234		0.501		0.15		0.104	0.075		0.07
Mean	0.377	0.912	0.942	1.109	0.678	0.456	0.19	0.192	0.12	0.088	0.067	0.202
Flow (MCM)	0.978	2.442	2.523	2.684	1.816	1.183	0.509	0.499	0.321	0.235	0.173	0.542
Maximum	1.519	2.219	2.826	1.672	1.69	0.896	0.295	0.342	0.228	0.114	0.083	0.934
Minimum	0.147	0.4	0.317	0.553	0.372	0.234	0.135	0.122	0.094	0.037	0.06	0.061
Runoff (mm)	29.552	73.788	76.233	81.089	54.872	35.734	15.375	15.073	9.687	7.111	5.223	16.379

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.4 cumecs

Total : 14. Runoff : 423.534 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1987/1988

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.073	1.417	1.089	1.414	1.147	0.809	0.996	0.291	0.289	0.123	0.09	0.076
3	0.094	1.008	0.934	1.169	1.015	0.805	2.154	0.287	0.267	0.117	0.096	0.074
4	0.075	1.008	0.875	0.918	0.972	1.586	1.628	0.267	0.252	0.117	0.103	0.07
5	0.07	0.99	0.72	0.924	0.866	1.769	1.03	0.265	0.219	0.117	0.104	0.071
6	0.065	1.638	0.807	2.008	0.904	1.592	0.834	0.254	0.183	0.117	0.104	0.079
7	0.06	0.704	0.766	1.775	0.904	1.445	0.739	0.242	0.165	0.117	0.104	0.08
8	0.061	0.49	1.75	2.681	0.854	0.973	0.673	0.242	0.164	0.117	0.104	0.076
9	0.068	0.445	1.16	2.232	0.948	0.895	0.611	0.233	0.164	0.117	0.099	0.074
10	0.061	0.52	1.176	0.903	0.887	0.948	0.568	0.24	0.164	0.118	0.103	0.07
11	0.06	0.432	2.2	2.362	1.384	0.891	0.501	0.233	0.157	0.144	0.099	0.07
12	0.06	0.358	2.238	2.29	1.605	0.925	0.466	0.23	0.161	0.5	0.098	0.095
13	0.06	0.626	2.138	0.717	1.293	0.918	0.447	0.221	0.155	0.866	0.103	0.359
14	0.06	0.466	1.191	2.37	1.024	1.272	0.429	0.221	0.149	1.183	0.104	0.192
15	0.06	0.72	0.77	2.137	2.213	1.46	0.573	0.212	0.149	0.868	0.098	0.157
16	0.06	1.688	0.716	2.235	2.529	1.318	0.572	0.212	0.162	0.187	0.092	0.139
17	0.06	1.063	0.698	2.153	2.593	1.37	0.804	0.228	0.156	0.149	0.092	0.124
18	0.057	1.808	0.744	2.552	2.099	0.957	0.68	0.221	0.147	0.133	0.092	0.11
19	0.055	1.051	1.079	2.028	1.731	0.786	0.528	0.221	0.147	0.132	0.092	0.09
20	0.052	0.887	1.96	2.13	1.362	0.673	0.513	0.212	0.141	0.132	0.087	0.111
21	0.052	0.863	1.779	2.175	0.994	0.611	0.498	0.209	0.139	0.126	0.086	0.146
22	0.052	0.586	1.594	2.321	2.406	0.572	0.481	0.201	0.139	0.123	0.085	0.16
23	0.052	0.47	2.087	2.053	2.035	0.519	0.447	0.201	0.138	0.117	0.081	0.245
24	0.049	0.603	2.175	1.692	1.764	0.481	0.413	0.201	0.133	0.117	0.086	1.852
25	0.058	0.487	2.19	1.579	1.667	0.466	0.37	0.201	0.138	0.117	0.085	0.568
26	0.068	0.447	2.138	1.454	1.525	0.478	0.344	0.201	0.132	0.117	0.086	0.22
27	0.291	0.505	2.481	1.351	1.352	0.464	0.328	0.201	0.132	0.117	0.091	0.174
28	0.503	0.658	2.823	1.254	1.191	0.464	0.315	0.199	0.132	0.117	0.081	0.156
29	0.541	1.048	2.025	1.102	1.101	0.478	0.315	0.183	0.132	0.112	0.08	0.146
30	0.593	1.673	3.133		0.993	0.671	0.34	0.202	0.132	0.109	0.08	0.136
31		0.645	2.366		0.93		0.404		0.132	0.104		0.181
Mean	0.118	0.849	1.573	1.779	1.395	0.915	0.641	0.228	0.169	0.218	0.093	0.199
Flow (MCM)	0.306	2.273	4.212	4.458	3.737	2.372	1.716	0.591	0.452	0.584	0.242	0.534
Maximum	0.593	1.808	3.133	2.681	2.593	1.769	2.154	0.315	0.36	1.183	0.104	1.852
Minimum	0.049	0.358	0.698	0.717	0.854	0.464	0.315	0.183	0.132	0.104	0.08	0.07
Runoff (mm)	9.247	68.672	127.262	134.672	112.905	71.674	51.854	17.868	13.65	17.642	7.32	16.137

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 21. Runoff : 651.054 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1988/1989

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.264	3.501	3.473	3.446	3.421	3.393	0.611	0.289	0.219	0.164	0.132	0.104
3	0.303	3.5	3.472	3.445	3.42	3.066	0.565	0.289	0.202	0.164	0.132	0.104
4	0.346	3.499	3.471	3.444	3.419	2.76	0.621	0.287	0.201	0.164	0.132	0.098
5	0.392	3.498	3.471	3.443	3.418	2.484	0.585	0.392	0.201	0.164	0.132	0.092
6	0.442	3.497	3.47	3.442	3.417	2.361	0.504	1.397	0.201	0.164	0.132	0.092
7	0.496	3.496	3.469	3.441	3.416	2.283	0.498	0.404	0.212	0.167	0.132	0.092
8	0.554	3.495	3.468	3.44	3.416	2.206	0.498	0.318	0.24	0.196	0.133	0.092
9	0.617	3.494	3.467	3.439	3.415	2.132	0.498	0.289	0.242	0.183	0.145	0.092
10	0.683	3.494	3.466	3.439	3.414	2.059	0.498	0.289	0.24	0.182	0.133	0.098
11	0.755	3.493	3.465	3.438	3.413	1.987	0.498	0.289	0.212	0.182	0.132	0.104
12	0.83	3.492	3.464	3.437	3.412	1.918	0.484	0.289	0.201	0.182	0.132	0.104
13	0.911	3.491	3.463	3.436	3.411	1.849	0.472	0.412	0.193	0.182	0.132	0.104
14	0.996	3.49	3.463	3.435	3.41	1.783	0.392	0.435	0.19	0.182	0.132	0.104
15	1.087	3.489	3.462	3.434	3.409	1.718	0.385	0.304	0.182	0.182	0.132	0.103
16	1.182	3.488	3.461	3.433	3.408	1.654	0.385	0.279	0.182	0.173	0.132	0.093
17	1.283	3.487	3.46	3.432	3.408	1.592	0.397	0.277	0.182	0.164	0.132	0.092
18	1.389	3.486	3.459	3.431	3.407	1.532	0.385	0.287	0.182	0.164	0.124	0.092
19	1.5	3.486	3.458	3.431	3.406	1.473	0.37	0.287	0.182	0.164	0.117	0.091
20	1.617	3.485	3.457	3.43	3.405	1.415	0.372	0.267	0.226	0.164	0.117	0.081
21	1.74	3.484	3.456	3.429	3.404	1.359	0.382	0.265	0.636	0.164	0.117	0.08
22	1.868	3.483	3.455	3.428	3.403	1.305	0.37	0.265	0.376	0.164	0.117	0.08
23	2.003	3.482	3.455	3.427	3.402	1.251	0.37	0.254	0.202	0.162	0.116	0.08
24	2.144	3.481	3.454	3.426	3.401	1.2	0.37	0.242	0.191	0.141	0.105	0.082
25	2.29	3.48	3.453	3.425	3.4	1.149	0.37	0.242	0.182	0.132	0.104	0.102
26	2.443	3.479	3.452	3.424	3.4	1.1	0.37	0.242	0.182	0.132	0.104	0.104
27	2.603	3.478	3.451	3.423	3.399	1.053	0.356	0.242	0.182	0.132	0.104	0.104
28	2.769	3.478	3.45	3.423	3.398	1.007	0.339	0.242	0.182	0.132	0.104	0.104
29	2.942	3.477	3.449		3.397	0.962	0.33	0.232	0.18	0.132	0.104	0.104
30	3.121	3.476	3.448		3.396	0.918	0.339	0.221	0.165	0.132	0.104	0.104
31		3.475	3.447		3.395		0.304		0.164	0.132		0.104
Mean	1.327	3.482	3.461	3.435	3.408	1.812	0.441	0.327	0.218	0.161	0.123	0.096
Flow (MCM)	3.438	9.326	9.269	8.309	9.129	4.697	1.182	0.848	0.583	0.432	0.319	0.257
Maximum	3.121	3.501	3.474	3.447	3.422	3.394	0.766	1.397	0.636	0.196	0.145	0.104
Minimum	0.228	3.307	3.447	3.423	3.395	0.918	0.304	0.221	0.164	0.132	0.104	0.08
Runoff (mm)	103.879	281.757	280.038	251.025	275.804	141.899	35.716	25.63	17.618	13.05	9.639	7.777

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 1.5 cumecs
Total : 48. Runoff : 1452.244 mm Possible
data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1989/1990

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.091	0.331	1.786	1.21	0.373	0.887	0.739	0.254	0.164	0.178	0.117	0.133
3	0.081	0.302	0.575	1.276	0.359	0.805	0.735	0.242	0.164	0.176	0.117	0.132
4	0.08	0.275	0.421	1.342	0.849	0.702	0.698	0.232	0.164	0.174	0.117	0.132
5	0.08	0.242	1.396	1.407	0.883	0.698	0.694	0.221	0.164	0.173	0.117	0.132
6	0.075	0.221	1.177	1.852	0.837	0.713	0.669	0.216	0.164	0.171	0.117	0.132
7	0.07	0.201	0.997	1.456	0.833	0.684	0.611	0.187	0.164	0.169	0.116	0.132
8	0.07	0.193	0.316	0.467	0.829	0.578	0.575	0.201	0.162	0.167	0.105	0.132
9	0.07	0.234	1.47	2.242	0.785	0.537	0.55	0.199	0.149	0.166	0.104	0.132
10	0.07	0.601	1.589	1.221	0.739	0.531	0.437	0.183	0.139	0.164	0.104	0.13
11	0.07	0.653	1.707	1.618	0.673	0.49	0.365	0.182	0.132	0.162	0.104	0.117
12	0.19	0.965	1.826	2.016	0.614	0.378	0.319	0.183	0.132	0.16	0.104	0.099
13	0.315	2.382	1.631	2.413	0.591	0.33	0.629	0.199	0.132	0.158	0.104	0.092
14	0.304	1.328	1.707	2.197	0.535	0.315	2.754	0.201	0.132	0.157	0.104	0.092
15	0.289	1.035	1.784	1.881	0.498	0.315	3.26	0.201	0.132	0.155	0.104	0.086
16	0.287	0.846	1.861	1.575	0.498	0.315	0.872	0.201	0.132	0.153	0.104	0.08
17	0.277	0.266	1.938	1.42	0.166	0.387	1.488	0.201	0.132	0.151	0.111	0.08
18	0.267	0.284	2.014	1.313	1.092	0.588	1.804	0.201	0.132	0.149	0.11	0.08
19	0.43	0.313	2.091	1.217	2.017	0.54	1.784	0.201	0.13	0.148	0.128	0.08
20	2.473	0.265	2.168	1.05	1.543	0.531	1.699	0.201	0.118	0.146	0.604	0.08
21	0.457	0.224	2.245	0.926	1.345	0.501	1.455	0.201	0.128	0.144	0.466	0.08
22	0.289	0.358	2.321	0.759	0.627	0.481	1.223	0.201	0.251	0.142	0.312	0.08
23	0.266	2.144	2.398	0.754	2.478	0.437	1.049	0.191	0.263	0.141	0.291	0.08
24	0.242	1.379	2.475	0.716	2.129	0.324	0.93	0.182	0.242	0.139	0.289	0.079
25	0.481	1.222	2.552	0.695	2.048	0.3	0.738	0.182	0.221	0.137	0.277	0.071
26	0.606	0.709	2.628	0.941	2.236	0.315	0.462	0.182	0.193	0.135	0.265	0.07
27	0.731	0.893	2.705	0.722	2.112	0.747	0.344	0.182	0.182	0.133	0.265	0.07
28	0.414	0.316	2.782	0.478	1.988	0.599	0.328	0.182	0.182	0.132	0.265	0.065
29	0.326	1.419	2.007		1.448	0.625	0.315	0.18	0.182	0.13	0.263	0.06
30	0.297	0.948	0.845		1.248	0.662	0.312	0.165	0.182	0.128	0.239	0.06
31		2.41	1.079		1.155		0.279		0.182	0.126		0.06
Mean	0.327	0.758	1.78	1.297	1.096	0.544	0.931	0.2	0.165	0.153	0.188	0.097
Flow (MCM)	0.846	2.03	4.767	3.137	2.936	1.411	2.494	0.519	0.441	0.41	0.488	0.261
Maximum	2.473	2.41	2.782	2.413	2.478	1.016	3.26	0.265	0.263	0.18	0.604	0.168
Minimum	0.07	0.193	0.316	0.467	0.166	0.3	0.279	0.165	0.118	0.126	0.104	0.06
Runoff (mm)	25.568	61.328	144.02	94.774	88.697	42.621	75.349	15.695	13.329	12.385	14.744	7.873

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 19. Runoff : 598.349 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1990/1991

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.06	0.174	1.101	1.227	1.227	0.921	0.571	0.317	0.147	0.18	0.146	0.117
3	0.06	0.161	0.353	1.38	1.217	0.921	0.568	0.326	0.147	0.165	0.133	0.117
4	0.06	0.133	1.891	2.937	1.305	2.229	0.516	0.312	0.147	0.162	0.124	0.117
5	0.06	0.118	0.666	2.27	2.713	1.544	0.45	0.279	0.147	0.149	0.111	0.116
6	0.06	0.111	1.066	0.503	1.832	1.413	0.431	0.265	0.147	0.147	0.104	0.105
7	0.06	0.104	2.105	0.529	0.885	1.224	0.431	0.265	0.147	0.147	0.104	0.104
8	0.06	0.104	2.274	0.556	0.88	0.705	0.431	0.265	0.147	0.147	0.104	0.104
9	0.06	0.104	1.479	0.583	0.875	1.264	0.431	0.254	0.147	0.147	0.104	0.104
10	0.06	0.104	1.392	0.609	0.869	1.822	0.431	0.242	0.147	0.147	0.104	0.098
11	0.06	0.177	1.305	0.636	0.864	2.381	0.431	0.242	0.139	0.147	0.104	0.092
12	0.06	0.188	1.218	0.663	0.859	2.94	0.431	0.242	0.132	0.153	0.104	0.092
13	0.057	0.182	1.131	0.69	0.854	2.324	0.431	0.242	0.132	0.214	0.104	0.092
14	0.045	0.182	1.044	0.716	0.849	0.78	0.428	0.232	0.132	0.219	0.104	0.092
15	0.056	0.182	0.957	0.743	0.844	1.823	0.402	0.221	0.132	0.202	0.104	0.092
16	0.052	0.182	0.87	0.77	2.321	1.507	0.4	0.221	0.133	0.201	0.104	0.091
17	0.052	0.182	0.783	0.796	2.043	1.483	0.4	0.221	0.197	0.201	0.104	0.081
18	0.075	0.182	0.695	0.823	1.726	1.46	0.4	0.219	0.326	0.199	0.104	0.08
19	0.212	0.173	0.608	0.85	1.487	1.187	0.4	0.202	0.634	0.183	0.188	0.08
20	0.052	0.164	0.521	0.876	1.254	1.102	0.4	0.201	0.591	0.182	0.961	0.08
21	0.077	0.164	0.434	0.903	1.155	0.98	0.4	0.191	0.528	0.182	0.287	0.08
22	0.093	0.162	1.166	2.434	0.99	0.841	0.4	0.182	0.439	0.182	0.2	0.08
23	0.092	0.147	1.044	1.842	0.563	0.809	0.4	0.182	0.431	0.18	0.165	0.08
24	0.099	0.132	0.943	1.174	0.602	0.762	0.385	0.182	0.428	0.165	0.156	0.08
25	0.2	0.118	0.926	0.888	0.641	0.716	0.37	0.182	0.4	0.164	0.147	0.079
26	0.265	0.078	0.841	0.963	0.679	0.694	0.37	0.182	0.356	0.164	0.147	0.072
27	0.244	0.73	0.833	2.391	0.718	0.691	0.37	0.182	0.311	0.164	0.147	0.079
28	0.242	0.903	0.817	1.337	0.756	0.655	0.356	0.173	0.241	0.164	0.138	0.08
29	0.232	0.441	0.666		0.795	0.631	0.342	0.156	0.188	0.156	0.118	0.08
30	0.221	0.304	0.652		1.249	0.607	0.342	0.147	0.201	0.147	0.039	0.08
31		0.358	0.916		0.719		0.339		0.199	0.147		0.08
Mean	0.103	0.215	1.032	1.12	1.131	1.236	0.42	0.228	0.25	0.171	0.157	0.103
Flow (MCM)	0.267	0.575	2.765	2.709	3.028	3.203	1.125	0.591	0.669	0.457	0.407	0.276
Maximum	0.265	0.903	2.274	2.937	2.713	2.94	0.575	0.326	0.634	0.219	0.961	0.468
Minimum	0.045	0.078	0.353	0.503	0.563	0.607	0.339	0.147	0.132	0.147	0.039	0.072
Runoff (mm)	8.061	17.364	83.532	81.857	91.492	96.754	34.002	17.859	20.205	13.809	12.285	8.333

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.5 cumecs

Total : 16. Runoff : 489.435 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1991/1992

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.212	0.91	0.182	0.785	0.242	0.534	0.228	0.147	0.132	0.07	0.06	0.06
3	0.185	0.96	0.182	1.873	0.242	0.534	0.185	0.147	0.132	0.075	0.06	0.06
4	0.182	0.793	0.18	1.657	0.242	0.534	0.173	0.147	0.132	0.081	0.06	0.06
5	0.18	0.858	0.165	0.538	0.246	0.534	0.162	0.147	0.132	0.091	0.06	0.06
6	0.157	1.366	0.177	0.466	0.285	0.516	0.149	0.147	0.13	0.092	0.052	0.06
7	0.147	0.949	0.295	0.464	0.273	0.498	0.147	0.147	0.118	0.092	0.052	0.06
8	0.147	0.83	0.246	0.464	0.221	0.498	0.147	0.156	0.117	0.092	0.052	0.06
9	0.161	0.783	0.242	0.445	0.185	0.498	0.147	0.164	0.111	0.092	0.052	0.06
10	0.291	1.391	0.24	0.387	0.182	0.498	0.147	0.164	0.104	0.092	0.052	0.06
11	0.288	1.238	0.223	0.342	0.182	0.498	0.171	0.156	0.104	0.098	0.052	0.06
12	0.172	1.212	0.221	0.312	0.173	0.498	0.419	0.147	0.104	0.104	0.052	0.06
13	0.156	1.027	0.221	0.291	0.164	0.498	0.322	0.139	0.104	0.098	0.052	0.06
14	0.147	0.934	0.211	0.289	0.164	0.498	0.291	0.132	0.104	0.092	0.052	0.06
15	0.156	0.934	0.201	0.289	0.164	0.498	0.289	0.132	0.104	0.092	0.052	0.06
16	0.204	0.913	0.201	0.279	0.227	0.495	0.277	0.132	0.104	0.092	0.052	0.06
17	0.22	0.999	0.321	0.275	0.313	0.469	0.24	0.132	0.104	0.092	0.052	0.06
18	0.163	1.46	0.338	0.265	0.317	0.478	0.183	0.132	0.104	0.092	0.052	0.06
19	0.12	1.162	0.422	0.293	0.651	0.464	0.165	0.132	0.098	0.092	0.052	0.052
20	0.116	0.859	1.45	1.06	0.506	0.464	0.164	0.132	0.092	0.092	0.052	0.052
21	0.118	0.829	1.069	0.949	0.402	0.464	0.164	0.132	0.092	0.092	0.052	0.052
22	0.246	0.785	0.926	0.652	0.4	0.447	0.162	0.132	0.092	0.092	0.052	0.052
23	0.223	0.742	0.274	0.338	0.133	0.431	0.149	0.132	0.092	0.092	0.052	0.052
24	0.217	0.685	0.803	0.312	0.395	0.431	0.147	0.132	0.091	0.091	0.052	0.052
25	0.185	0.445	0.888	0.279	0.656	0.415	0.147	0.132	0.081	0.028	0.052	0.052
26	0.182	0.324	0.974	0.265	0.918	0.4	0.147	0.132	0.08	0.026	0.052	0.052
27	0.173	0.258	2.923	0.265	1.55	0.38	0.147	0.132	0.08	0.071	0.052	0.052
28	0.162	0.221	2.318	0.254	0.776	0.294	0.147	0.132	0.08	0.07	0.052	0.052
29	0.149	0.202	1.281	0.242	0.571	0.263	0.147	0.132	0.08	0.069	0.052	0.052
30	0.147	0.201	1.008		0.553	0.244	0.147	0.132	0.08	0.061	0.052	0.052
31		0.199	0.801		0.534		0.147		0.079	0.06		0.052
Mean	0.177	0.796	0.618	0.521	0.391	0.46	0.19	0.14	0.103	0.082	0.053	0.057
Flow (MCM)	0.458	2.132	1.656	1.306	1.046	1.193	0.51	0.362	0.275	0.219	0.138	0.152
Maximum	0.291	1.46	2.923	1.873	1.55	0.534	0.419	0.164	0.132	0.104	0.06	0.06
Minimum	0.091	0.199	0.165	0.242	0.133	0.244	0.147	0.132	0.079	0.026	0.052	0.052
Runoff (mm)	13.827	64.426	50.024	39.456	31.603	36.036	15.405	10.949	8.319	6.618	4.162	4.586

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.2 cumecs

Total : 9.4 Runoff : 285.617 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1992/1993

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.052	0.08	1.222	1.308	1.598	1.107	1.472	1.545	1.616	1.689	1.763	1.833
3	0.057	0.08	0.708	1.342	1.133	1.294	1.474	1.548	1.619	1.692	1.765	1.836
4	0.088	0.08	1.917	1.376	0.668	1.286	1.477	1.55	1.621	1.694	1.767	1.838
5	0.211	0.08	0.673	1.411	1.718	1.459	1.479	1.552	1.623	1.696	1.77	1.84
6	0.099	0.08	1.113	1.445	1.519	1.453	1.482	1.555	1.626	1.699	1.772	1.843
7	0.086	0.379	1.553	1.479	1.567	0.689	1.484	1.557	1.628	1.701	1.774	1.845
8	0.075	0.7	1.212	1.514	1.615	0.787	1.486	1.56	1.63	1.704	1.777	1.848
9	0.07	0.658	1.036	1.548	1.663	0.892	1.489	1.562	1.633	1.706	1.779	1.85
10	0.07	0.481	0.336	1.582	1.711	0.76	1.491	1.564	1.635	1.708	1.781	1.852
11	0.07	0.642	1.164	1.616	1.759	0.659	1.493	1.567	1.637	1.711	1.784	1.855
12	0.07	0.666	1.106	1.651	1.807	0.529	1.496	1.569	1.64	1.713	1.786	1.857
13	0.07	0.69	1.049	1.685	1.598	0.366	1.498	1.571	1.642	1.715	1.789	1.859
14	0.07	0.715	0.992	1.719	1.485	0.696	1.5	1.574	1.645	1.718	1.791	1.862
15	0.07	0.739	0.935	1.753	1.564	0.893	1.503	1.576	1.647	1.72	1.793	1.864
16	0.07	0.764	0.878	1.788	2.084	0.989	1.505	1.578	1.649	1.722	1.796	1.866
17	0.07	1.909	0.821	1.822	2.046	1.034	1.508	1.581	1.652	1.725	1.798	1.869
18	0.438	1.676	0.764	1.856	2.009	1.462	1.51	1.583	1.654	1.727	1.8	1.871
19	0.299	1.04	0.707	1.89	2.06	1.884	1.512	1.585	1.656	1.73	1.803	1.874
20	0.209	0.977	0.65	1.925	0.634	2.179	1.515	1.588	1.659	1.732	1.805	1.876
21	0.182	0.914	1.002	1.959	1.599	2.111	1.517	1.59	1.661	1.734	1.807	1.878
22	0.157	2.642	0.847	1.993	1.476	1.482	1.519	1.593	1.663	1.737	1.81	1.881
23	1.537	1.955	0.693	2.028	1.46	1.122	1.522	1.595	1.666	1.739	1.812	1.883
24	0.484	2.144	1.996	2.062	1.445	0.859	1.524	1.597	1.668	1.741	1.815	1.885
25	0.128	1.762	1.391	2.096	1.429	0.593	1.526	1.6	1.67	1.744	1.817	1.888
26	0.117	1.38	0.363	2.13	1.413	0.555	1.529	1.602	1.673	1.746	1.819	1.89
27	0.116	0.998	1.647	2.165	1.397	0.561	1.531	1.604	1.675	1.748	1.822	1.892
28	0.105	1.559	1.027	2.199	1.382	0.6	1.534	1.607	1.678	1.751	1.824	1.895
29	0.103	1.197	1.098		1.613	1.227	1.536	1.609	1.68	1.753	1.826	1.897
30	0.092	1.115	1.168		1.515	1.467	1.538	1.611	1.682	1.755	1.829	1.9
31		1.475	1.239		1.425		1.541		1.685	1.758		1.902
Mean	0.177	0.957	1.066	1.736	1.551	1.074	1.505	1.577	1.649	1.722	1.794	1.866
Flow (MCM)	0.459	2.562	2.855	4.2	4.155	2.784	4.032	4.088	4.417	4.613	4.651	4.999
Maximum	1.537	2.642	1.996	2.199	2.084	2.179	1.541	1.611	1.685	1.758	1.829	1.902
Minimum	0.052	0.08	0.336	1.274	0.634	0.366	1.47	1.543	1.614	1.687	1.76	1.831
Runoff (mm)	13.872	77.414	86.256	126.899	125.526	84.114	121.798	123.508	133.453	139.376	140.519	151.031

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 1.3 cumecs
Total : 43. Runoff : 1324.037 mm Possible
data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1993/1994

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	1.907	1.977	2.051	2.124	0.667	2.06	0.424	0.245	0.137	0.105	0.104	0.087
3	1.909	1.98	2.053	2.126	1.429	2.109	0.467	0.241	0.14	0.123	0.102	0.085
4	1.911	1.982	2.055	2.129	1.354	2.16	0.474	0.215	0.141	0.104	0.096	0.08
5	1.914	1.985	2.058	1.963	0.95	2.181	0.431	0.21	0.142	0.092	0.095	0.075
6	1.916	1.987	2.06	1.599	0.837	2.002	0.424	0.226	0.148	0.081	0.092	0.075
7	1.918	1.989	2.062	1.481	0.596	1.945	0.413	0.226	0.141	0.074	0.088	0.086
8	1.921	1.992	2.065	1.514	0.538	2.095	0.373	0.206	0.136	0.074	0.096	0.078
9	1.923	1.994	2.067	0.719	0.49	2.009	0.367	0.204	0.141	0.074	0.389	0.068
10	1.925	1.996	2.07	1.183	0.475	1.381	0.381	0.203	0.14	0.074	0.573	0.064
11	1.928	1.999	2.072	1.646	0.383	0.992	0.389	0.195	0.132	0.078	0.522	0.061
12	1.93	2.001	2.074	1.481	0.337	0.902	0.365	0.215	0.159	0.081	0.339	0.061
13	1.933	2.003	2.077	1.362	0.264	0.838	0.315	0.251	0.147	0.081	0.204	0.061
14	1.935	2.006	2.079	1.689	0.202	0.836	0.336	0.259	0.167	0.081	0.211	0.061
15	1.937	2.008	2.081	0.65	0.173	1.034	0.371	0.241	0.172	0.081	0.19	0.068
16	1.94	2.01	2.084	1.824	0.142	1.114	0.363	0.206	0.161	0.081	0.136	0.082
17	1.942	2.013	2.086	0.864	0.12	1.08	0.334	0.189	0.154	0.081	0.127	0.098
18	1.944	2.015	2.088	0.605	0.121	0.997	0.293	0.181	0.137	0.081	0.121	0.104
19	1.947	2.018	2.091	0.631	0.136	0.904	0.311	0.19	0.138	0.094	0.125	0.12
20	1.949	2.02	2.093	0.405	0.147	0.83	0.291	0.166	0.147	0.143	0.105	0.105
21	1.951	2.022	2.095	0.695	0.137	0.603	0.276	0.161	0.125	0.382	0.103	0.102
22	1.954	2.025	2.098	0.634	0.123	0.54	0.313	0.148	0.123	0.743	0.102	0.103
23	1.956	2.027	2.1	0.626	0.108	0.508	0.414	0.146	0.127	0.785	0.089	0.154
24	1.959	2.029	2.103	0.705	0.146	0.544	0.304	0.144	0.12	0.646	0.089	0.27
25	1.961	2.032	2.105	0.692	0.189	0.579	0.289	0.137	0.112	0.532	0.095	0.248
26	1.963	2.034	2.107	0.668	0.411	0.528	0.297	0.147	0.106	0.338	0.091	0.197
27	1.966	2.036	2.11	0.622	0.952	0.444	0.311	0.174	0.104	0.297	0.078	0.078
28	1.968	2.039	2.112	0.722	0.548	0.431	0.326	0.156	0.118	0.165	0.074	0.062
29	1.97	2.041	2.114		1.483	0.406	0.311	0.143	0.115	0.142	0.074	0.062
30	1.973	2.044	2.117		1.597	0.405	0.252	0.151	0.112	0.144	0.069	0.068
31		2.046	2.119		1.77		0.244		0.126	0.131		0.204
Mean	1.938	2.01	2.084	1.196	0.564	1.149	0.352	0.195	0.136	0.197	0.156	0.101
Flow (MCM)	5.025	5.385	5.581	2.893	1.511	2.978	0.943	0.505	0.363	0.527	0.405	0.272
Maximum	1.973	2.046	2.119	2.129	1.77	2.181	0.474	0.267	0.172	0.785	0.573	0.27
Minimum	1.904	1.975	2.048	0.405	0.108	0.405	0.244	0.137	0.104	0.074	0.069	0.061
Runoff (mm)	151.798	162.686	168.609	87.394	45.636	89.969	28.49	15.252	10.977	15.932	12.239	8.209

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.8 cumecs

Total : 26. Runoff : 800.184 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1994/1995

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)
Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.53	0.207	2.552	2.083	2.3	1.131	0.238	0.385	0.12	0.137	0.099	0.016
3	0.482	0.088	2.668	2.653	1.911	1.072	0.204	0.487	0.117	0.125	0.098	0.019
4	0.384	0.099	1.859	0.823	1.871	0.915	0.186	0.602	0.181	0.122	0.082	0.015
5	0.294	0.11	0.939	0.881	1.653	0.786	0.248	0.82	0.193	0.107	0.075	0.014
6	0.118	0.102	2.779	2.19	0.74	0.68	0.227	0.74	0.179	0.113	0.075	0.006
7	0.11	0.145	2.366	1.903	2.29	0.567	0.213	0.587	0.155	0.138	0.072	0.008
8	0.181	0.186	2.259	1.7	1.889	0.474	0.192	0.447	0.155	0.178	0.058	0.003
9	0.103	0.119	1.775	1.941	1.875	0.529	0.301	0.366	0.129	0.188	0.052	0.002
10	0.089	0.139	0.96	2.111	1.454	0.628	0.375	0.306	0.145	0.133	0.051	0.002
11	0.093	0.167	0.839	1.796	1.358	0.836	0.629	0.26	0.109	0.175	0.034	0.003
12	0.083	0.466	0.829	1.743	1.309	1.919	1.258	0.226	0.118	0.181	0.033	0.014
13	0.086	0.254	0.883	1.884	1.336	1.406	1.199	0.181	0.124	0.176	0.033	0.015
14	0.066	0.212	0.81	2.157	1.411	0.902	0.916	0.146	0.267	0.134	0.033	0.016
15	0.061	0.139	0.802	1.758	1.395	0.725	1.257	0.124	2.105	0.124	0.027	0.023
16	0.061	0.091	0.908	1.348	1.391	0.583	1.22	0.127	0.681	0.124	0.017	0.019
17	0.062	0.085	1.032	1.528	1.307	0.578	0.854	0.136	1.383	0.136	0.019	0.015
18	0.066	0.08	0.729	1.593	1.192	0.756	0.459	0.129	1.259	0.137	0.015	0.012
19	0.062	0.093	0.747	1.975	0.945	0.68	0.381	0.176	1.091	0.184	0.018	0.008
20	0.061	0.142	0.764	2.358	0.829	0.557	0.507	0.129	1.022	0.182	0.039	0.005
21	0.062	0.158	0.782	1.904	0.974	0.512	0.521	0.121	0.962	0.129	0.033	0.002
22	0.068	0.161	0.8	2.186	1.03	0.451	0.43	0.128	0.921	0.127	0.041	0.002
23	0.069	0.136	0.817	2.274	1.785	0.433	0.366	0.106	0.877	0.136	0.033	0.002
24	0.096	0.112	0.835	2.363	2.278	0.473	0.418	0.105	0.503	0.122	0.033	0.002
25	0.284	0.094	0.852	2.451	2.012	0.449	0.541	0.1	0.138	0.101	0.033	0.002
26	0.27	0.116	1.43	2.592	1.445	0.453	0.499	0.117	0.123	0.087	0.033	0.002
27	0.27	0.357	2.008	2.23	1.334	0.448	0.453	0.147	0.112	0.076	0.033	0.002
28	0.259	0.382	1.746	1.842	1.244	0.473	0.52	0.129	0.105	0.08	0.031	0.002
29	0.246	0.388	1.644		0.914	0.412	0.583	0.118	0.101	0.075	0.021	0.014
30	0.269	0.494	1.553		0.85	0.367	0.645	0.145	0.144	0.077	0.019	0.116
31		1.334	1.496		0.805		0.432		0.176	0.097		0.029
Mean	0.18	0.223	1.384	1.921	1.456	0.697	0.533	0.267	0.447	0.131	0.044	0.013
Flow (MCM)	0.467	0.597	3.707	4.647	3.9	1.805	1.428	0.691	1.196	0.35	0.115	0.036
Maximum	0.53	1.334	2.779	2.653	2.3	1.919	1.258	0.82	2.105	0.188	0.099	0.116
Minimum	0.061	0.08	0.729	0.823	0.74	0.367	0.186	0.1	0.101	0.075	0.015	0.002
Runoff (mm)	14.109	18.05	112.002	140.379	117.828	54.544	43.146	20.886	36.132	10.563	3.484	1.076

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 19. Runoff : 579.231 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1995/1996

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.015	0.206	0.501	1.218	1.278	1.626	0.638	0.463	0.291	0.227	0.111	0.105
3	0.015	0.244	0.412	1.488	1.396	1.278	0.565	0.46	0.288	0.225	0.111	0.093
4	0.015	0.521	0.127	1.664	1.948	1.959	0.575	0.424	0.288	0.222	0.111	0.082
5	0.017	0.247	1.02	1.625	0.707	0.905	0.542	0.454	0.286	0.197	0.113	0.081
6	0.031	0.151	0.671	2.059	1.639	1.547	0.575	1.789	0.272	0.195	0.129	0.081
7	0.033	0.127	0.526	0.895	1.299	1.556	0.604	0.721	0.272	0.195	0.13	0.081
8	0.032	0.741	0.466	0.777	0.959	1.318	0.634	0.473	0.272	0.195	0.118	0.081
9	0.02	0.664	0.315	1.754	0.959	0.964	0.617	0.46	0.259	0.195	0.106	0.082
10	0.019	0.929	0.188	2.73	1.056	0.872	0.614	0.427	0.256	0.195	0.105	0.092
11	0.023	0.372	0.398	2.217	1.153	0.794	0.581	0.394	0.256	0.195	0.105	0.093
12	0.018	0.666	0.345	2.079	1.25	1.231	0.581	0.388	0.256	0.192	0.105	0.092
13	0.04	1.71	0.667	1.953	1.347	1.273	0.611	0.373	0.253	0.174	0.105	0.082
14	0.037	1.112	1.172	1.724	1.444	1.17	0.621	0.373	0.227	0.173	0.104	0.081
15	0.033	0.579	1.676	1.647	1.541	1.12	0.658	0.373	0.238	0.173	0.094	0.082
16	0.033	0.479	2.259	1.488	1.638	0.901	0.651	0.356	0.225	0.167	0.093	0.107
17	0.033	0.436	2.024	1.955	1.735	0.779	0.607	0.339	0.197	0.166	0.093	0.235
18	0.042	0.543	1.673	1.75	1.832	0.658	0.648	0.324	0.197	0.166	0.092	0.166
19	0.054	0.843	1.282	1.504	1.929	0.588	0.601	0.322	0.238	0.166	0.092	0.116
20	0.177	0.745	1.112	1.289	2.026	0.621	0.588	0.322	0.409	0.166	0.093	0.109
21	0.439	0.33	0.942	1.226	2.123	0.648	0.644	0.322	0.427	0.161	0.088	0.092
22	0.413	0.2	0.773	1.101	2.22	0.691	0.617	0.324	0.427	0.142	0.093	0.071
23	0.391	0.145	1.464	0.411	2.317	1.223	0.578	0.35	0.445	0.166	0.093	0.07
24	0.375	0.21	0.855	0.776	2.414	1.159	0.533	0.324	0.628	0.166	0.093	0.083
25	0.376	0.594	0.716	1.081	2.442	0.979	0.631	0.322	0.686	0.166	0.092	0.081
26	0.415	1.672	0.622	1.386	1.964	0.828	0.644	0.336	0.443	0.163	0.082	0.077
27	0.164	1.65	1.046	2.145	1.811	0.716	0.529	0.339	0.362	0.14	0.124	0.081
28	0.652	1.124	1.874	0.666	1.746	0.679	0.504	0.324	0.35	0.138	0.487	0.081
29	0.604	0.92	1.58	1.563	1.311	0.668	0.501	0.339	0.291	0.138	0.225	0.081
30	0.212	1.167	2.211		1.074	0.716	0.501	0.367	0.259	0.136	0.169	0.08
31		0.833	1.573		0.97		0.498		0.256	0.114		0.077
Mean	0.158	0.656	1.005	1.501	1.571	1.037	0.594	0.435	0.319	0.176	0.122	0.094
Flow (MCM)	0.41	1.756	2.693	3.76	4.207	2.689	1.592	1.127	0.854	0.472	0.316	0.253
Maximum	0.652	1.71	2.259	2.73	2.442	1.959	0.737	1.789	0.686	0.253	0.487	0.235
Minimum	0.015	0.127	0.127	0.411	0.707	0.588	0.498	0.322	0.197	0.114	0.082	0.07
Runoff (mm)	12.38	53.057	81.345	113.597	127.088	81.232	48.095	34.058	25.787	14.256	9.561	7.643

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 20. Runoff : 610.500 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1996/1997

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.082	0.216	2.008	1.654	1.629	1.038	0.723	0.435	0.343	0.231	0.143	0
3	0.08	0.616	2.082	1.691	1.813	1.029	0.701	0.431	0.327	0.218	0.131	0
4	0.07	0.314	1.913	1.728	1.761	1.021	0.691	0.435	0.282	0.217	0.118	0
5	0.069	0.397	1.612	1.765	1.737	1.012	0.653	0.436	0.28	0.217	0.106	0
6	0.069	1.449	2.418	1.802	1.844	1.003	0.696	0.431	0.364	0.217	0.105	0
7	0.07	1.118	1.786	1.839	1.741	0.994	0.935	0.385	1.007	0.217	0.105	0
8	0.067	0.684	1.553	1.876	1.565	0.985	1.046	0.366	0.683	0.217	0.105	0
9	0.039	0.575	1.391	1.913	1.831	0.976	0.776	0.364	0.661	0.216	0.105	0
10	0.037	0.542	1.293	1.95	1.88	0.967	0.727	0.363	0.652	0.203	0.105	0.004
11	0.037	0.562	1.225	1.987	1.658	0.958	0.68	0.349	0.341	0.202	0.105	0
12	0.03	0.857	2.391	2.024	0.532	0.949	0.661	0.347	0.298	0.202	0.105	0
13	0.037	0.735	1.874	2.061	1.48	0.94	0.586	0.346	0.298	0.2	0.106	0
14	0.037	0.612	1.514	2.098	1.547	0.931	0.576	0.329	0.373	0.175	0.116	0.001
15	0.038	1.985	2.182	2.135	1.613	0.922	0.57	0.299	0.819	0.173	0.106	0.006
16	0.046	1.392	0.666	2.172	1.68	0.913	0.568	0.29	0.63	0.173	0.11	0.012
17	0.046	0.834	1.667	2.209	2.284	0.904	0.55	0.287	0.484	0.171	0.167	0.012
18	0.038	0.638	2.114	2.246	1.951	0.895	0.549	0.28	0.407	0.16	0.168	0.011
19	0.037	0.699	0.92	2.283	1.813	0.886	0.539	0.28	0.351	0.158	0.121	0.008
20	0.037	2.222	2.436	2.32	1.82	0.877	0.526	0.284	0.347	0.158	0.106	0.007
21	0.029	1.484	1.675	2.357	1.717	0.868	0.493	0.329	0.347	0.158	0.105	0.019
22	0.028	0.745	1.141	2.282	1.589	0.859	0.497	0.314	0.322	0.157	0.105	0.031
23	0.028	1.182	1.871	2.097	1.559	0.85	0.607	0.299	0.297	0.146	0.102	0.032
24	0.028	1.619	1.733	0.702	1.453	0.841	0.508	0.309	0.297	0.146	0.071	0.028
25	0.029	2.028	1.595	0.805	1.348	0.832	0.471	0.288	0.297	0.156	0.059	0.001
26	0.037	1.664	1.457	1.976	1.344	0.823	0.462	0.341	0.29	0.146	0.058	0
27	0.039	0.535	1.319	2.111	1.364	0.814	0.456	0.347	0.224	0.145	0.064	0
28	0.05	1.718	1.181	2.025	1.364	0.805	0.46	0.347	0.217	0.145	0.092	0
29	0.246	1.273	1.043		1.342	0.796	0.439	0.347	0.218	0.146	0.07	0
30	0.133	1.413	0.905		1.296	0.788	0.451	0.344	0.231	0.157	0.052	0
31		2.152	1.58		1.056		0.445		0.232	0.157		0
Mean	0.057	1.042	1.592	1.919	1.591	0.917	0.607	0.348	0.395	0.181	0.105	0.006
Flow (MCM)	0.147	2.791	4.265	4.642	4.261	2.378	1.626	0.902	1.057	0.485	0.273	0.015
Maximum	0.246	2.222	2.436	2.357	2.284	1.047	1.046	0.437	1.007	0.232	0.168	0.032
Minimum	0.028	0.048	0.666	0.702	0.532	0.788	0.439	0.28	0.217	0.145	0.052	0
Runoff (mm)	4.44	84.333	128.843	140.239	128.729	71.845	49.117	27.254	31.941	14.661	8.241	0.456

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.7 cumecs

Total : 23. Runoff : 695.511 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1997/1998

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.02	0.586	2.084	1.48	1.503	1.433	0.511	0.337	0.21	0.742	0.152	0.089
3	0.03	0.555	2.102	1.539	1.424	1.367	0.508	0.309	0.21	0.541	0.147	0.087
4	0.04	0.43	0.684	1.599	1.334	1.281	0.581	0.306	0.21	0.358	0.129	0.087
5	0.05	0.424	1.274	1.659	1.257	1.218	0.511	0.306	0.21	0.205	0.152	0.087
6	0.059	0.371	1.665	1.718	1.151	1.206	0.501	0.303	0.222	0.166	0.152	0.087
7	0.069	0.68	1.307	2.375	1.247	1.159	0.501	0.289	0.225	0.169	0.152	0.087
8	0.079	0.801	1.703	2.102	2.012	1.645	0.501	0.289	0.227	0.202	0.152	0.087
9	0.089	0.922	1.506	1.923	1.655	1.39	0.501	0.292	0.253	0.195	0.175	0.087
10	0.099	1.46	1.257	1.496	1.878	1.486	0.501	0.333	0.256	0.195	0.154	0.087
11	0.109	1.788	0.403	1.785	2.187	1.494	0.501	0.339	0.256	0.195	0.14	0.085
12	0.119	1.908	0.762	1.737	1.391	1.379	0.498	0.336	0.282	0.195	0.152	0.065
13	0.129	1.305	0.716	1.63	1.788	1.257	0.495	0.322	0.475	0.195	0.175	0.063
14	0.139	1.066	0.751	1.503	2.184	1.132	0.448	0.322	0.27	0.195	0.18	0.065
15	0.149	0.916	0.787	1.391	2.58	0.968	0.43	0.322	0.215	0.195	0.157	0.085
16	0.159	0.843	0.822	1.391	2.499	1.124	0.442	0.322	0.21	0.195	0.152	0.087
17	0.168	0.661	0.857	1.33	2.195	1.349	0.427	0.319	0.21	0.195	0.15	0.1
18	0.178	0.937	0.854	1.483	1.918	1.278	0.43	0.291	0.207	0.195	0.136	0.301
19	0.188	1.243	0.85	1.135	1.199	1.132	0.43	0.288	0.183	0.195	0.103	0.571
20	0.198	1.657	0.846	0.787	1.778	0.964	0.424	0.288	0.18	0.195	0.122	0.18
21	0.208	1.669	0.842	1.859	2.358	0.89	0.394	0.302	0.18	0.195	0.138	0.127
22	0.218	0.693	0.838	1.363	2.089	0.811	0.391	0.278	0.18	0.207	0.138	0.111
23	0.228	0.763	0.835	0.867	0.809	0.803	0.391	0.272	0.18	0.197	0.138	0.103
24	0.238	0.833	0.831	2.026	1.414	0.796	0.391	0.27	0.18	0.207	0.136	0.109
25	0.248	1.289	0.827	2.157	0.693	0.782	0.388	0.243	0.18	0.209	0.114	0.089
26	0.258	1.463	0.823	2.199	0.749	0.761	0.345	0.238	0.178	0.209	0.111	0.031
27	0.268	1.92	2.403	1.9	2.308	0.678	0.34	0.212	0.154	0.203	0.111	1.012
28	0.277	1.974	0.757	1.759	1.931	0.604	0.34	0.21	0.152	0.226	0.111	0.24
29	0.287	2.021	1.606		1.837	0.604	0.34	0.21	0.152	0.241	0.111	0.18
30	0.297	0.721	2.454		1.768	0.665	0.34	0.21	0.157	0.241	0.111	0.168
31		1.704	1.761		1.524		0.34		0.268	0.233		0.166
Mean	0.154	1.094	1.16	1.636	1.687	1.105	0.443	0.29	0.216	0.262	0.14	0.156
Flow (MCM)	0.398	2.93	3.106	3.958	4.518	2.865	1.187	0.751	0.577	0.701	0.364	0.417
Maximum	0.297	2.021	2.454	2.375	2.58	1.645	0.598	0.34	0.475	1.024	0.18	1.012
Minimum	0.01	0.307	0.403	0.787	0.693	0.604	0.34	0.21	0.152	0.166	0.103	0.031
Runoff (mm)	12.028	88.509	93.836	119.586	136.489	86.551	35.867	22.701	17.442	21.171	10.99	12.599

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.6 cumecs

Total : 21. Runoff : 662.291 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1998/1999

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.387	0.238	0.666	1.232	2.573	1.566	1.511	0.637	0.482	0.305	0.166	0.488
3	0.16	0.351	0.907	1.684	2.725	1.44	1.494	0.601	0.482	0.305	0.166	0.278
4	0.114	0.604	0.75	2.136	2.427	1.315	1.411	0.562	0.482	0.305	0.166	0.267
5	0.109	1.759	0.586	2.587	2.286	1.19	1.395	0.558	0.482	0.305	0.166	0.21
6	0.089	1.227	0.552	2.194	2.07	1.064	1.33	0.558	0.482	0.305	0.164	0.06
7	0.087	0.625	1.508	1.928	2.268	0.939	1.257	0.558	0.536	0.305	0.152	0.297
8	0.206	0.466	2.104	1.532	2.162	2.73	1.151	0.558	0.939	0.305	0.152	0.778
9	0.963	0.356	2.123	1.636	2.009	2.643	1.139	0.558	0.579	0.305	0.152	0.331
10	0.257	0.311	2.142	1.707	1.856	2.383	1.128	0.558	0.488	0.305	0.141	0.314
11	0.168	0.314	2.005	1.778	1.703	2.124	1.032	0.555	0.482	0.305	0.139	0.246
12	0.163	1.286	0.717	1.849	1.55	1.865	1.024	0.504	0.482	0.305	0.139	0.241
13	0.14	0.495	1.709	2.744	1.398	1.606	1.016	0.482	0.482	0.3	0.15	0.241
14	0.136	1.874	1.594	2.621	1.245	1.346	0.912	0.482	0.482	0.246	0.152	0.241
15	0.103	1.077	1.478	0.605	1.092	1.087	0.828	0.482	0.473	0.241	0.152	0.235
16	0.099	0.804	1.363	2.504	0.939	0.828	0.825	0.482	0.382	0.317	0.152	0.174
17	0.099	0.683	1.247	2.547	2.779	2.314	0.825	0.482	0.373	1.031	0.147	0.166
18	0.099	0.431	1.132	1.724	2.338	2.216	0.828	0.482	0.373	0.458	0.149	0.164
19	0.099	0.409	1.016	0.901	2.134	2.134	0.825	0.482	0.414	0.331	0.645	0.152
20	0.099	0.44	0.901	1.053	1.984	2.079	0.775	0.492	0.866	0.314	0.699	0.152
21	0.101	0.769	0.785	1.205	2.044	2.025	0.685	0.54	0.952	0.246	0.648	0.15
22	0.191	0.803	1.793	1.357	2.508	1.891	0.678	0.525	0.909	0.249	0.192	0.138
23	0.517	0.985	1.937	1.509	2.314	1.759	0.678	0.415	0.825	0.308	0.152	0.138
24	0.501	0.693	1.935	1.661	2.254	1.664	0.678	0.409	0.694	0.246	0.152	0.138
25	0.568	1.893	1.811	1.813	0.9	1.655	0.678	0.409	0.486	0.241	0.152	0.138
26	1.194	1.622	1.638	1.965	2.443	1.685	0.678	0.409	0.382	0.241	0.152	0.138
27	0.697	1.166	1.409	2.117	2.317	1.98	0.678	0.482	0.373	0.241	0.152	0.138
28	0.409	0.574	1.401	2.269	2.192	1.891	0.671	1.222	0.368	0.193	0.147	0.138
29	0.386	0.52	1.782		2.067	1.989	0.604	0.72	0.311	0.103	0.155	0.138
30	0.314	0.495	2.282		1.941	1.772	0.598	0.488	0.305	0.099	1.168	0.138
31		0.43	2.328		1.816		0.598		0.305	0.099		0.136
Mean	0.288	0.775	1.421	1.773	2.024	1.762	0.954	0.544	0.521	0.296	0.238	0.243
Flow (MCM)	0.747	2.074	3.805	4.289	5.422	4.568	2.554	1.411	1.396	0.792	0.617	0.65
Maximum	1.194	1.893	2.328	2.744	2.779	2.73	1.63	1.222	0.952	1.031	1.168	0.963
Minimum	0.087	0.238	0.433	0.605	0.9	0.828	0.598	0.409	0.305	0.099	0.127	0.06
Runoff (mm)	22.583	62.674	114.945	129.566	163.814	138.009	77.165	42.618	42.172	23.92	18.649	19.636

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : 0.9 cumecs

Total : 28. Runoff : 860.523 mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT, SURFACE WATER DIVISION.
Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 1999/2000

Station Name : LIKABULA AT LIKABULA FORESTRY (140306)

Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1												0.195 -
2	0.111	0.614	0.418	1.183	1.755	1.596	0.894	0.409	0.685	0.391		0.195 -
3	0.111	0.312	0.339	1.669	1.524	1.879	0.85	0.409	0.394	0.386		0.195 -
4	0.111	0.194	0.339	2.154	1.49	1.524	0.861	0.409	0.497	0.373		0.195 -
5	0.114	0.215	0.838	0.627	1.497	1.371	0.804	0.409	1.285	0.359		0.192 -
6	1.115	0.195	0.883	2.276	1.727	1.159	0.719	0.409	1.722	0.325		0.168 -
7	0.834	0.166	0.811	1.841	1.541	1.187	0.676	0.406	1.374	0.3		0.161 -
8	0.326	0.14	0.803	1.582	1.449	1.704	0.954	0.403	2.289	0.259		0.142 -
9	0.23	0.14	0.796	1.578	1.362	1.75	0.811	0.362	0.569	0.241		0.166 -
10	0.274	0.147	0.726	1.524	1.387	1.96	0.903	0.356	1.486	0.225		0.152 -
11	0.764	0.327	0.712	1.432	1.724	2.17	2.126	0.325	1.085	0.225		0.138 -
12	0.756	0.929	1.443	1.706	0.595	2.38	1.668	0.292	1.109	0.225		0.149 -
13	0.933	1.024	2.173	2.315	1.477	1.975	0.995	0.289	0.816	0.225		0.138 -
14	0.588	2.323	1.493	1.567	2.358	1.847	0.836	0.286	0.695	0.626		0.127 -
15	0.401	1.744	1.404	1.587	2.016	1.579	0.821	0.272	0.637	1.12		
16	0.438	1.441	1.056	1.222	1.677	1.553	0.789	0.272	0.578	0.923		0.14 -
17	1.9	0.932	0.804	0.857	1.528	1.57	0.793	0.267	0.523	0.441		
18	1.318	0.825	0.858	1.608	1.391	1.503	0.702	0.278	0.485	0.345		0.161 -
19	0.737	0.761	2.118	2.358	1.611	1.379	0.661	0.289	0.463	0.339		
20	0.904	0.655	2.346	2.025	1.847	1.265	0.658	0.3	0.457	0.333		0.14 -
21	0.605	0.366	1.526	1.781	1.882	1.245	0.658	0.311	0.397	0.291		
22	0.439	0.336	1.289	1.75	1.689	1.12	0.671	0.305	0.391	0.286		0.138 -
23	0.427	0.308	1.233	1.58	1.604	0.969	0.617	0.316	0.391	0.256		
24	0.372	0.297	1.121	1.624	1.511	0.909	0.53	0.291	0.424	0.227		0.138 -
25	0.288	0.23	0.801	1.865	1.503	0.89	0.52	0.294	0.585	0.225		
26	0.259	0.222	0.685	2.105	1.474	0.883	0.52	0.35	0.439	0.225		0.138 -
27	0.251	0.197	1.544	2.091	1.387	0.811	0.52	0.399	0.394	0.222		
28	0.2	0.195	1.24	0.881	1.449	0.859	0.52	0.637	0.406	0.197		0.138 -
29	0.192	0.213	1.093	2.361	1.494	1.434	0.52	0.406	0.409	0.195		
30	0.168	0.406	0.89		1.391	1.355	0.52	0.327	0.379	0.195		0.136 -
31		0.442	0.958		1.602		0.511		0.371	0.195		
												0.114 -
												0.111 -
												0.111 -
												0.247 -
												0.238 -

-

Mean	0.509	0.532	1.074	1.674	1.578	1.447	0.794	0.35	0.713	0.34	0.156	-
Flow (MCM)	1.32	1.426	2.878	4.194	4.228	3.751	2.128	0.907	1.911	0.911	0.404	-
Maximum	1.9	2.323	2.346	2.361	2.358	2.38	2.126	0.637	2.289	1.12	0.247	-
Minimum	0.111	0.14	0.339	0.627	0.595	0.811	0.511	0.267	0.371	0.195	0.111	-
Runoff (mm)	39.888	43.085	86.945	126.716	127.722	113.338	64.281	27.396	57.719	27.525	12.199	-

Flow (cumecs)

Annual Statistics

Maximum Minimum Mean : - cumecs

Total : - Runoff : - mm

Possible data flags

No data st Estimated values "e"

ANNEX 6 - RAW DATA 50 YEAR RECORDS FOR LIKHUBULA RIVER

WATER RESOURCES DEPARTMENT,
SURFACE WATER DIVISION. Annual Report of Daily Data: Mean Daily Flow

Station Nu Year: 2000/2001

Station Name : LIKABULA AT LIKABULA FORESTRY (140306) Time-Series Type : Flow (cumecs)

Latitude : Longitude Elevation : Area : 33.1 sq km

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2	0.103	1.988	1.867	1.985	2.049	2.691	0.916	0.571	0.322	2.045	0.195	0.138
3	0.111	2.23	2.079	1.708	2.334	2.643	0.912	0.507	0.322	1.781	0.195	0.138
4	1.061	1.913	2.103	1.503	2.618	2.489	0.912	0.501	0.322	1.458	0.19	0.138
5	1.248	2.002	2.083	1.755	2.584	2.319	0.886	0.501	0.322	0.907	0.142	0.138
6	1.136	1.98	1.546	2.029	2.56	2.324	0.811	0.501	0.322	0.439	0.138	0.138
7	1.216	2.025	1.379	0.675	2.513	2.56	0.811	0.498	0.322	0.359	0.138	0.138
8	0.912	1.927	1.281	1.69	2.759	2.584	0.897	0.466	0.324	0.38	0.138	0.138
9	1.32	1.622	1.218	1.823	2.877	2.584	0.872	0.463	0.35	0.955	0.138	0.138
10	1.588	1.306	1.02	1.955	2.768	2.528	0.864	0.463	0.324	0.912	0.138	0.138
11	1.453	1.085	1.032	2.087	2.775	1.936	0.828	0.463	0.319	0.776	0.138	0.136
12	1.168	1.024	1.318	2.219	2.718	2.014	0.825	0.482	0.291	0.432	0.138	0.041
13	1.609	1.159	1.306	2.351	2.66	2.054	0.899	0.501	0.288	0.322	0.138	0.395
14	1.372	1.583	1.643	2.483	2.603	1.825	1.442	0.498	0.288	0.261	0.138	0.109
15	1.391	1.766	2.022	2.615	2.546	1.698	1.34	0.466	0.288	0.253	0.205	0.089
16	1.432	1.766	1.985	2.616	2.488	1.519	0.866	0.463	0.288	0.227	0.663	0.087
17	1.375	1.379	2.571	2.604	2.431	1.503	0.825	0.463	0.288	0.225	0.328	0.087
18	1.188	1.285	2.642	1.839	2.374	1.494	0.825	0.463	0.288	0.225	0.241	0.087
19	0.868	1.35	2.361	1.36	2.316	1.428	0.825	0.463	0.288	0.225	0.171	0.087
20	1.467	1.354	1.914	0.881	2.259	1.362	0.821	0.463	0.288	0.225	0.152	0.087
21	2.066	1.285	1.677	1.794	2.202	1.358	0.741	0.463	0.288	0.225	0.163	0.087
22	1.472	1.281	1.462	0.881	2.144	1.327	0.661	0.46	0.288	0.225	0.163	0.087
23	1.265	1.281	1.511	2.57	2.087	1.249	0.674	0.43	0.288	0.225	0.14	0.087
24	1.017	1.351	1.503	2.441	2.03	1.139	0.658	0.427	0.288	0.222	0.138	0.112
25	0.89	1.683	1.503	2.479	1.972	1.032	0.621	0.427	0.288	0.197	0.138	0.311
26	1.068	1.511	1.587	0.912	1.915	1.024	0.617	0.424	0.288	0.195	0.138	0.123
27	1.652	1.66	0.768	1.196	1.858	1.024	0.614	0.391	0.288	0.195	0.138	0.089
28	2.235	1.915	0.881	1.481	1.8	1.024	0.581	0.359	0.288	0.195	0.138	0.087
29	1.762	1.746	2.57		2.547	1.016	0.578	0.353	0.364	0.195	0.138	0.087
30	1.503	1.63	2.301		2.071	0.96	0.578	0.324	1.211	0.195	0.138	0.087
31		1.545	2.07		2.071		0.578		1.396	0.195		0.206
Mean	1.24	1.593	1.707	1.864	2.345	1.775	0.814	0.461	0.369	0.515	0.178	0.127
Flow (MCM)	3.214	4.266	4.571	4.509	6.281	4.6	2.18	1.195	0.989	1.378	0.462	0.341
Maximum	2.235	2.23	2.642	2.616	2.877	2.691	1.442	0.578	1.396	2.045	0.663	0.395
Minimum	0.103	1.024	0.768	0.675	1.765	0.96	0.578	0.324	0.288	0.195	0.138	0.041
Runoff (mm)	97.087	128.888	138.093	136.217	189.754	138.986	65.849	36.11	29.875	41.635	13.959	10.289

Flow (cumecs)

Annual Statistics
Maximum
Minimum Mean :
1.0 cumecs Total :
34. Runoff :
1031.101 mm
Possible data flags

No data st Estimated values "e"

ANNEX 7

DATA ANALYSIS OF LIKHUBULA RIVER COMPARISON OF DESIGN FLOW RATES WITH ACTUAL FLOW RATES

ANNEX 7 - DATA ANALYSIS OF LIKHUBULA RIVER COMPARISON OF DESIGN FLOW RATES WITH ACTUAL FLOW RATES

Average Flow Year		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	1970/71	0.414	1.683	2.035	2.048	1.59	0.776	0.576	0.358	0.285	0.218	0.167	0.19
	1971/72	0.314	0.479	1.61	1.639	2.13	1.771	0.574	0.475	0.367	0.251	0.183	0.179
	1972/73	0.266	0.781	1.336	1.678	1.026	1.176	0.481	0.298	0.224	0.181	0.116	0.166
	1973/74	0.238	1.003	1.672	1.545	1.722	1.582	1.105	0.38	0.487	0.264	0.166	0.156
	1974/75	0.151	0.943	0.847	1.137	1.686	0.7	0.966	0.266	0.21	0.179	0.125	0.219
	1975/76	0.26	1.347	1.763	1.786	2.714	2.159	1.052	0.703	0.429	0.287	0.192	0.378
	1976/77	0.611	1.037	1.798	1.723	1.736	1.39	0.484	0.324	0.222	0.181	0.199	0.162
	1977/78	0.226	0.909	1.856	2.015	1.912	2.445	1.112	0.613	0.37	0.234	0.186	0.196
	1978/79	0.498	1.589	1.306	1.538	1.939	1.047	0.529	0.406	0.569	0.209	0.179	0.096
	1979/80	0.499	0.854	0.74	1.09	1.186	1.263	0.425	0.261	0.29	0.201	0.135	0.223
	1980/81	0.149	0.832	1.565	2.232	1.814	0.967	0.382	0.25	0.152	0.14	0.129	0.123
	1981/82	0.117	0.381	2.114	1.943	1.518	0.905	0.4	0.221	0.452	0.197	0.107	0.314
	1982/83	0.619	0.745	0.771	1.539	1.413	0.427	0.272	0.178	0.288	0.15	0.084	0.078
	1983/84	0.101	0.705	0.581	1.058	1.466	0.991	0.481	0.46	0.233	0.152	0.096	0.093
	1984/85	0.398	1.286	1.822	1.289	1.935	1.512	0.538	0.276	0.207	0.198	0.218	0.17
	1985/86	0.307	1.31	1.849	2.105	1.619	1.856	0.675	0.346	0.228	0.167	0.255	0.191
	1986/87	0.377	0.912	0.942	1.109	0.678	0.456	0.19	0.192	0.12	0.088	0.067	0.202
	1987/88	0.118	0.849	1.573	1.779	1.395	0.915	0.641	0.228	0.169	0.218	0.093	0.199
	1988/89	1.327	3.482	3.461	3.435	3.408	1.812	0.441	0.327	0.218	0.161	0.123	0.096
	1989/90	0.327	0.758	1.78	1.297	1.096	0.544	0.931	0.2	0.165	0.153	0.188	0.097
	1990/91	0.103	0.215	1.032	1.12	1.131	1.236	0.42	0.228	0.25	0.171	0.157	0.103
	1991/92	0.177	0.796	0.618	0.521	0.391	0.46	0.19	0.14	0.103	0.082	0.053	0.057
	1992/93	0.177	0.957	1.066	1.736	1.551	1.074	1.505	1.577	1.649	1.722	1.794	1.866
	1993/94	1.938	2.01	2.084	1.196	0.564	1.149	0.352	0.195	0.136	0.197	0.156	0.101
	1994/95	0.18	0.223	1.384	1.921	1.456	0.697	0.533	0.267	0.447	0.131	0.044	0.013
	1995/96	0.158	0.656	1.005	1.501	1.571	1.037	0.594	0.435	0.319	0.176	0.122	0.094
	1996/97	0.057	1.042	1.592	1.919	1.591	0.917	0.607	0.348	0.395	0.181	0.105	0.006
	1997/98	0.154	1.094	1.16	1.636	1.687	1.105	0.443	0.29	0.216	0.262	0.14	0.156
	1998/1999	0.288	0.775	1.421	1.773	2.024	1.762	0.954	0.544	0.521	0.296	0.238	0.243
	1999/20	0.509	0.532	1.074	1.674	1.578	1.447	0.794	0.35	0.713	0.34	0.156	-
		1.24	1.593	1.707	1.864	2.345	1.775	0.814	0.461	0.369	0.515	0.178	0.127

CM/sec		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Monthly Average		0.396709677	1.025096774	1.469806452	1.640193548	1.608774194	1.204935484	0.627774194	0.374096774	0.348483871	0.254903226	0.198419355	0.2098
CM/Day													
Monthly Avg	86400	34,275.72	88,568.36	126,991.28	141,712.72	138,998.09	104,106.43	54,239.69	32,321.96	30,109.01	22,023.64	17,143.43	18,126.72
Design Volumes (M3/Day)		20,045.00	57,784.00	117,158.00	158,216.00	182,131.00	154,898.00	84,326.00	55,987.00	41,265.00	30,275.00	21,773.00	15,759.00
Total Measured Extraction		27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00	27,101.00
Blantyre Water Board		18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00	18,740.00
Total Extraction incl BwB		45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00	45,841.00

ANNEX 8

BIBLIOGRAPHY

Access to Information Act, 2017

A Guide for USAID Project Managers for Bridges Incorporating Climate Change Adaptation In Infrastructure Planning And Design, November 2015

Overview of Corruption in Malawi, Transparency International Report, 2014

ANNEX 9

LIST OF INTERVIEWS WITH STAKEHOLDERS

Bakolo, Stainley	:	Blantyre Water Board
Kamanga, Eng. Patrick	:	Malawi Roads Authority
Kaunde, Eng. Willard	:	Malawi Roads Authority
Koloko, Andy	:	Agricultural Commercialization Project
Nyando, Cleaverson	:	Lilongwe City Council

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Malawi