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**MINISTRY OF AGRICULTURE FOOD SECURITY AND
COOPERATIVES**



**AGRICULTURAL SECTOR DEVELOPMENT PROGRAMME
IRRIGATION DEVELOPMENT SUB-COMPONENT**

**THE STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT (SESA) FOR THE
NATIONAL IRRIGATION MASTER PLAN (NIMP) AND THE NATIONAL IRRIGATION
POLICY (NIP)**

**FINAL SESA REPORT
VOLUME II: MAIN REPORT**

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SUBMITTED BY

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THE STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT (SESA) FOR THE NATIONAL IRRIGATION MASTER PLAN (NIMP) AND THE NATIONAL IRRIGATION POLICY (NIP)

VOLUME II: MAIN REPORT

Prepared by:

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For

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ABBREVIATIONS AND ACRONYMS

AMR	Annual Mean Runoff
ARV	Anti-retroviral
ASDP	Agricultural Sector Development Program
ASDS	Agricultural Sector Development Strategy
ASLMs	Agricultural Sector Lead Ministries
BICO	Bureau for Industrial Cooperation
BOD ₅	Biochemical Oxygen Demand
BWO	Basin Water Officers
BWO	Basin Water Offices
CBO	Community Based Organization
CITES	Convention on International Trade in Endangered Species
CTES	Convention on International Trade in Endangered Species
°C	Degree centigrade
D- by- D	Decentralization by Devolution of powers
DADPs	District Agricultural Development Plans
DALDOs	District Agriculture and Livestock Development Officers
DCs	District Commissioners
DDCA	Drilling and Dam Construction Agency
DEC	District Environmental Coordination
DEds	District Executive Directors
DFTs	District Facilitation Team Members
DITS	Division of Irrigation and Technical Services
DoE	Division of Environment
EAC	East African Community
EI	Environmental Impact
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMA	Environmental Management Act
EMA	Environmental Management Act,
ENSO	El Niño South Oscillation
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
FA	Forest Act
FAO	Food and Agriculture Organization of UN
GBV	Gender Based Violence
GDP	Gross Domestic Products
GoT	Government of Tanzania
GoT	Government of Tanzania
GRR	Great Ruaha River
GWP/TAC	Global Water Partnership/Technical Advisory Committee
ha	hectare
Ha	Hectare
HIV/AIDS	Human Immunodeficient Virus/Acquired Immuno-deficiency Syndrome
IAIA	International Association of Impact Assessment
ICID	International Commission on Irrigation and Drainage
ICT	Information and Communication Technology
ICZM	Integrated Coastal Zone Management
IMT	Irrigation Management Transfer
INPIM	International Network on Participatory Irrigation Management
IOs	Irrigators Organizations
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IPTRID	International Programme for Technology and Research in Irrigation and Drainage

IRRI	International Rice Research Institute
ITCZ	Inter-tropical Convergence Zone
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
JICA	Japanese International Cooperation Agency
km ²	Squared kilometres
km ³	cubic kilometers
LA	Land Act
LAA	Land Acquisition Act
LDC	Least Developed Country
LGAs	Local Government Authorities
LUPA	Land Use Planning Act
LVB	Lake Victoria Basin
LVBC	Lake Victoria Basin Commission
M&E	Monitoring and Evaluation
M/EM	Mitigation /Enhancement Measures
m ³	cubic metres
m ³ s ⁻¹	Cubic metres per second
MAFC	Ministry of Agriculture Food Security and Cooperatives
MAR	Mean Annual rainfall
MCA	Multi-Criteria Analysis
MCM	Million Cubic Metres
MDAs	Ministries, Departments, and Agencies
MDG	Millennium Development Goals
MEM	Ministry of Energy and Minerals
MKUKUTA	<i>Mkakati wa Kukuza Uchumi na Kuondoa Umaskini Taifa</i> , Swahili acronym for: National Strategy for Growth and Poverty Reduction
MKURABITA	Mpango wa Kurasimisha Rasilimali na Biashara za Wanyonge Tanzania
mm	millimetres
MNRT	Ministry of Natural Resources and Tourism
MOM	Manage, Operate, and Maintain
MOM	Management, Operations and Maintenance
MoWI	Ministry of Water and Irrigation
MW	Mega Watts
NAFCO	National Agriculture and Food Corporation
NAP	National Action Plan
NAWAPO	National Water Policy
NBI	Nile Basin Initiative
NEAC	National Environmental Advisory Committee
NEMC	National Environment Management Council
NEP	National Environment Policy
NEPA	National Environmental Policy Act
NGOs	Non-Governmental Organizations
NIDP	National Irrigation Development Plan
NIMP	National Irrigation Master Plan
NIP	National Irrigation Policy
NPA	National Parks Act
NSGRP	National Strategy for Growth and Reduction of Poverty
O&M	Operation and Maintenance
O&OD	Opportunities & Obstacle to Development
OECD	Organization for Economic Co-operation and Development
OP	Operational Policies
PAPs	Project Affected Parties
PIDP	Participatory Irrigation Development Programme
PIM	Participatory Irrigation Management

PLSPPs	Policies, Legislation, Strategies, Programs, and Plans
PMO	Prime Minister's Office
PPA	Plant Protection Act
PPP	Public Private Partnership
PS	Permanent Secretary
PSRP	Public Services Reform Program
PW	Productivity of Water
QVI	Quantifiably Verifiable Indicator
R&D	Research and Development
RALF	Research in Alternative Livelihoods Fund
RBMSIIP	River Basin Management and Smallholder Irrigation Improvement Project
REMP	Rufiji Environment Management Project
REPC	Regional Environmental Policy Committee
RPF	Resettlement Policy Framework
RWH	Rain Water Harvesting
SADC	Southern African Development Community
SEA	Strategic Environmental Assessment
SEAR	Strategic Environmental Assessment Regulation
SEMMP	Strategic Environmental Management and Monitoring Plan
SEMoP	Strategic Environmental Monitoring Plan
SEMP	Strategic Environmental Management Plan
SESA	Strategic Environmental and Social Assessment
SMEC	Snowy Mountains Engineering Corporation
SMUWC	Sustainable Management of the Usangu Wetlands and its Catchments
STDs	Sexually Transmitted Diseases
SUA	Sokoine University of Agriculture
TAA	Tanzania Airport Authority
TANAPA	Tanzanian National Parks Authority
TANCID	Tanzania National Commission for Irrigation and Drainage
TANESCO	Tanzania Electric Supply Company
TAWIRI	Tanzania Wildlife Research Institute
TDA	Transboundary Diagnostic Analysis
TDHS	Tanzanian Demographic Health Surveys
TGNP	Tanzania Gender Networking Programme
TIC	Tanzanian Investment Centre
TLU	Tropical Livestock Units
ToR	Terms of Reference
TPC	Tanganyika Planting Company
TTCL	Tanzania Telecommunications Company Limited
UDOM	University of Dodoma
UDSM	University of Dar es Salaam
UGRRC	Upper Great Ruaha River catchment
UK	United Kingdom
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
URT	United Republic of Tanzania
VEC	Village Environmental Committee
VLA	Village Land Act
VPO	Vice President's Office
WB	World Bank
WCA	Wildlife Conservation Act
WEC	Ward Environmental Committee

WHO	World Health Organization
WHS	World Health Organization Statistics
WLS	Water Laboratory Services
WMO	World Meteorological Organization
WRM	Water Resource Management
WRMA	Water Resources Management Act
WUA	Water Users' Association
WWF	World Wide Fund for Nature
ZIEs	Zonal Irrigation Engineers

1 INTRODUCTION

1.1 Background

Tanzanian agriculture mainly relies on rain, and suffers from the inadequacy, seasonality, and unreliability of rainfall. Thus, crop yields are generally low, and although irrigation is considered necessary to mitigate climate constraints and to stabilize agricultural production and ensure local food security its systems have not been extensively developed in Tanzania.

Tanzania launched the National Irrigation Master Plan (NIMP) in 2002 to achieve the Agricultural Sector Development Strategy (ASDS) objective of sustainable irrigation development for increased agricultural productivity and profitability. The NIMP addresses development of irrigation schemes with emphasis on smallholder ones. The NIMP proposes a stage-wise process of planned irrigation development which:

- i. Develops Institutional capacity along with human resource development;
- ii. Utilizes that capacity to design, construct, and manage irrigation schemes in compliance with the standards; and
- iii. Improves water use efficiency and expansion of irrigation coverage.

The NIMP recommends:

- i. An institutional development program to increase the capacity of irrigation managers and technical staff, government agencies, and organizations to design, construct, and manage irrigation schemes to commonly¹ accepted standards;
- ii. Improvement in water use efficiency of traditional systems in order to ensure water supply for expanding intra-basin irrigation development; and
- iii. Identification of potential sites where additional irrigation schemes could be developed by assessing the availability of water, geographic features, level of economic development, and land use in different areas.

The NIMP states that there are about 29.4 million hectares (ha) available for potential irrigation development in Tanzania. This total includes areas of high potential (2.3 million ha), medium potential (4.8 million ha), and low potential (22.3 million ha). Of the total area, the NIMP estimates that 405,400 ha can be developed by 2017 (Table 1-1). As of June 2009, the total area provided with improved irrigation infrastructure was 310,745 hectares (NIP, 2010). By June 2010 cumulative area developed was 331,490 hectares.

¹ For example the standards set by: The International Commission on Irrigation and Drainage, the International Water Management Institute, the International Rice Research Institute, or Asian the Vegetable Research Development Center.

Table 1-1: NIMP Estimates of Irrigation Development (Ha) by Planning Horizon

S/N	Type of Irrigation Schemes to be Developed	Short-Term 2003-2007	Medium-Term By 2012	Long-Term By 2017
1	Rehabilitation of traditional irrigation schemes	179,800	216,100	274,600
2	Development of water harvesting schemes	41,600	57,200	68,200
3	New Smallholder Schemes	43,800	51,600	62,600
	Total	265,200	324,900	405,400

Source: URT, 2002a

Subsequent to the preparation of the NIMP, the Government of Tanzania (GoT) began development of the National Irrigation Policy (NIP), which is designed to fully address the challenges that the irrigation sector faces and promote effective irrigation development. The NIP was endorsed by the cabinet in February 2010.

The NIP provides a vision and step-wise prioritization of irrigation development in the country. It defines the irrigation roles and responsibilities of different institutions and their relationships with the district level planning process. Normally, the NIMP would have been prepared after the adoption of the NIP. However, as this was not the case, the NIMP will have to be updated to align itself with the NIP to ensure that it becomes the operational tool for implementing the NIP.

1.2 Description of the Assignment

In broad terms, the purpose of a Strategic Environmental and Social Assessment (SESA) is to provide a means for introducing environmental and social concerns into water resource management at the strategic level of policies, legislation, strategies, programs, and plans (PLSPP). SESA include a wide range of instruments that assess both the potential impacts of PLSPPs and the institutional capacity to integrate environmental, social, economic, and good governance considerations. Measures can then be taken to eliminate, avoid, mitigate, or compensate for the potential impact. SESA address both 'upstream' (shift towards the strategic level) and 'mainstream' (weave directly into the decision making process) environmental and social concerns.

The strategic level refers to all stages of decision making that precede the decision to go ahead with a specific project or set of projects. Specifically, Part VII, Clause 2 of the Environmental Management Act No. 20 of 2004 requires that:

“Without prejudice to subsection (1), when promulgating regulations, public policies, programs and development plans shall include a strategic environmental assessment statement on the likely effects of such regulations, public policies, program or development plans may have on the environment.”

This requirement is further reinforced by the Strategic Environmental Assessment Regulations, 2008 (SEAR) (URT, 2008a), which defines Strategic Environmental Assessment (SEA) as:

“A systematic process for evaluating the environmental, including health, consequences of proposed legislation, policy, plan, strategy or programs initiatives in order to ensure that they are fully included and appropriately addressed at the earliest appropriate stage of decision on par with economic and social considerations, which comprises the determination of the scope of an environmental report and its preparation, the carrying out of public participation and consultations and the taking into account of the report.”

1.3 Differences between Environmental Impact Assessment and Strategic Environmental and Social Assessment

The differences between EIA and SESA are described in the following table.

Table 1-2: Differences between EIAs and SESAs

S/No	EIA	SESA
1	Applied to specific and relatively short-term (life-cycle) projects and their specifications.	Applied to policies, plans and programs with a broad and long-term strategic perspective.
2	Takes place at early stage of project planning once parameters are set.	Ideally, takes place at an early stage in strategic planning.
3	Considers limited range of project alternatives.	Considers a broad range of alternative scenarios.
4	Usually prepared and/or funded by the project proponents.	Conducted independently of any specific project proponent.
5	Focuses on obtaining project permission, and rarely with feedback to policy, plan or program consideration.	Focuses on decision on policy, plan and program implications for future lower-level decisions.
6	Well-defined, linear process with clear beginning and end (e.g. from feasibility to project approval).	Multi-stage, iterative process with feedback loops.
7	Preparation of an EIA document with prescribed format and contents is usually mandatory. This document provides a baseline reference for monitoring.	May not be formally documented.
8	Emphasis on mitigating environmental and social impacts of a specific project, but with identification of some project opportunities, off-sets, etc	Emphasis on meeting balanced environmental, social and economic objectives in policies, plans and programs. Includes identifying macro-level development outcomes.
9	Limited review of cumulative impact often confined to phases of a specific project. Does not cover regional-scale developments or multiple projects.	Inherently incorporates consideration of cumulative impacts.

Source: OECD, 2006

1.4 Previous Strategic Environmental and Social Assessment in Tanzania

The adoption and application of SESA in developing countries have been very slow due to financial and human resource constraints. There is debate on the suitability of SESA in developing country contexts where there is growing evidence that EIA is not working well (Mwalyosi & Hughes, 1998; Mwalyosi, 2004). Often, the reasons are not so much technical, as they are issues related to lack of political and institutional will, limited skills and capacity, bureaucratic resistance, antagonisms from vested interests, corruption, compartmentalized organizational structures and lack of clear environmental goals and objectives. These structural problems are considered to be major constraints to the introduction of SESA (Dalal-Clayton and Sadler, 1999).

The SESA conducted within the United Republic of Tanzania (URT) SESA requirements is the Strategic Environmental Assessment of Mafia Island done in 2008, which can be regarded as the first SESA in Tanzania (IRG, 2008). Table 1.3 below shows the development of SESA internationally.

Table 1- 3 Stages of SESA-SEA development

S/No	Stage	Developments
1	Formative Stage before 1990	Certain legal and policy precedents for SEA were established by the introduction and early implementation of EIA. The US National Environmental Policy Act (NEPA, 1969) was intended to apply to 'legislation and other major actions'. For much of this period, however, its scope of application beyond the project level was limited, and primarily focused on programs. In a few other countries, elements of SEA were recognizable in certain EIA processes, for example public inquiries and environmental reviews conducted in Australia and Canada. By the end of the 1980's, other countries and international organizations had begun to make some provisions for SEA
2	The Formalization Stage – from 1990 to 2000	An increasing number of countries in response to Agenda 21 and other policy statements on sustainable development established SEA systems. These systems were and still are relatively diversified. Some countries made provision for SEA of policy, plans and programs separately from EIA legislation and procedure (e.g. Canada and Denmark). Other countries have introduced SEA requirements through environmental appraisal (e.g. UK), in reforms to EIA legislation (e.g. New Zealand, Australia). Certain lending and development programs financed by the World Bank became subject to sectoral and regional environment assessment (EA). In a few African countries, SEA is not explicitly provided for in legislation but is implied in the framework EIA legislation and in the schedule of activities to which EIA is applicable (for example, South Africa, Ghana, Zambia, The Gambia and Lesotho)
3	The Extension Stage – 2001 onward	Set to begin and marked by the widespread adoption and further consolidation of SEA. Key driving forces will be the transposition

S/No	Stage	Developments
		of the recently concluded European Directive on SEA by member States (to enter into force in 2004) and later by accession countries; and the negotiation of an SEA Protocol to the UNECE Convention on Transboundary EIA by signatory countries. These and other international legal and policy developments indicate a possible tripling of the number of countries that make provision for SEA over the next decade. SEA increasingly being applied in developing countries including Africa either voluntarily or as a result of donor conditionality, and has gradually began appearing as explicit requirements in legislation as national polices

Source: UNEP, 2002

1.5 Study Scope and Objectives

1.5.1 Scope

The scope of this SESA is limited to an assessment of the potential environmental and social impacts of implementing the irrigation support, efficiency improvement, and expansion policy decisions described in the National Irrigation Policy (NIP) and the National Irrigation Master Plan (NIMP). It is intended to be a comprehensive, program-wide assessment. The URT would like the subsequent implementation of the NIMP and the newly formulated NIP takes on board the following:

- i. Ensure that the NIMP is aligned with the NIP, as part of an integrated water resource management approach for Tanzania as a whole;
- ii. Allow a more pre-emptive and strategic assessment of the potential environmental and social impacts of both the NIP and NIMP, thereby ensuring that requisite institutional regulatory and decentralization frameworks are established;
- iii. Integrate the management of the environmental and social impacts into subsequent planning of the location and scale of irrigation investments, alternatives, mitigation measures, and monitoring activities; and
- iv. Ensure that the potential cumulative and incremental adverse and beneficial impacts in the short, medium, and long term are identified and clearly understood at an early stage of implementation of the NIMP and thereby integrated into the decision making process.

The more detailed environmental and social analysis needed at the project-level will be done as irrigation schemes are developed in the future as per the governing law.

1.5.2 General Objectives

The general objectives of a SESA in Tanzania are defined by the Strategic Environmental Assessment Regulations (URT, 2008a). The objectives are to:

- i. Ensure that environmental concerns are thoroughly considered in draft policies, bills, regulations, plans, strategies, or programs;
- ii. Enable the public to contribute to the consideration of environmental concerns in the preparation of policies, bills, regulations, plans, strategies, or programs;

- iii. Establish clear, transparent and effective procedures for the formulation of policies, bills, regulations, strategies, plans, or programs; and
- iv. Integrate environmental concerns into tools designed to further sustainable development.

1.5.3 Specific Objectives

The specific objectives of this SESA are to:

- i. Subject the NIP and the NIMP to a Strategic Environmental and Social Assessment (SESA), which fully examines the potential environmental and social issues that could be associated with their implementation;
- ii. Evaluate and compare the impacts against alternative options;
- iii. Assess the legal and institutional aspects relevant to the issues and impacts; and
- iv. Recommend broad measures to strengthen the environmental and social management of irrigation development in Tanzania within an integrated and holistic water resource management approach, which takes into account the entire gamut of environmental and social issues at the national and trans-boundary (international) levels.

1.5.4 Integrated Water Resources Management Objectives

The objectives of Integrated Water Resources Management (IWRM) are:

- i. Economic efficiency;
- ii. Equity; and
- iii. Environmental sustainability.

Attaining these objectives avoids a fragmented approach of water resources management by considering the following aspects:

- i. An enabling environment of suitable policies, strategies, and legislation for sustainable water resource development and management;
- ii. Putting in place the institutional framework through which to put into practice these policies, strategies, and legislation; and
- iii. Setting up the management tools required by these institutions to do their job.

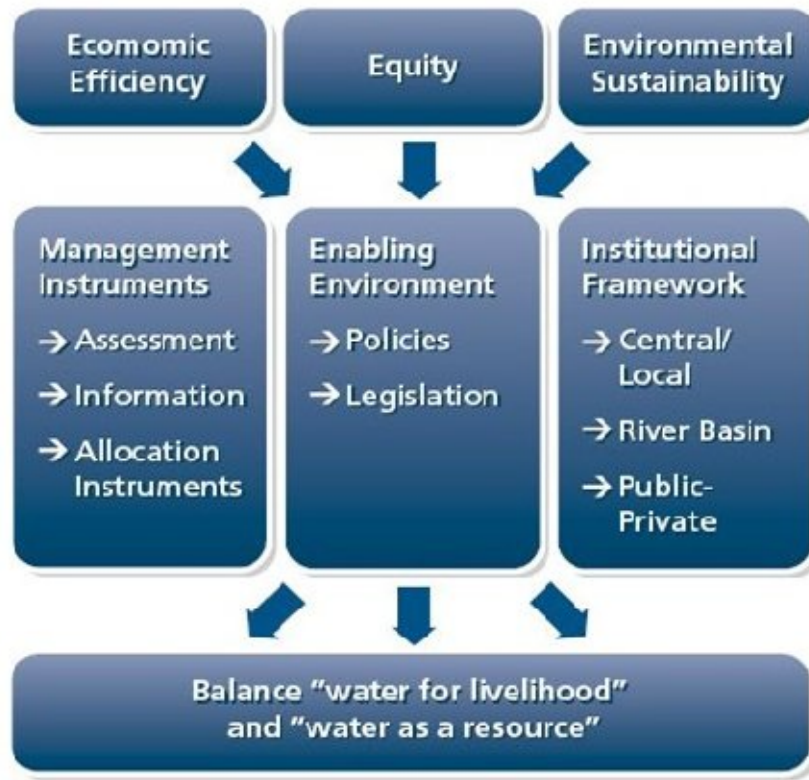


Figure 1-1: The Three Objectives of IWRM

Source: <http://waterwiki.net/index.php/Image:IWRMpillars.jpg>

1.6 Methodology

The overall approach is participatory. Strategic Environmental and Social Assessments have a range of approaches that can be broadly classified on a continuum from impact oriented SESAs to institution–centered SESAs. Impact oriented SESAs assess likely environmental and social effects and propose mechanisms to avoid, mitigate, or compensate for these effects. Institution-centered SESAs focuses on the analysis of institutions, governance structures, and frameworks because of the non-linear and overtly political nature in which policies and their supporting legislation are developed.

The methodology is a mix of ‘desk top’ review and field work. The methodology is described in greater detail in section 2.

1.7 Organization of this Report

This introductory section is followed by a section that describes the approach and methodology that guided the Strategic Environmental and Social Assessment (SESA) study. Section three (3) sets forth the policy and legal framework for this assignment. Section four (4) describes the scoping done before and after the SESA project began including key issues and concerns identified during public consultation. Sections five (5) and six (6) describe and discuss, respectively, the NIP and the NIMP. Section seven (7) describes the baseline data sets that were collected and analyzed. Section eight (8) presents an analysis of the NIP and the NIMP policy alternatives. Section nine (9) presents an analysis of the direct potential impacts including the potential indirect and the cumulative impacts. Section ten (10) is discussion on the proposed mitigation measures. Section eleven (11) presents the Strategic Management and Monitoring Plan. Section twelve (12) gives the conclusions and recommendations.

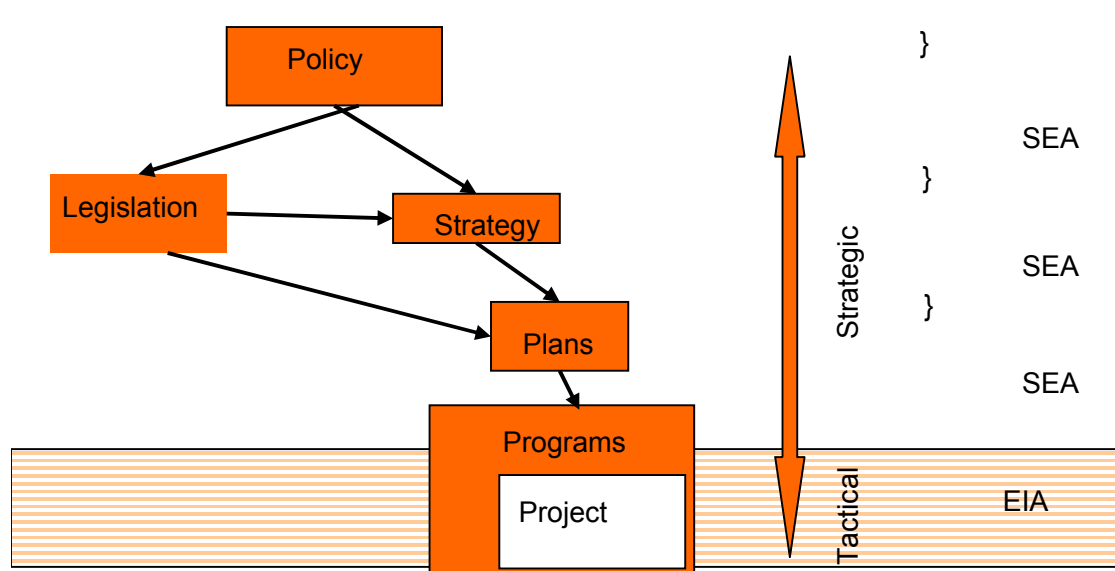
2 APPROACH AND METHODOLOGY FOR THE STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT

2.1 Approach

Strategic Environmental and Social Assessment introduces environmental and social concerns at the level of national policies, legislation, strategies, programs, and plans (PLSPPs). SESA assesses both the potential impacts from the PLSPPs themselves and the PLSPP agencies' institutional capacity in order to:

- i. Integrate environmental and social considerations into an on-going refinement of PLSPP; and
- ii. Implement the SESA Management Plan and the SESA Monitoring Plan.

Figure 2-1 depicts the relationship between SEAs for policies, legislation, strategies, plans, and programs, and EIAs for projects.

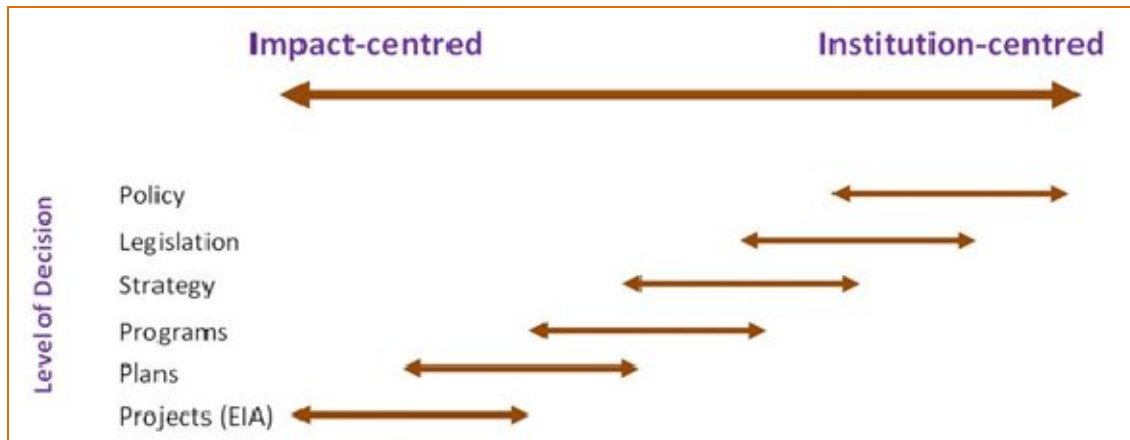


Source: World Bank, 2007

Figure 2-1: The Relationship between SEAs for Policy, Legislation, Strategies, Plans, and Programs and EIAs for Projects

This SESA focuses on Tanzania's policy to develop the irrigation sector. It is a multi-sectoral assessment that is an iterative and participatory process for gathering data, assessing potential impacts, developing mitigation measures and making recommendations in order to introduce environmental and social concerns at the level of Tanzanian irrigation policy implementation.

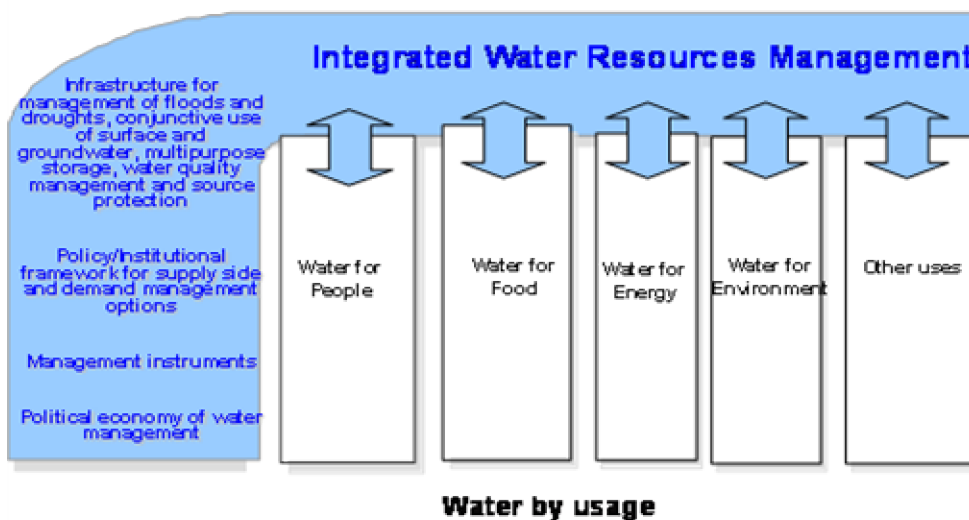
Strategic Environmental and Social Assessments have a range of approaches that can be broadly classified along a continuum from impact oriented SESAs to institution-centered SESAs. Figure 2-2 depicts the relationship between type of SESA and the level of decision-making.



Source: World Bank 2007

Figure 2-2: The Relationship between Type of SESA and the Level of Decision-Making

Institution-centered and impact-centered SESAs are part of IWRM (Figure 2-3), which advocates for holistic approach to water management that links land and water development within a catchment and links social and economic development with protection of natural ecosystems (GWP/TAC, 2000).



Source: World Bank, 2007

Figure 2-3: Conceptual Framework for Integrated Water Resources Management

The approach for this SESA is consistent with Tanzania's national legislative framework and is in agreement with guidelines developed by the World Bank. It is a hybrid of impact and institutional centered approaches that assess the impacts, institutions and governance structures pertaining to NIP and NIMP. In addition to weaving environmental and social concerns into the NIP and NIMP, it adheres also to the principles of Integrated Water Resource Management.

2.2 Methodology

2.2.1 Introduction

The general methodology used during the SESA study consisted of:

- i. Review of relevant national and international policies and legislations, published and unpublished reports including relevant World Bank Safeguard Policies and Guidelines
- ii. Collection and processing of secondary data held by GoT ministries, departments, divisions, and agencies;
- iii. Consultations with stakeholders;
- iv. Rapid appraisal of field conditions; and
- v. Data analysis and reporting.

The SESA assignment activities began during the inception phase and expanded thereafter.

During the inception phase, the following activities were carried out:

- i. The types of data required to attain the SESA objective(s) and
- ii. The availability of relevant data required for the assignment.

2.2.2 Review of Relevant Literatures

Based on the results of the preliminary data review, the information gaps needed to be addressed to carry out the assignment were determined. A comprehensive list of the data required to undertake the SESA and to prepare the strategic environmental management and monitoring plans using an Integrated Water Resources Management (IWRM) approach was prepared.

The review of relevant national policies and legislations, focused on an analysis of the institutional and regulatory framework of the relevant ministries and agencies, to determine their capacity to undertake and sustain the activities proposed in the SESA Strategic Management Plan and the Strategic Monitoring Plan. Furthermore, International policies and guidelines such as World Bank safeguard guidelines were also reviewed to ensure adherence to international standards.

2.2.3 Collection of Existing SESA Relevant Data

Data collection workplan was prepared and used to gather the required missing data. The plan included the examination of all available sources of data, such as research studies, government records at the national, zonal, regional, district and basin water offices, Non-Governmental Organizations (NGOs) or private firms' documents and records.

2.2.4 Public Consultations

Consultations with individuals and with small groups were conducted throughout Tanzania. The purpose of the public consultation process was to:

- i. Obtain stakeholders' views, issues, and concerns on the potential environmental – physical, biological, and social - impacts that implementing the NIMP and NIP may have;
- ii. Obtain stakeholder views on measures to avoid or mitigate, the identified potential environmental impacts; and
- iii. Ensure stakeholder agreement that their issues and concerns have been addressed in the SESA Report.

The format of these consultations, whether individual or group, consisted of:

- i. A brief introduction of the assignment;
- ii. A check list of questions that could be discussed informally or formally, depending on the situation; and
- iii. A standard procedure for taking notes on stakeholder issues and concern.

2.2.5 Stakeholders' Identification

Identification of stakeholder groups began during the SESA inception phase. The initial set of key and important stakeholder groups were extracted from the SESA study Terms of Reference (TOR). During subsequent meetings with stakeholders, additional stakeholder groups were

identified and contacted. The complete list of groups and individual stakeholders contacted is in the Stakeholders' Consultation Report (Appendix 10).

Stakeholders groups were consulted throughout the country, at the national, the district, and village levels. Individual and group stakeholders included government officials, non-governmental organization employees, small business people, unofficial community leaders, and farmers. Detailed, in-depth, discussions were held with local community members who were deemed most likely to be affected by the development of irrigation and drainage schemes and a range of stakeholders from government entities.

The key stakeholders identified and consulted during the SESA study include:

- i. The Department of Environment, Vice President's Office;
- ii. Central Government Ministries – Ministry of Water and Irrigation, Ministry of Lands Housing and Human Settlements Development;
- iii. All Zonal Irrigation and Basin Water Offices;
- iv. National Environment Management Council (NEMC);
- v. Selected representative from Local Government Authorities (LGAs);
- vi. Selected irrigation services providers (especially those engaged in agribusiness, e.g inputs, markets);
- vii. Selected small holder and large scale irrigators; and
- viii. Selected scheme levels farmers and IO Leaders.

2.2.6 Stakeholder Meetings

Stakeholder meetings were held from 9th May to 30th July 2010 at the zonal irrigation offices, Basin River Offices, district offices, selected irrigation schemes and rural communities. The Department of Environment, Vice Presidents' Office and selected central government offices, including the Agricultural Sector Lead Ministries (ASLMs), were consulted during the inception period. The schedule of public stakeholder consultations and a list of people contacted are presented in Appendix 10 together with stakeholder sign-in sheets with signatures.

Detailed concerns and issues of individuals or groups are shown in Appendix 10 including some of the photos/plates captured during consultation/visits. Consultations with the officers and members of selected Irrigators Organizations (IOs) were also made. Information on the IOs is included also in the Stakeholders' Consultation Report (Appendix 10).

2.2.7 Solicitation of Key Issues and Concerns

Stakeholder issues and concerns were solicited throughout the SESA study. During the consultations, the stakeholders raised a variety of issues and concerns. The key issues and concerns raised by different stakeholders are presented in the Stakeholder Consultation Report (Appendix 10). These were then used to inform the analysis of issues, identification of alternatives and weighting criteria and the development of strategic management plan.

2.2.8 Identification and Analysis of Alternatives

The identification of alternatives was based on the NIP and NIMP generic quest of achieving sustainable irrigation development. Within this framework, the NIP and NIMP were used as guiding documents in the identification of alternatives. The statements put emphasis on promoting different types of irrigation each conforming to cross-cutting and cross-sectoral policy categories. Ultimately, the following six alternatives or options were identified.

1. Alternative 0: Do not implement the policy measures and plans in the NIP and NIMP respectively;
2. Alternative 1: Promote improvement of traditional irrigation schemes only;
3. Alternative 2: Promote all types of existing irrigation schemes concurrently with new smallholders and commercial irrigation schemes of all scales (i.e. small, medium and large);
4. Alternative 3: Government plays a coordination and policy roles and the private sector manages irrigation;
5. Alternative 4: Promote Public Private Partnership in irrigation investment and management;
6. Alternative 5: Promote sharing of O and M such that IOs manage some structures like secondary canals while government does the rest.

These were deemed reasonable for the assessment of the extent to which these alternatives may be more appropriate from an environmental and socio – economic and cultural point of views. The alternatives include a counterfactual scenario (Alternative 0) which suggests that the policy measures and plans in NIP and NIMP are not implemented. This also implies that the areas recommended in the NIMP are not developed in order to enable the analysis and underline the environmental and social conditions over different timelines, without development of irrigation, but with all the other water-uses from other sectors still continuing in these areas.

Additionally, other alternatives are considered, that is, alternatives 1 through 5. Alternative 1 suggests that emphasis be put on improvement of traditional irrigation schemes only, whereas alternative 2 requires that all types of irrigation schemes are promoted concurrently (i.e. existing irrigation schemes and new smallholders and commercial irrigation schemes of all scales - small, medium and large). This scenario is similar to the present irrigation development approach in Tanzania, except that analytical considerations are made based on maximum water extraction quantities in the high potential irrigation areas, with the view of reducing, eliminating or otherwise effectively mitigating the direct, induced and cumulative impacts.

The analysis of these alternatives therefore required the selection of criteria to reflect performance in meeting various environmental and socio–economic and cultural goals. This analysis was done using the Multi-Criteria Analysis (MCA) technique, which applies a numerical analysis of performance through scoring and weighting of alternatives.

In scoring, the expected consequences of each alternative were assigned a numerical score on strength of preference scale for each alternative and for each criterion with the more preferred alternatives assigned higher scores on the scale, and less preferred alternatives assigned lower scores. In weighting, the numerical weights were assigned to define, for each criterion, the relative valuations of a shift between the top and bottom of the chosen scale.

The generation of criteria was therefore informed by policy statements and possible potential impacts of implementing the alternatives, which include an array of impact categories such as physical, biological as well as socio-economic and cultural impacts. The NIP statements embrace among others elements of institutional strengthening as well as financing mechanisms and funding support for irrigation development. In addition, aspects related to regulatory framework; land tenure and ownership rights identification; and water resource development were equally considered. Consequently, the following set of criteria was established.

1. Likelihood of ensuring that staff are well trained to manage the irrigation;
2. Possibility of support for the private sector to invest in and manage irrigation;
3. Possibility of the government to coordinate and finance the development only but not operation & management;
4. Likelihood of ensuring sustainable and well managed irrigation operations;
5. Possibility of having well researched irrigation activities;
6. Possibility of having well established and registered Irrigators Organizations (IOs);
7. Possibility of establishing an irrigation development fund;
8. Possibility of enabling access to funds;
9. Likelihood of expanding economic opportunities;
10. Possibility of increasing and expanding areas under irrigation;
11. Possibility of ensuring increased opportunities for income generation;
12. Possibility of increasing revenue generation for local and central governments;
13. Ability to provide investment fund for irrigation;
14. Possibility of developing all Irrigation scheme types;
15. Potential for ensuring working enforcement and compliance;
16. Potential for creating good governance;
17. Possibility of achieving enhanced legislative changes in support of irrigation development and creating enabling environment to attract private investors and financiers in the irrigation sector;
18. Possibility of ensuring that violators are punished;
19. Likelihood of having well demarcated and surveyed and registered irrigated land;
20. Possibility of ensuring that land uses are known and fixed and no change of use without permit;
21. Possibility of having well documented and analyzed groundwater potentials and of advocating its use;
22. Possibility of ensuring well organized inter-basin water transfers;
23. Likelihood of achieving reliable and sustainable crop production under irrigation and hence contribute to food security, employment, poverty reduction and the overall economic growth of the nation;
24. Likelihood of ensuring equitable use of water for irrigation purposes;
25. Likelihood of successful implementation of the empowerment interventions which will help developing the private sector;
26. Likelihood of privatization and commercialization of irrigation schemes to help conforming to market oriented economy;
27. Possibility of achieving increased crop production (yield improvement) and increased farm income;
28. Possibility for increased cropping intensity and crop diversification opportunities and the feasibility of year-round crop production activities;
29. Possibility for increased farm employment—more employment opportunities for farming families as well as for hired labourers in the locality;
30. Possibility for increased farm income (for farmers) and increased farm and off-farm employment opportunities for rural landless laborers, which result in better school

- attendance of children of farm laborers and improved social capital - due to the income effects of irrigation;
31. Possibility for ensuring enhanced women empowerment through involvement in irrigation activities;
 32. Possibility of having sustainable and successful Irrigation Organizations which enhance social cooperation;
 33. Likelihood of increasing farm consumption and permanent wealth (permanent asset accumulation due to irrigation) - This has significant implications for reducing intrinsic food insecurity in the country;
 34. Likelihood of ensuring reduced food (crop) prices which allows access to food for all - This is more beneficial to landless and subsistence families and provides better nutrition intake. It is also equally beneficial to urban poor and city dwellers, since they spend a large proportion of their daily income on food items;
 35. Possibility of ensuring that export tax revenue accruing to government coffers - This is important particularly for Tanzania being largely an agricultural-based country;
 36. Likelihood of reducing friction in the rural economy and reducing transaction costs - including farm marketing costs;
 37. Possibility of developing irrigation schemes with less maintenance requirements, low conveyance loss, less land acquisition, and with protection against water-borne diseases (e.g. irrigation schemes with lined canals);
 38. Possibility of having recreational benefits accruing out of irrigation facilities;
 39. Possibility of easing access to groundwater and less drudgery in fetching water for daily household needs in addition to irrigation water;
 40. Possibility of guaranteeing that mechanisms for ensuring that water fees reflect the economic value of water are instituted.

A numerical value was then attributed to each of these criteria on a scale from zero to five, with 0=representing — no impact or likelihood/possibility, 1=representing – very low or negligible impact or likelihood/possibility, 2=representing — low to moderate impact or likelihood/possibility, 3=representing — moderate, 4=representing — moderate to high impact or likelihood/possibility and 5= representing — high impact or likelihood/possibility.

Each of the six alternatives was then rated based on its performance against each of the 40 criteria. The individual scores/ratings and weightings were then tabulated using a spreadsheet to gain a final score (average or aggregated score) for each alternative.

2.2.9 Risk Analysis

The analysis of alternatives was complemented with a risk analysis which was done based on the understanding that some results of implementing the six alternatives are expected to be particularly sensitive to certain variables. In this context the term risk is used to refer to the potential of an adverse condition occurring on a plan which will cause the plan not to meet expectations. It is therefore a measure of the potential harm or loss associated with an activity executed in an uncertain environment. The risks used in this analysis are the synonyms of potential negative impacts of implementing the alternatives and they include the risks of:

1. Inadequate funds for staff development;
2. Unattended scheme due to leave of absence during training;
3. Movement to greener pasture of the trained personnel;

4. Mismanagement of government funds;
5. Inadequate funds for irrigation development;
6. Loss of habitat and ecological environment due irrigation development;
7. Water depletion due to increased irrigation abstraction;
8. Water use conflicts due to increased irrigation demand;
9. Increased land degradation due to forest, bush and grass clearing for establishing new land for irrigation purpose;
10. Impediment to movement of people, livestock and wildlife;
11. Creation of habitat for disease vectors;
12. Localized soil erosion;
13. Soil salinization and changes in soil chemical properties due to improper fertilizer use recommendations without considering soil chemistry;
14. Loss of forests and other vegetation from the cleaning of dam impoundment areas followed by long term inundation;
15. River bank degradation;
16. Flooding;
17. Sedimentation;
18. Reduced downstream flows;
19. Pollution of receiving land and water bodies;
20. Reduced environmental flows with negative consequences on aquatic and water sensitive species;
21. Loss of wildlife habitats and biodiversity;
22. Degradation of river catchments and riparian ecosystems/biodiversity;
23. Degradation of ecologically sensitive areas - wildlife corridors, protected areas and catchment forests – loss of biodiversity;
24. Land degradation, soil erosion and water pollution – loss or changes in aquatic biodiversity;
25. Soil salinity – loss or changes in the soil flora and fauna and aquatic biodiversity
26. Interference with fish migration and breeding – changes or loss in the biodiversity of fish and fish populations;
27. Privatization and commercialization of irrigation schemes may compromise the goal of poverty reduction and equity in welfare distribution;
28. The rate of growth of the private sector may not cater for the anticipated upsurge of management and development in irrigation schemes;
29. Irrigation funds may not be used in an efficient and economical way and exclusively for purposes intended;
30. Irrigation expansion targets may not be well aligned to capacity and available financing;
31. Water utilization and provision of water permit may not be subjected to economic criteria in consideration of water for the poor and the environment;
32. Increased child labor, prostitution, and social strife during planting and harvesting
33. Increased incidences of HIV/AIDS due to increased immigrations;
34. Poor health and sanitation due to water borne diseases;
35. Conflicts due to water misuse and destruction of irrigation infrastructure.

The likelihood of occurrence and potential severity of consequence for these risks were evaluated separately for each alternative and an aggregated risk factor was calculated. The likelihood that harm or risk will occur was assessed alongside with the consequences if harm does occur. This was informed by information gathered from stakeholder consultation and experiences in earlier irrigation plans and related policies.

The “Aggregated Risk Factor” was used as a measure of risk for the respective alternatives. This was calculated as a product of “Aggregated Relative Likelihood of Risk Occurrence” and “Aggregated Severity of Consequence.” A numerical value was assigned to each measure on a scale from zero to 1.0, with 0 representing — none, 0.01 to 0.20 representing – negligible or marginal, 0.21 to 0.40 representing — low, 0.41 to 0.60 representing — moderate, 0.61 to 0.80 representing — high or serious, and 0.81 to 1.00 representing — extreme or catastrophic.

It is however worth noting that, risk represents uncertainty: its components are difficult to explicitly quantify. Estimates of relative risk levels were determined using experience and judgment. The relative risk levels, while not precise probabilities provide a means of tracking and communicating areas that need special attention (e.g. mitigation measures). The goal is to reduce all risks to low levels during the irrigation development process. Risk analysis is therefore important in the management and implementation of the NIP and NIMP as well as the actions that are required to ensure that those risks are controlled.

2.3 Assessment of Schemes

In the NIP, irrigation schemes are classified as:

- i. Unimproved Traditional Irrigation Schemes;
- ii. Improved Traditional Irrigation Schemes;
- iii. Unimproved Rain Water Harvesting Irrigation Schemes;
- iv. Improved Rain Water Harvesting Irrigation Schemes;
- v. New Schemes - Smallholder (small scale, medium and large) Irrigation Schemes;
- vi. New Schemes - Commercial (small scale, medium and large) Irrigation Schemes; and
- vii. Existing Commercial Irrigation Schemes.

During the inception period, which was undertaken from the 7th through the 14th of February 2010, ten irrigation schemes were visited in four irrigation zones namely Kilimanjaro, Central, Mbeya, and Morogoro. In addition, four River Basin Offices namely Pangani, Rufiji, Internal Drainage, and Wami Ruvu were visited. The schemes investigated were Mombo, Njoro ya Liwali, Lekitatu, Bahi, Tanangozi, Mbarali Large Scale, Utengule Usongwe, Wami Ruhindo Lower Moshi, and Msoga. Out of the ten (10) schemes, four (4) schemes are Traditional Unimproved, 2 are Traditional Improved, 1 is an Improved Rainwater Harvesting Scheme, 1 is a Rainwater Harvesting Unimproved, 1 is a smallholder small scale commercial scheme, and 1 is a commercial scheme. Geographically, 4 schemes were in Kilimanjaro zone, 3 in Mbeya zone, 1 in Central zone and 2 in Morogoro zone.

During the SESA phase, rapid assessments of an additional 20 schemes were completed (Table 2-1). Thus a total of 30 irrigation schemes proposed by the Client were investigated.

Of the seven (7) types^[1] of irrigation schemes addressed in the NIP, the rapid appraisal was conducted for:

^[1] Unimproved Traditional Irrigation Schemes; Improved Traditional Irrigation Schemes; Unimproved Rain Water Harvesting Irrigation Schemes; Improved Rain Water Harvesting Irrigation Schemes; New Schemes - Smallholder (small scale, medium and large)

- i. Improved Traditional Schemes (14 schemes or 46%);
- ii. Improved Rain Water Harvesting Schemes (4 schemes or 12%);
- iii. New Smallholder Schemes – small (5 or 16%), medium (2 or 7%), and large (1 or 4%);
- iv. New Schemes - Commercial (small scale, medium and large) (1 schemes or 4%);
- v. Existing Commercial Schemes – small (1 or 4%) and large (2 or 7%).

The NIP indicates that the traditional systems are deemed to be ‘improved’ when the government improves the irrigation infrastructure and organizes the irrigators into formally registered irrigators’ organizations. These “improved” schemes have permanent structures and facilities for irrigation, drainage, and flood protection. They are designed with complete water control and measurement facilities to assist with water delivery and management.

Table 2-1: Irrigation Schemes Investigated for SESA Rapid Appraisal

	Name of Irrigation Scheme	Type ¹	District	Irrigation Zone	Source of water and conveyance
1	Mombo	Improved Traditional	Korogwe	Kilimanjaro	River/gravity
2	Njoro ya Liwali	Improved Traditional	Moshi (R)	Kilimanjaro	River/gravity
3	Lekitatu	Improved Traditional	Arumeru	Kilimanjaro	River/gravity
4	Lower Moshi	Improved Traditional	Moshi (R)	Kilimanjaro	River/gravity
5	Bahi	Improved Rain Water Harvesting	Bahi	Central	Seasonal river/gravity
6	Tanangozi	New Smallholder Drip (Small scale)	Iringa (R)	Mbeya	Ground Water pumping
7	Utengule Usongwe	Improved Traditional	Mbeya (R)	Mbeya	River/gravity
8	Wami Luhindo	New Smallholder (Small scale)	Mvomero	Morogoro	River/pumping
9	Msoga	New Smallholder (Small scale)	Bagamoyo	Morogoro	Dam
10	Chereche	Improved Traditional	Rorya	Mwanza	Dam
11	Nyatwali	Improved Smallholder (Small scale)	Bunda	Mwanza	Lake/pumping
12	Nduguti	Improved Rain Water Harvesting	Shinyanga (R)	Mwanza	Seasonal river

Irrigation Schemes; New Schemes - Commercial (small scale, medium and large) Irrigation Schemes; and Existing Commercial Schemes.

	Name of Irrigation Scheme	Type ¹	District	Irrigation Zone	Source of water and conveyance
13	Mibono	New smallholder – (Large scale)	Sikonge	Tabora	River/Gravity
14	Lusu	Improved Rain Water Harvesting	Nzega	Tabora	Seasonal river
15	Muhwazi	Improved Traditional	Kibondo	Tabora	River/gravity
16	Kitere	Improved Traditional	Mtwara(R)	Mtwara	Ground water/Artesian well
17	Chinangali II	New Smallholder Drip (Large scale)	Chamwino	Central	Ground water/pumping
18	Buigiri	New Smallholder (Small scale)	Chamwino	Central	Seasonal river/Dam
19	Uhelela/ Mtazamo	Improved Rain Water Harvesting	Bahi	Central	Seasonal river
20	Kiru Six	Smallholder (medium scale)	Babati	Central	River/gravity
21	Mahande	Improved Traditional	Monduli	Kilimanjaro	River/gravity
22	Mwega	Improved Traditional	Kilosa	Morogoro	River/gravity
23	Nakahuga	Improved Traditional	Songea	Mtwara	River/gravity
24	Katuka	New smallholder scheme – medium	Sumbawanga	Mbeya	River/gravity
25	Mbarali	Commercial (Large scale)	Mbalali	Mbeya	River/gravity
26	Tulo-Kongwa	Improved Traditional	Morogoro (R)	Morogoro	River/gravity
27	Mkula	Improved Traditional	Kilombero	Morogoro	River/gravity
28	Kiroka	Improved Traditional	Morogoro (R)	Morogoro	River/gravity
29	Tanganyika Planting Company (TPC)	Commercial (Large scale)	Moshi	Kilimanjaro	River/Ground water/Sprinkler/ Drip
30	Vasso Estate	Commercial (Small scale)	Moshi(R)	Kilimanjaro	River/Drip

¹ Unimproved Traditional Irrigation Schemes; Improved Traditional Irrigation Schemes; Unimproved Rain Water Harvesting Irrigation Schemes; Improved Rain Water Harvesting Irrigation Schemes; New Schemes - Smallholder (small scale, medium and large) Irrigation Schemes; New Schemes - Commercial (small scale, medium and large) Irrigation Schemes; and Existing Commercial Schemes.

2.4 Process for Developing the Strategic Environmental Management and Monitoring Plan

A major output of this SESA is the Strategic Environmental Management and Monitoring Plan (SEMMP). The process for developing this is depicted in Figure 2-4. It started with the analysis of the National Irrigation Policy and National Irrigation Master Plan. The information gained from this analysis guided the collection of baseline data, which was designed to provide information on the potential environmental and social impacts related to implementation of the NIP and NIMP.

The analysis of the NIP and the NIMP also guided the conduct of the Stakeholder Consultations. The consultation started with a brief introduction of the objectives of the SESA assignment, a description of the NIMP potential irrigation areas and NIP. A list of checklist containing questions which were required to elicit the desired information was prepared designed and used during consultation.

The simultaneous collection of baseline data and consultation with the stakeholders provided information that facilitated the identification of policy and development alternatives. The alternatives to the NIP are based on changes in the philosophy and approach to the policy objective and to the reformulation of the policy categories. The potential impacts were assessed for each alternative to identify the alternative that had the least severity of impact. The alternatives were then subjected to a Risk Analysis (Likelihood of Occurrence + Severity of Consequences) to determine which alternative impact combination is acceptable or acceptable with mitigation, or unacceptable.

Although Figure 2-4 depicts the analysis of the legislative and institutional environments as occurring after the Risk Analysis, this analysis begins at the same time. The information obtained through the data collection and the stakeholder consultations were used to guide the legislative and institutional analysis. The purpose of the legislative analysis was to determine the legal authority that the government has to regulate and enforce measures to prevent potential environmental impacts, to enforce the legislation and to identify the capacity that the relevant government institutions have to monitor and manage potential environmental impacts. Areas where different policies and legislations conflict each other were identified and proposal for harmonization suggested.

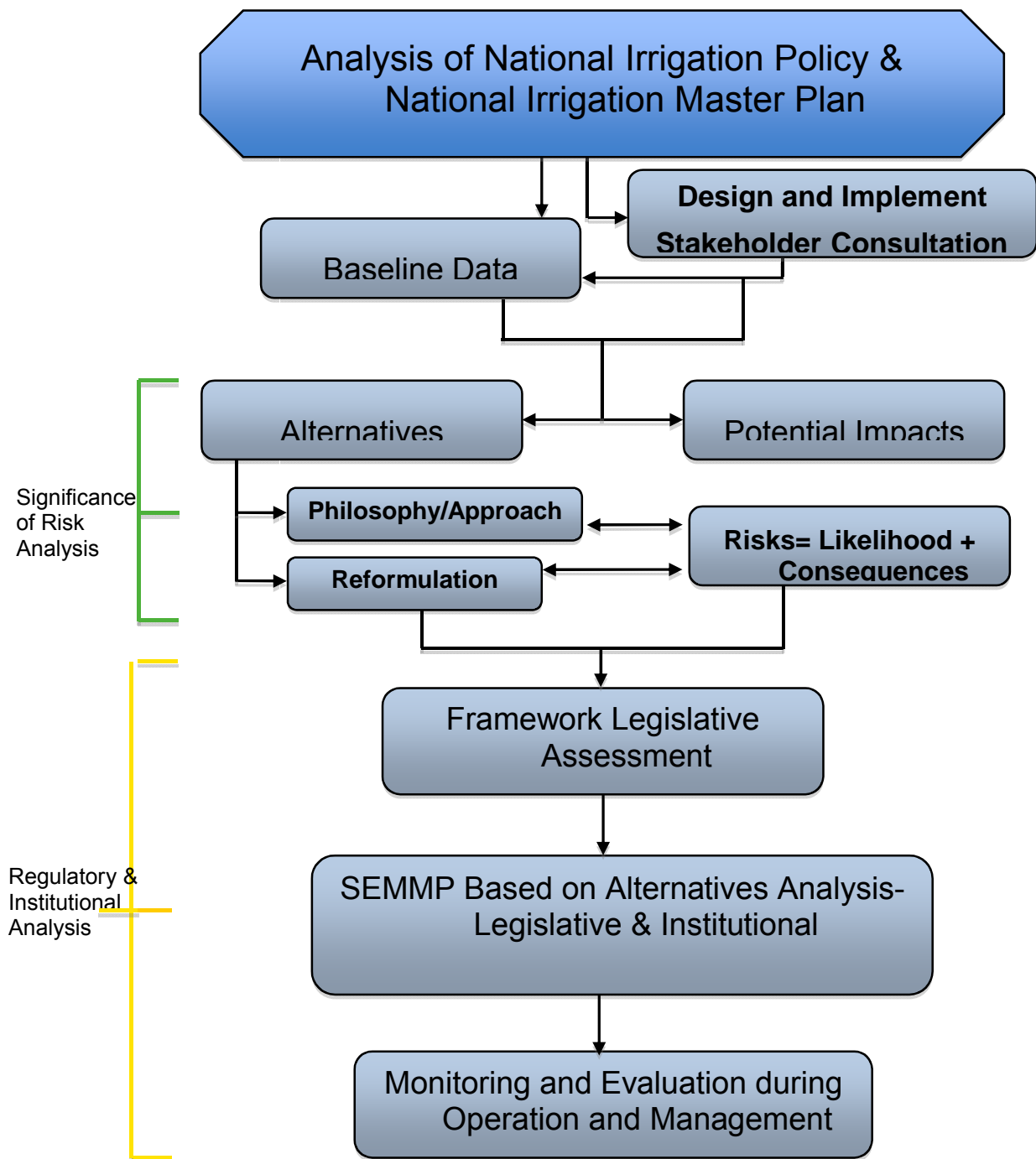


Figure 2-4: Conceptual Framework for Creating the Strategic Management and Monitoring Plan

3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Introduction

Under Article 27 of the Tanzanian Constitution, the public is called upon to ensure that the natural resources of the country are managed properly. Every person is obliged to safeguard and protect the natural resources of the United Republic, State property, and all property jointly owned by the people. All persons shall by law be required to safeguard State and communal property to combat all forms of misappropriation and wastage, and to run the economy of the nation diligently, with the attitude of people who are masters of the fate of their nation.

In accordance with these constitutional requirements, the United Republic of Tanzania (URT) has promulgated laws, regulations and standards for the protection, conservation, rehabilitation, and improvement of the environment. The national and international regulations and guidelines that govern the preparation of this SESA include the Environmental Management Act No. 20 of 2004, the Strategic Environmental Assessment Regulation 2008 and the national policies on environment, land, wildlife, forests, water, occupational health, energy, and others relevant to this SESA study. International guidelines applicable to this project include the World Bank's Operational Policies on Environmental Assessment (OP 4.01), Natural Habitats (OP 4.04), Forests (OP 4.36), Involuntary Resettlement (OP 4.12) and Cultural Property (OP 11.03).

Tanzania is a signatory to several regional and international conventions, protocols, treaties, and safeguards policies and is, therefore, bound by their requirements. This SESA study complies with these local, regional, and international regulatory frameworks. The policies, legislative, regulatory, and administrative context pertinent to this SESA are briefly described in this chapter.

3.2 National Irrigation Policy and National Irrigation Master Plan Pertinent Policies and Legislation

The reviewed and analyzed policies and legislations relevant to NIP and NIMP implementation are shown in Table 3-1.

It should be noted that once national policies are translated into legislation, the legislation is the primary means of determining the parameters for the implementation of the policies. It is, therefore, to the enacted legislation rather than the national policies of other ministries that the NIP and NIMP must be subjected. If there are any inconsistencies between the legislation and any aspects of the NIP and NIMP, these must be resolved either in terms of the legislation in force or through a change in the legislation if the declared policy must stand. Further, if there are aspects of the declared policy which are not governed by any law, then it will be necessary that appropriate legislation is introduced to regulate such aspects so that there is a common understanding as to what is required and expected and how it must be achieved. It may well be necessary that existing law be further developed to fully address any new declared policies. International practices and developments in similar spheres may serve to inform the nature of the preferable or appropriate legislative trends. It is against this background that the above legislations were analyzed and reviewed for the purposes of the NIP and NIMP.

Table 3-1: Policy framework and associated Legislations

S/No	Sector	Policy	Legislation	Administering Authority
1	Environment	The National Environmental Policy, 1997	<ol style="list-style-type: none"> 1. Environmental Management Act No. 20 of 2004 2. Environmental Impact Assessment and Audit Regulations, GN 349 of 2005; and 3. Strategic Environmental Assessment Regulations, GN 348 of 2008 	<p>Vice President's Office, Division of Environment,</p> <p>National Environment Management Council</p>
2	Land and land use	National Land Policy (1995)	<ol style="list-style-type: none"> 1. Land Act of 1999 2. Land Regulations 3. Village Land Act of 1999 4. Land Acquisition Act of 1967 5. Land Use Planning Act, 2007 6. Rural Farmlands Act Chapter 22 7. Local Government District Authorities Act, 1982 8. Protected Places and Areas Act, 1969 9. Public Lands (Preserved Areas) Act (Ordinance 12 of 1954) 	<p>Ministry of Lands Housing and Human Settlements Development ,</p> <p>PMO-RALG</p>
3	Agriculture	<p>Agricultural and Livestock Policy (1997)</p> <p>Irrigation policy (2010)</p>	<ol style="list-style-type: none"> 1. Pesticides Control Regulations, 1984 2. Industrial and Consumer Chemicals (Management and Control) Act, 2003 	Ministry of Agriculture Food Security and Cooperatives
4	Livestock	Livestock Policy (2006)	<ol style="list-style-type: none"> 1. Fisheries Act, 2003 2. Fisheries Regulations (2005) 3. Grazing Land and Animal Feed Resources Act No 13 of 2010 	Ministry of Livestock and Fisheries Development
5	Natural resources and Tourism	<p>National Forests Policy (1988)</p> <p>Wildlife Policy, 1998</p>	<ol style="list-style-type: none"> 1. Plant Protection Act, 2002 2. Ngorongoro Conservation Areas Act, Chapter 284 3. Forest Act No. 14 of 2002; 4. National Parks Act (1992) 5. Wildlife Conservation Act No. 5 of 2009 	Ministry of Natural Resources and Tourism
6	Water	National Water Policy, 2002	<ol style="list-style-type: none"> 1. Water Resources Management Act, 2009 2. Water Miscellaneous Laws Amendments, 1999 	Ministry of Water

Also included is a review of the regional and international arrangements to which Tanzania is a party and their implications for the implementation of the NIP and NIMP.

The following descriptions, review and analysis of the legislation currently in force shows the legal parameters within which the NIP and NIMP must be implemented and aspects of the policies that will or may require a change in the law or additional legislative interventions.

Recommended changes are indicated by the context or circumstances that are in line with current international trends and practices for sustainable utilization of the environment and appropriate frameworks responding to the social implications of the implementation of the irrigation policies.

3.3 Policy Framework

3.3.1 The National Environmental Policy, 1997

This is the major policy document that outlines the national environmental situation and gives guidance to environmental managers in Tanzania. The policy seeks to promote the economy and livelihoods of people while promoting sustainable use of natural resources. The policy provides the framework for the formulation of further policies, strategies, plans, programs, and guidelines for the achievement of sustainable development. Key objectives of this policy with regard to the water and agricultural sectors are:

- i. Intensifying, diversifying, and promoting production systems, technologies, and practices that are environmentally sound;
- ii. Ensuring sustainability, security, and equity in the use of resources;
- iii. Preventing pollution and controlling the degradation of life supporting land, water, vegetation, and air resources;
- iv. Conserving and enhancing the natural, including the biological diversity unique to Tanzania, and cultural heritage;
- v. Improving the management and conservation of wetlands;
- vi. Improving the efficiency of water used for irrigation, including the management of water logging and soil salinization; and
- vii. Planning and implementing water resources programs in an integrated manner and in ways that protect water catchments.

The policy promotes the use of Environmental Impact Assessment (and Strategic assessments) as a planning tool that integrates environmental issues into the planning process, and the policy stipulates the use of numerous approaches in environmental management in Tanzania.

The National Environmental Policy indicates that environmental issues are best handled with the participation of all citizens at the relevant level. To quote the NEP:

It is widely recognized that interventions which are like to have positive impacts are those which enjoy the greatest support from grassroots. It is also recognized that ideal interventions are that are based on the people's own initiatives, and for which solutions are geared towards felt needs, thereby diminishing the gap between theory and practice. Local level environmental action is in-situ, responds to specific needs which can change quickly, and is small. Environmental action by national institutions on the other hand is ex-situ, could be comparatively rigid, based in a large institution often in an urban setting, and is large scale. There is an absolute necessity to exercise a bottom-up approach in problem identification, project planning, implementation, and monitoring (URT, 1997c).

Relevance to the SESA

The National Environmental Policy is the basis for the Environmental Management Act (Cap 20) of 2004 and the Strategic Environmental Assessment Regulations (SEAR) of 2008, and this SESA is being conducted in order that the NIP is in accordance with the SEAR.

3.3.2 Tanzania Wildlife Policy, 1998

The aim of the policy and regulatory framework is to involve a broader section of the society in wildlife protection and in the use, management, and development of protected areas.

The wildlife sector mandate is sustainable utilization of the wildlife resources. The wildlife policy and legislation focuses on peoples' participation in the conservation and protection of the resources. The policy has facilitated improvement in performance of the sector in attaining the overall goal of effective conservation and sustainable utilization of wildlife resources. For example, anti-poaching activities have been intensified resulting in the decrease of poaching incidences.

Relevance to the SESA

The relevance to the SESA lies in the fact that the Wildlife Policy fosters the sustainable use of wildlife resources, which the SESA addresses by examining the potential impact the development of the NIMP's high and medium potential irrigated areas may have on critical wildlife habitats and protected areas.

3.3.3 National Water Policy, 2002

Tanzania considers water to be a basic human need and right. It is to be allocated in accordance with existing legislation. Community participation is deemed to be a key to local management of allocations.

The National Water Policy (NAWAPO, 2002) focuses on:

- i. Beneficiary and stakeholder participation in the community's management of water resources;
- ii. Improved integration of water and sanitation management; and
- iii. Water resources and environmental awareness component.

Relevance to the SESA

This SESA assignment investigates the potential impacts of developing the NIMP identified high and medium irrigation potential areas on community management of irrigation water; enforcement of water and natural resource related laws; and implementation of environmental flows for environmental sustainability.

Three components of the National Water Policy (NAWAPO) are relevant to this SESA. First is the emphasis on beneficiary, stakeholder, participation in the community's management of water resources. Water is considered a basic human need, the use of which is to be allocated in accordance with existing legislation. The policy indicates that the allocation system should separate water use permits from land titles as a means of fostering community participation.

Second is the improved integration of water and sanitation activities. Improvement in managing water supplies and protecting them from human waste is a part of this component. The NAWAPO advocates that entities that pollute water are to pay for remediation and that water should be conserved.

Third is the water resources and environmental awareness component. The policy is that all water related activities should aim to enhance, or to cause the least negative effect on, the natural environment. The allocation of water for environmental purposes is recognized. Water for environmental purposes shall be determined using the best scientific information available that considers both the temporal and spatial water supply needed to maintain the health and viability of riverine and estuarine ecosystems.

3.3.4 National Forest Policy, 1988

The policy goal is to enhance the contribution of the forest sector to the sustainable development of the nation through conservation and management of natural resources. To attain this goal the policy focuses on four main areas: land management, forest-based industries and products, ecosystem conservation and management, and institutional and human resources. The national forest policy has three key policy statements that pertain to this SESA assignment:

Policy statement (1): To ensure sustainable supply of forest products and services and environmental conservation, all types of forest reserves will be managed for production and/or protection based on sustainable management objectives defined for each forest reserve. The management of all types of forest reserves will be based on forest management plans.

Policy statement (5): To enable sustainable management of forests on public lands, clear ownership for all forests and trees on those lands will be defined. Forests and the responsibility for their management will be allocated to villages, private individuals, or to government. Central, local and village governments may demarcate and establish new forest reserves.

Policy statement (15): New forest reserves for biodiversity conservation will be established in areas of high biodiversity value. Forest reserves with protection objectives of a national strategic importance may be declared as nature reserves. This statement allows for local governments to enforce protection on locally determined areas of importance for conservation or production.

Relevance to the SESA

Some of the areas identified for irrigation development by the NIMP are in or near forested areas, especially in the Southern and Northern highlands and western parts of Tanzania. The implementation of NIMP may conflict with Policy statement 15 of the National Forest Policy. This SESA investigates the potential environmental impacts that irrigation development may have on the Tanzanian forests.

3.3.5 Agricultural and Livestock Policy, 1997

Agriculture Policy of 1997 recognizes the need to improve agriculture practices and to foster the adoption of new techniques in order to achieve higher productivity, and it is deemed that technologies that enhance agricultural labor productivity are a key to agricultural development. As a policy, the government will establish effective information systems on farm implements, machinery and equipment.

The Ministry of Agriculture will monitor and regulate the agricultural industry. It will advocate the interests of farmers and stock-owners to ensure that macro-economic, trade, taxation and land policies are optimized to stimulate rural development. Its monitoring function will provide continuous input to policy analysis, enabling public resources to be allocated in the most cost-effective manner.

Extension policy will continue to be based on the training and visit system, but applied with greater flexibility as extension workers become better trained to respond to farmer needs. Specific training and intensive campaigns will promote new technologies where appropriate. Weeding with animal power is a new technology of high potential and high priority.

The government will continue to act as coordinator and adviser to donors, but developmental assistance will increasingly be channeled through non-governmental organizations or directly to the beneficiaries.

The government is committed to ensuring food security for all. Otherwise it will devote itself to creating an 'enabling environment' for agricultural development under the stimulus of market forces. The government's monitoring and regulatory functions will ensure that trends can be recognized, and if necessary modified to meet the nation's longer term expectations of social equity and conservation of resources.

Land use managers are required to develop land use plans whereby a certain amount of land is put aside for livestock grazing and for agriculture. This is done to minimize conflict between farmers and livestock keepers. However, during the field reconnaissance it was observed that there is a general absence of land use plans. This absence may lead to problems and conflicts between different land users during the implementation of the proposed irrigation expansion.

Relevance to the SESA

The development of irrigated agriculture, especially commercial irrigated agriculture, is a focus of the policy. This SESA investigates the potential environmental impacts from such a focus.

3.3.6 Livestock Policy, 2006

The Livestock Policy (2006) was prepared after the Division of Livestock was incorporated into the new Ministry of Livestock Development and Fisheries. This policy seeks to focus on specific key

issues of the livestock industry that were not covered in the Agricultural and Livestock Policy (1997). These include animal identification, registration, and traceability; animal welfare, indigenous technical knowledge, biotechnology and bio-safety, organic livestock farming, food safety, emerging diseases, livestock product regulatory institutions, professional regulatory institutions, animal genetic resource conservation, livestock stocking, veterinary laboratory systems, livestock related disasters, and pet animals. The livestock industry has a clear development vision, based on the Tanzania Development Vision 2025 which states that:

“By the year 2025, there should be a livestock sector which to a large extent shall be commercially run, modern, and sustainable using improved and highly productive livestock to ensure food security and improve income at the household and national levels while conserving the environment.”

The rationale behind the National Livestock Policy is to commercialize the industry and stimulate its development while conserving the environment. The aim is to support the livelihoods of livestock farmers through increased incomes and self-sufficiency in animal food products, thus addressing the goals set in the National Strategy for Growth and Reduction of Poverty (NSGRP).

The overall objective of the National Livestock Policy is to develop a competitive and more efficient livestock industry that contributes to the improvement of the industry.

The task ahead is to establish an environment where opportunities for higher incomes and employment are created for resource-poor livestock farmers, including the commercial farming sector. To achieve this, three major goals for policy reform shall be implemented:

- i. To encourage the development of commercially oriented, efficient, and internationally competitive livestock industry;
- ii. To support the emergence of a more diverse structure of production with a large increase in the numbers of successful smallholder livestock producer enterprises; and
- iii. To conserve livestock resources and put in place policies and institutions for sustainable resource development and use.

Increased livestock populations and human activities related to livestock production in some areas of the country have resulted in over exploitation of natural resources. This has led to over grazing, soil erosion, deforestation, destruction of water sources, and environmental pollution, essentially the same environmental threats associated with improper development of irrigation.

Constraints to environmental conservation in livestock production include low awareness among stakeholders, low priority accorded to allocation of land for livestock use, inadequate expertise, and inter-sectoral coordination.

Thus to ensure that the environment is conserved for sustainable livestock production, the following policy statements on the environment have been issued:

- i. The Government will strengthen technical support services on environmental issues;
- ii. Efforts will be undertaken to promote proper land use planning for livestock production;
- iii. Efforts will be undertaken to strengthen inter-sectoral coordination on environmental issues.

Relevance to the SESA

This SESA investigates the potential impact that the proposed irrigation development will have on pasture and grasslands.

3.3.7 National Land Policy, 1995

Land in Tanzania is vested in the President as trustee on behalf of all. The National Land Policy requires full and fair compensation to be paid to any person whose right of occupancy or recognized long standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the State under the Land Act of 1999. Section 34 of that Act also states that where a right of occupancy includes land that is occupied by persons under customary law, and those persons are to be moved or relocated, they must be compensated for loss of interest in the land and for other losses. The National Land Policy of 1995 (Revised in 1997) recognizes the need for protecting environmentally sensitive areas. The policy emphasizes the protection of the environment and natural ecosystems from pollution, degradation and physical destruction. In addition, the policy recognizes the importance of social services such as water, roads, energy, and solid waste management for environmental protection. It also identifies the need for conservation and preservation of prehistoric/historic sites and buildings.

Relevance to the SESA

This policy is relevant to the SESA study, for part of the assessment is to identify potential impacts of irrigation development to land use.

3.3.8 Energy Policy of Tanzania, 2003

The objective of this policy is to provide input into the development process through the establishment of an efficient energy production, procurement, transportation, and distribution program that results in environmentally sound exploitation of available resources. The energy policy recognizes the critical role of energy in all sub-sectors of economy. It underscores the importance of sufficient energy supplies and efficient use of energy to realize sustainable development.

Relevance to the SESA

This SESA study investigates the potential impacts that the expansion of irrigated area may have on the amount of water that is available for other uses, for example hydropower generation.

3.3.9 Tanzania Development Vision, 2025

The Tanzania Development Vision 2025 is the guiding framework for national development until the year 2025. It aims to achieve a high quality livelihood for people of Tanzania that is characterized by sustainable and equitable growth.

It also aims at attaining good governance through rule of law and the development of a strong and competitive economy by moving from a Least Developed Country (LDC) to a middle-income country by 2025.

Relevance to the SESA

This SESA study investigates the potential impacts of irrigation development on the social environment, which is the environmental sector that the Vision 2025 targets.

3.4 Legal Framework

Tanzania's environmental assessment framework is regulated through three (3) key national legislations:

- i. The Environmental Management Act (EMA), No. 20 of 2004;
- ii. The Environmental Impact Assessment and Audit Regulations, 2005; and
- iii. The Strategic Environmental Assessment Regulations, 2008.

In addition, there are a number of acts and regulatory frameworks that give direction to environmental assessments in Tanzania. The following are excerpts and descriptions of the legal acts and regulations investigated by this SESA assignment.

3.4.1 Legal Acts

3.4.1.1 Environmental Management Act No. 20 of 2004

The Environmental Management Act, No. 20 of 2004 substantively encapsulates the general policy on the management of all matters which impact on the environment. Although there is other legislation that deals with some specific aspects of the environment, the EMA is the blue print on all matters environmental and all such other legislation must be compliant with the environmental management principles set in the EMA.

Section 2 of the EMA indicates that, "environment" covers all the physical attributes of the surroundings of human beings, including land, water, climate, micro-organisms, the biological factors of animals and plants, cultural resources and the social economic factor of aesthetics, including the natural and the built environment and their interaction. "Environmental management" requires the protection, conservation and sustainable use of the various elements of the environment (section 2, EMA). "Sustainable use" and "sustainable development" require the maintenance of the carrying capacity of supporting ecosystems through use or development of the environment without compromising the ability of future generations to meet their needs (section 2, EMA) .

Relevance to the SESA

It is mandatory in Part VII of EMA that any proposed laws, national policies, strategies, plans or undertakings, be accompanied by a Strategic Environmental Assessment to assess the likely effects of the proposal on the sustainable management of the environment. In the irrigation development sector, there is a range of environmental concerns which must be addressed and these form the subject of the entirety of this SESA, conducted in accordance with the Strategic Environmental Assessment Regulations, 2008. The implementation of the proposed irrigation investments and this SESA process will be in full compliance with the Act.

3.4.1.2 Environmental Action Plans and Environmental Protected Areas

Environmental Action Plans at the national, sector and local authority levels are required in terms of Part IV of the EMA and this means that any anticipated irrigation developments must of necessity fit in with the action plans at all these levels. In areas that have been declared Environmental Protected Areas, Environmentally Sensitive Areas or Protected Wetlands, there are specific management, conservation and protection protocols prescribed under Part V of the EMA that must be observed in the environmental management of these areas. Section 52 of the

EMA specifically specifies swamps, areas designated as prone to soil erosion or landslides, areas declared as sensitive by local authorities, arid and semi-arid lands, areas closed by the Minister to livestock keeping, occupation, cultivation or other specified activity as constituting sensitive areas. Regardless of the provisions of any law, rivers, riverbanks, lakes, lakeshores and shorelines can be declared protected areas for purposes of the EMA thus becoming subject to management prescribed for such areas and to the imposition of any protective restrictions considered necessary (section 52 of the EMA). The restrictions can be very wide-ranging and, subject to permission by way of an EIA, effectively severely curtail or prohibit activities that are necessary in the development of irrigation (section 55 (2) of the EMA). Human activity that is detrimental to the integrity of shorelines, riverbanks, dams or reservoirs is prohibited within 60 meters of these features. Under section 56 of the EMA, the same restrictions are also applicable with respect to wetlands.

Pursuant to the provisions of any sector-specific legislation, environmental protected areas may be declared national protected areas. A feature of the management of such areas is that zoning, access and use restrictions may be imposed.

3.4.1.3 Scope of the Environmental Management Act

The EMA is essentially a framework, crosscutting piece of legislation that covers all aspects of the environment. It gives the Minister power to make declarations regarding the protection, conservation and preservation of various defined areas such as environmental protected areas or environmentally sensitive areas, wetlands, rivers and river banks, lakes, lake shores or shorelines, declarations for reasons of natural features and beauty, flora and fauna of the area, unique or special geographical, physiological, ecological, historic and cultural features, scientific features, biological diversity, interests of local communities or international obligations. The sector-specific legislation mandated by the EMA governs the different sectors of the environment in more detail and where there is any conflict between any such legislation and the provisions and principles of the EMA, the EMA prevails. Land, water, forests, wildlife resources, fisheries and biological diversity, protection of the atmosphere, organic pollutants, hazardous chemicals and pesticides are all aspects on which the EMA, supplemented by sector-specific legislation, impose management, conservation and preservation controls. Irrigation development and expansion will be required to comply with the dictates of the EMA and any sector-specific legislation governing an aspect of the environment. Any declared protected or sensitive areas may not be developed for irrigation purposes. No irrigation development can take place prior to the issue of an EIA certificate upon approval of an EIS prepared following an EIA.

Being mainly framework legislation, sector-specific legislation developed by the Minister responsible for the specific sector in consultation with the Minister responsible for the environment is an extension of the EMA. The immediate responsibility for the enforcement of the environmental legislation under sector ministries lies with that sector ministry subject always to the overriding direction of the National Environment Management Council that is seized with the enforcement of compliance with the EMA.

The EMA overrides any provision under any other legislation on any aspect of the environment if any such provision is in conflict with any of the provisions of the EMA. For example in section 50, it provides as follows:

“The management and utilization of land shall be in accordance with the prevailing land laws provided that where there is any conflict on the environmental aspect of land management; the provisions of “the EMA” shall prevail.”

The EMA provides similarly under section 63 (2) with respect to laws on forests and section 65 (4) with respect to fisheries and wild life.

In addition, power is granted under various sections of the EMA for the issue by the Minister, the Council or local government authorities, of guidelines and the prescribing of measures or regulations for the environmental management of any aspect of the environment. For example, with respect to the protection and management of rivers, riverbanks, lakes or lakeshores and shorelines referred to above, section 55 (1) of the EMA provides that:

“Without prejudice to the provisions of any other relevant written law, the [Environmental Management] Council and local government authorities responsible for environmental matters shall issue guidelines and prescribe measures for the protection of river banks, rivers, lakes or lakeshores and shorelines.”

The same powers are replicated in respect of wetlands under section 56 (5); conservation of biological diversity under sections 67 and 68; the management of rangelands under section 70 (1) of the Act; and various other provisions on other aspects of the environment and environmental management (see Part V of the Act: Environmental Management).

3.4.1.4 Environmental Impact Assessments and Audits

Part VI of the EMA also requires that Environmental Impact Assessment (EIA) studies be carried out by experts registered as such under the law (section 83 of the EMA as read with the Environmental (Registration of Environmental Experts), 2005). Before undertaking any project in respect of which an EIA is required, an Environmental Impact Statement (EIS) must be prepared. EIAs are required in respect of dams, rivers and water resources, aerial spraying, agriculture, including animal production, or any other activity prescribed by law. Irrigation development, on the scale anticipated under the NIP and NIMP, and the various activities that it encompasses, will undoubtedly be subject to EIAs and EISs. EIAs are to be carried out in accordance with the law or regulatory guidelines specific to the project or, in the absence of such specific laws or guidelines, in terms of EIA regulations made in terms of the EMA, that is, the Environmental Impact Assessment and Audit Regulations, 2005. EISs are also prepared in accordance with regulations made by the Minister and they are currently provided for under the EIA regulations. Projects may not commence until the Minister, subject to any conditions that the certificate may state, has issued an EIA Certificate. The implementation of projects in respect of which EIAs are mandated must be monitored through environmental audits consisting of an evaluation of the conservation and preservation of the environment.

3.4.1.5 The Wildlife Conservation Act No 5, 2009

This legislation was enacted to protect and ensure the conservation of wildlife species. The Act operates in accordance with the requirements of the Convention on International Trade in Endangered Species (CITES), the National Park Ordinance, and other related legislation.

Relevance to the SESA

This SESA investigates the potential impact that the proposed irrigation development may have on wildlife and on protected areas.

3.4.1.6 Occupational Health and Safety Act No. 5 of 2003

This Act makes provisions for the safety, health, and welfare of persons working in factories and other places of work. It also provides for the protection of persons other than persons at work against health and safety hazards arising out of, or in connection with, activities of persons at work.

Relevance to the SESA

This SESA investigates the potential health and safety impacts of the proposed irrigation development.

3.4.1.7 Local Government Act (District and Urban Authorities) of 1982

This Act details the responsibilities of urban and district councils in the administration of their day-to-day activities. Environmental Management and the conduct of Environmental Impact Assessments are pointed out as some of the activities to be managed by Local Government (i.e. district and urban authorities).

Relevance to the SESA

The SESA study consults with selected local government authorities to determine their issues and concerns about the potential impact of the proposed irrigation development.

3.4.1.8 Land Act No. 4 and Village Land Act No. 5 of 1999

The Land Act seeks to control land use and clarify issues pertaining to ownership of land and land-based resources, transactions involving land, and land administration. This act identifies three categories of land—village, public, and general. It recognizes protected or restricted land (e.g. national parks, forest reserves, etc), and ensures that the tenure and rights of legitimate land users are considered and respected.

It stipulates that land sensitivity and potential environment impacts of proposed road works shall be considered in order to ensure that the land is not polluted and to allow for natural and rapid restoration of cleared vegetation or disturbed land.

The Village Land Act provides the legal framework for the management and administration of village land. The Act empowers the Village Council to manage all village land. It is important therefore that there should be consultations and consideration of the views of local authorities.

Section 156 of the Land Act requires that for communal right of way, compensation shall be paid to any person for use of land, who is in lawful or actual occupation of that land, for any damage caused to crops or buildings and for the land and materials taken or used for irrigation works. Requirements for the assessment of compensation are provided in the Land Regulations of 2001. Valuation must be done by a qualified and authorized professional.

Relevance to the SESA

This SESA study investigates the potential impact on land use and land administration by the proposed irrigation development.

3.4.1.9 Land Use Planning Act No 6 of 2007

Before allocating land to any use, the Land Use Planning Act (LUPA) requires that land use plans that are prepared by the land use planning authorities at the national, district and village levels be adhered to. This is in order to ensure national co-ordination and physical development within zonal land use frameworks. Under Part V, LUPA calls for co-ordination of various land use management activities undertaken by any lead agencies to get any land use considerations integrated into development policies, plans, programmes and projects. Because land use framework plans are subjected to EIA, inter and intra district and inter-sectoral co-ordination among lead agencies is required to enable coordinated physical development and systematic land use in each zone, region, district and village.

Under section 71 of the EMA, the Minister responsible for the environment can give general or specific directions environmental and land-use planning directives to be incorporated or taken into account in the allocation of land to any use under LUPA.

Additional analysis of the LUPA is presented in Section 13, Analysis of the Institutional and the Regulatory Environment.

Relevance to the SESA

Under section 27 of LUPA, areas planned for irrigation development must take cognizance of any land use plans in place, especially as these must contain land suitability assessments consisting of:

- i. Technical reports on the physical characteristics and resources of the land;
- ii. Description and analyses of current use and general condition of the land;
- iii. Suitability of the land for the proposed land uses;
- iv. Community needs in the area or zone; and
- v. An EIA.

3.4.1.10 Grazing Land and Animal Feed Resources Act No 13 of 2010

This act established the National Grazing-land and Animal Feed Resources Advisory Council. The Council shall have the general function of advising the Minister on policies and strategies for promotion development and management of grazing-land and animal feed resources. The act stipulates that grazing-lands shall be demarcated or delineated in accordance with the provisions of the village Land Act and the Land Use Planning Act.

Relevance to the SESA

This act is in line with the management of conflicts between farmers and pastoralists and hence the need to demarcate land for grazing among other land uses including irrigation.

3.4.1.11 Guidelines for Sustainable Liquid Biofuels Development in Tanzania, November 2010

The guidelines are issued by the Ministry of Energy and Minerals (MEM). The guidelines are designed to be a resource for those interested in investing in the Tanzania biofuels industry. The guidelines describe the institutional organization to promote biofuels in Tanzania.

The Biofuels One Stop Centre is responsible for the coordination approval, and monitoring of biofuels investments. It is also the source of information on biofuels development within Tanzania. The Biofuels One Stop Centre is within the Tanzanian Investment Centre (TIC). The MEM and other ministries and institutions provide technical backstopping to the Biofuels One Stop Centre as mandated by current legislation. The guidelines provide information on definitions, application procedures for investing in biofuels.

Relevance to the SESA

Encouraging private investment in irrigation development is a NIP policy category. The guidelines provide information on the permits and fees required, including the need to obtain permits for surface water abstraction and ground water exploitation. The sections on environmental and social impact assessment and community engagement ensure that investors know what is required of them.

3.4.1.12 Water Resources Management Act, 2009

This act provides the institutional and legal framework for the sustainable management and development of water resources within Tanzania. Part I, Article 3 indicates that 'reserve' water is that required for:

Satisfying basic human needs by securing a basic water supply for people who are now, or who shall in the reasonably near future be, relying upon or taking water from the relevant water resources; and protecting aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resources.

Further in Part II, Article 6, Clause (2), it is written that water allocation shall be in the following order of preference:

- i. Domestic purposes;
- ii. Environmental reserve; and
- ii. Socio-economic activities depending on the availability of water resources.

Thus Part II, Article 6, Clause (2), clearly indicates that water will be allocated for irrigation, a socio-economic activity, after the reserve – domestic and environmental – requirement is satisfied.

Relevance to the SESA

This SESA study has direct relevance to the Water Resource Management Act, for it investigates the implementation status of two key components:

- i. The determination and management of environmental flows and
- ii. The huge water resource potentials of Tanzania are currently untapped. This SESA study investigated all potential impacts from the proposed irrigation development and mitigation measures.

The Water Resources Management Act, 2009 (WRMA) introduced integrated water resources management (IWRM) principles into the management of the water resources of Tanzania. A widely accepted definition of IWRM is given by Global Water Partnership as

“a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.”

IWRM recognizes the inter-connected nature of the hydrological cycle and promotes a river catchment or basin perspective to the management of water resources, even where these cross administrative and international boundaries. Water resources management includes planning the development of water resources, implementing the plans and all measures for allocation, conservation and controlling the utilization of the water resource, all with the participation of the public. It calls for development without compromising the environment, seeking a balance that supports the natural systems and the social systems that define the ever-growing demand, disposal and pollution of water, and social sustainability. The WRMA implements these principles.

3.4.2 Regulations

3.4.2.1 Environmental Impact Assessment and Audit Regulations, GN No. 349 of 2005

This regulation describes the process for preparing EIAs and is applicable to EIAs in the irrigation sector. Mandatory EIAs are required for all projects likely to have significant potentially adverse environmental impacts. An EIA requires in-depth studies to determine the scale, extent, and significance of the impacts and identification of appropriate mitigating measures. Listed among such projects are:

- i. Agriculture including large-scale cultivation, water resources development projects (dams, water supply, flood control, irrigation, drainage), large scale mono-culture (cash and food crops, including floriculture), biological pest control, agricultural projects necessitating the resettlement of communities, livestock and range management, and intensive livestock rearing;
- ii. Water supply including canalization of water courses, diversion of the normal flow of water, water transfer schemes, abstraction, and utilization of ground and surface water for bulk supply; and
- iii. Land planning including development, land reclamation, resettlement and relocation of people and animals.

This captures a whole range of activities that would accompany the anticipated development and expansion in the irrigation sector.

Relevance to the SESA

The relevance to SESA is that much as EIA is in project level while SESA is in the policy level, however they can inform each other on social and environmental impacts.

3.4.2.2 The Strategic Environmental Assessment Regulations, 2008

Strategic environmental assessment is the regulation that sets out the requirements of a SESA conducted in Tanzania. This regulation requires that the potential environmental impacts of a piece of legislation, policy, plan, strategy or program in order to ensure that the environmental considerations are taken into account at the earliest possible stage in the decision making process. The regulations stipulate that environmental considerations should be on par with economic and social considerations.

The objective of any strategic environmental assessment conducted under the Act or under any other written law shall be to:

- i. Ensure that environmental concerns are thoroughly considered in drafting bills, regulations, plans, strategies, or programs;
- ii. Enable the public to contribute to the consideration of environmental concerns in the preparation of bills, regulations, plans, strategies, or programs;
- iii. Establish clear, transparent, and effective procedures for the formulation of bills, regulations, policies, strategies, plans, or programs; and
- iv. Integrate environmental concerns into measures and instruments designed to further sustainable development.

The Director of Environment shall be responsible for coordination of consultation in relation to the strategic environmental assessment, and the Sector Environmental Coordinator shall ensure that strategic environment assessment of Bills, regulations, policies, strategies, programmes or plans as provided for under these regulations and the Act is carried out in the respective sector Ministry and all parastatal organizations under its respective jurisdiction.

The Sector Ministry shall submit to the Minister of State in the Vice-President's Office – Environment, a Strategic Environmental Assessment Report prepared in the format as specified below:

- i. An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant Bill, regulations, policy, strategy, plans and programmes;
- ii. The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the Bill, regulations, policy, strategy, plan or programme;
- iii. The environmental characteristics of areas likely to be significantly affected;
- iv. Any existing environmental problems which are relevant to the Bill, regulations, policy, strategy, plan or programme;
- v. The environmental protection objectives, established at national level, which are relevant to the Bill, regulations, policy, strategy, plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation;
- vi. The likely significant effects on the environment, including short, medium and long-term effects, magnitude and extent of impact, likelihood of occurrence, reversibility, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects, on issues such as biodiversity, population, social, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage, including architectural and archaeological heritage, landscape, and the inter-relationship.
- vii. The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the Bill, regulations, policy, strategy, plan or programme;
- viii. An outline of the reasons for the selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;
- ix. A description of the variables and measures envisaged for monitoring;
- x. A non-technical summary of the information provided under paragraphs i to ix; and
- xi. Comprehensive Swahili version of the non-technical summary.

Relevance to the SESA

This regulation is of the utmost relevance to the SESA for it sets the legal definition of what the Division of Environment requires. The format of this SESA has been developed in cooperation and consultation with DoE.

3.5 Administrative Framework

On February 8th, 2005, the Environment Management Act (No. 20), 2004, was signed into law by the President of the United Republic of Tanzania (URT), an act which provides the legal and institutional framework for the sustainable management of the environment. The administrative authority for a Strategic Environmental Assessment at the national level is vested in the office of the Vice-President. Part VII of EMA No.20 of 2004 provides details of the administrative and institutional framework for the environmental management in Tanzania as indicated below:

3.5.1 Overall Environmental Management Responsibility

All environmental issues in Tanzania are regulated and controlled by the Minister of State, Vice President's Office - Environment. Thus the Vice President's Office is responsible for monitoring environmental planning, monitoring, and management as well as policy issues throughout the country. With regard to this SESA, it is the final approval authority.

3.5.2 Minister Responsible for Environment

The Minister responsible for the Environment is the Minister of State in the Vice-President's Office – Environment. This Minister is responsible for all matters relating to environmental regulation and management. This Minister approves SESA reports. The Minister may also delegate the power of approval for an EIA to the DOE, Local Government Authorities or Sector Ministries. The Minister also:

- i. Prescribes (in the regulations) the qualifications of persons who may conduct an EIA;
- ii. Reviews NEMC reports on the approval of an EIS;
- iii. Issues EIA certificate for the project subject to an EIA; and
- iv. Suspends EIA certificate in case of non-compliance.

3.5.3 National Environmental Advisory Committee

The National Environmental Advisory Committee (NEAC) is the top advisory body to the State Minister, Vice President's Office, Environment or any sector ministry on any matter concerning environment, It is comprised of members from various fields of environmental management in the public, private sector and civil society. The members of the NEAC are specified in the first schedule of the EMA No. 20 of 2004. They are:

- i. The Permanent Secretary, Vice President's Office, chairs the NEAC. Other members include:
- ii. Director of Environment – Secretary;
- iii. Director General of National Environment Management Council;
- iv. Commissioners for Minerals and Energy;
- v. Representatives from Attorney General and Ministry of Community Development
- vi. Directors of Sector Ministries, including Local Government, Disaster Management, Roads, Human Settlement, Ministry of Health (Preventive Services), etc;.

- vii. Chief Government Chemist; and
- viii. Representative from Higher Learning Institution, Civil Societies Organizations and Private Sector.

3.5.4 Division of Environment

The Division of Environment (DoE) deals with the development of environmental policy and coordination of its implementation. It also plays an advisory role to the government on all matters pertaining to environmental management. It is the institution responsible for reviewing SESA's and for recommending approval or disapproval of the SESA.

The Division of Environment has the following overall functions:-

- i. Formulation of policy on Environment;
- ii. Co-ordination and Monitoring of Environmental issues;
- iii. Environmental Planning; and
- iv. Policy-oriented Environmental Research.

3.5.5 National Environment Management Council

The National Environment Management Council (NEMC) has the overall responsibility of undertaking enforcement, compliance, review, and monitoring of Environmental Impact Assessments. The NEMC is responsible for ensuring that all development projects in Tanzania comply with all relevant environmental laws. The Environment Management Act No. 20 of 2004 specifically states that NEMC's role is to:, among many others, is to review and recommend for approval/clear EIA's. It also enforces and ensures compliance of the national environmental quality standards.

Once NEMC approves an EIA pertaining to a project that abstracts water from rivers, the nine river basin offices are responsible for issuing and managing water use permits.

The NEMC's mandate is fully described in Section 3.8 – Analysis of Institutional and Regulatory Environments.

3.5.6 Sector Ministries

Under the existing institutional and legal framework the Sector Ministries are required to establish Sector Environmental Sections headed by the Sector Environmental Coordinator.

The Sector Ministries Environmental Sections;

- i. Ensure environmental compliance by the Sector Ministry;
- ii. Ensure all environmental matters contained in other written falling under sector ministry are implemented and report of their implementation is submitted to the DOE;
- iii. Liaise with the DOE and the Council (NEMC) on matters involving environment and all matters with respect to which cooperation or shared responsibility is desirable or required;
- iv. Ensure that environmental concerns are integrated into the ministry or departmental development planning and project implementation in a way which protects the environment;

- v. Evaluate existing and proposed policies and legislation and recommend measures to ensure that those policies and legislation take adequate account of effect on the environment;
- vi. Prepare and coordinate the implementation of environmental action plans at national and local levels;
- vii. Promote public awareness of environmental issues through educational programmes and dissemination of information;
- viii. Refer to the Council (NEMC) any matter related to the environment;
- ix. Undertake analysis of environmental impact of sectoral legislation, regulation, policies, plans, strategies and programmes through strategic environmental assessment (SEA);
- x. Ensure that sectoral standards are environmentally sound;
- xi. Oversee the preparation of and implementation of EIA required for investments in the sector;
- xii. Ensure compliance with various regulations, guidelines and procedures issued by the Minister responsible for environment; and
- xiii. Work closely with Ministry responsible for local government, to provide environmental advice and technical support to district level staff working in the sector.

3.5.7 Regional Secretariat

The Regional Secretariat, which is headed by the Regional Environmental Management Expert, is responsible for coordination of all environmental management in their respective regions. The Regional Environmental Expert:

- i. Advises the local authorities on matters relating to the implementation of and enforcement of environmental By-laws/Act; and
- ii. Creates a link between the region and the DoE and the Director General of the Council (NEMC).

3.5.8 Local Government Authorities

Local Government Authorities exist for the purpose of consolidating and giving more power to the people to competently participate in the planning and implementation of development programs within their respective areas. Local Government Authorities are classified as: urban and rural.

Urban authorities are responsible for the administration and development of designated urban areas ranging from townships, municipalities and the cities.

Rural Authorities are termed District Councils. All Local Government Authorities are mandated to carry out the two main functions of administration and of maintaining law and order. They are also responsible for economic and development planning in their respective areas of jurisdiction. The Local Government Service Commission has the responsibility for personnel administration and management in Local Government Authorities (Online Gateway of the United Republic of Tanzania – Administration).

Under the Local Government Act of 1982 (Urban and District Authorities), Local Government Authorities include the City Councils, Municipal Councils, District Councils, Town Councils,

Township, Kitongoji, Ward, Mtaa and Village. The Environmental Management Committee of each jurisdiction:

- i. Initiates inquiries and investigation about any allegation related to the environment and implementation of or violation of the provisions of the Environmental Management Act;
- ii. Requests any person to provide information or explanation about any matter related to the environment;
- iii. Resolves conflicts among individual persons, companies, agencies non-governmental organizations, government departments or institutions about their respective functions, duties, mandates, obligations or activities;
- iv. Inspects and examines any premises, streets, vehicles, aircraft or any other place or article which it believes or have reasonable cause to believe that pollutant or other articles or substances believed to be pollutant are kept or transported;
- v. Requires any person causing environmental damage to remediate the damage, without causing harm to public health, at their own cost; and
- vi. Initiates proceedings of civil or criminal nature against any person, company, agency, department or institution that fails or refuses to comply with any directive issued by any such Committee.

In accordance with EMA (Cap 191) the Cities, Municipals, Districts, and Town Councils are headed by Environmental Management Officers who are responsible for environmental matters. The functions of the officers are to:

- i. Ensure enforcement of Environmental Management Act in their respective areas;
- ii. Advise the Environmental Management Committee on all environmental matters;
- iii. Promote awareness in their areas on the protection of the environment and conservation of natural resource;
- iv. Collect and manage information on the environment and utilization of natural resources;
- v. Prepare periodic reports on the state of the local environment;
- vi. Monitor the preparation, review and approval of an EIA for local investors;
- vii. Review by-laws on environmental management and on sector specific activities related to environment;
- viii. Report to the DOE and the Director General of the Council (NEMC) on the implementation of the Environmental Management Act; and
- ix. Perform other functions as may be assigned by the local government authority from time to time.

The Local Governments including District Councils ensure the enforcement of EMA No. 20 of 2004 at the respective local level. Among other things, they are involved with monitoring the preparation, review, and approval of EIAs for local investments; Village Environmental Committee (VEC) is responsible for the proper management of environment at the village level.

3.6 Regional Agreements and Conventions

In recognition of the rights and obligations with respect to shared trans-boundary natural resources regionally and internationally, the EMA requires participation in the implementation of environmental management measures to avoid and minimize trans-boundary adverse

environmental impacts to the detriment of the interests of other states and the environment. These obligations are imposed under Part XV of the EMA. Similarly, Part XII of the WRMA imposes similar obligations with regard to water. It requires the development of policies and strategies which ensure the sustainable, equitable utilization and management of trans-boundary waters.

The regional arrangements currently in place are: The East African Community (EAC) Treaty, the Lake Victoria Basin Commission's Protocol for the Sustainable Development of the Lake Victoria Basin, the Revised SADC Protocol on Shared Watercourse Systems and the Nile Basin Initiative for the shared Nile resources.

3.6.1 East African Community Treaty

As a member of the EAC, Tanzania has regional obligations under the EAC Treaty. Chapter 18 of the Treaty addresses agriculture and food security and, with regard to irrigation, the parties have agreed on improving water catchment management and adopting and promoting the use of environmentally safe methods of land use. Under Chapter 19 of the Treaty that addresses co-operation in environment and natural resources management, recognizing that development activities can have negative impacts on the environment leading to the degradation of the environment and depletion of natural resources, member states have undertaken to foster co-operation in the joint and efficient management and sustainable utilization of natural resources within the Community. This includes undertaking environmental management strategies to co-operate and co-ordinate their policies and actions for the protection and conservation of the natural resources and the environment against all forms of degradation and pollution arising from developmental activities, the control of trans-boundary movement of toxic material and to provide prior and timely notification of and relevant information to each other on natural and human activities that may or are likely to have significant trans-boundary environmental impacts and to consult with each other at an early stage.

The agreed objective is to preserve, protect and enhance the quality of the environment; to contribute towards the sustainability of the environment; to ensure sustainable utilization of natural resources like lakes, wetlands, forests and other aquatic and terrestrial ecosystems; and to jointly develop and adopt water resources conservation and management policies that ensure sustenance and preservation of ecosystems (Article 111 of the Treaty). The states' obligations with regard to co-operation on policies on the sustainable use and management of the environment extend to other natural resources such as forests (Article 114 of the Treaty), water and marine resources (Article 114(2)(b)) and wildlife (Article 116). Management tools such as the adoption of common environment control regulations, incentives and standards, the undertaking of environmental impact assessments of all development project activities and programmes and encouraging the manufacture and use of bio-degradable pesticides, herbicides and packaging materials, are among agreed measures to be taken by member states.

In undertaking development activities such as the irrigation developments contemplated under the NIP and NIMP, Tanzania must be mindful of its obligations under these Treaty arrangements. Enforcement of state obligations under the treaty arrangements rely to a large extent on domestic legislation in place and co-operation and co-ordination require that the domestic laws on the agreed area of co-operation be in harmony. The principles advocated under the treaty arrangements, such as the precautionary principle, the polluter pays principle, public participation, environment impact assessments and audits, the principle of prevention, minimization and control of pollution of watercourses, the principle of protection and preservation of ecosystems of international watercourses, the principle of community of interests in an international water course, the principle that water is a social and economic good and a finite resource and the

principle of subsidiarity, all require the parties to have domestic legislation in support of the implementation and enforcement of the principles.

Tanzanian legislation provides a sound basis on which it can meet its regional treaty obligations in implementing the NIP and NIMP.

Notification of other state parties of the planned activities within its territory that may have adverse effects on the other states will be the first step and, as required under the Treaty arrangements, sufficient time should be allowed to permit the parties to consult. Tanzania has an obligation to honor these Treaty requirements as is confirmed under domestic legislation (Part XII of the WRMA and Part XV of the EMA). Compliance with the treaty obligations and the domestic laws will lend momentum to the enforcement commitment necessary for the achievement of the treaty objectives.

3.6.2 The Lake Victoria Basin Commission's Protocol

The principles and objectives of the Protocol for Sustainable Development of Lake Victoria Basin (LVB Protocol) to which Tanzania is a party are the same as those agreed upon with regard to the sustainable use and management of the environment in the EAC Treaty to which this instrument is a Protocol. The LVB states all derive social and economic benefits from the resource. Recognition of the fact that development activities may have negative impacts on the resource leading to its degradation and depletion compelled them to come to an agreement to co-operate in a co-ordinated manner on its sustainable use and management. Accordingly, the state parties agreed to harmonize their legislative and other approaches to address the issues of sustainable development of Lake Victoria Basin.

3.6.3 Southern African Development Community, 2003

The Revised SADC Protocol on Shared Watercourse Systems (SADC Protocol) was ratified in September 2003, and its overall objective is to foster closer cooperation among member states for the judicious, sustainable and coordinated management, protection and utilization of shared watercourses. As a member of SADC, Tanzania has signed the revised SADC Protocol on Shared Watercourse Systems. Tanzania's obligations stemming from this Protocol are set out below:

- i. It must give information concerning the planned measures and if necessary, negotiate the possible effects of the planned measures on the shared watercourse;
- ii. Before implementing or permitting the implementation of planned measures which may have a significant adverse effect upon other Watercourse States, it must provide the States with timely notification and the notification must be accompanied by available technical data and information, including the results of any environmental impact assessment, in order to enable the notified States to assess the likely effects of the planned measures;
- iii. Unless otherwise agreed, it must allow the notified States a period of six months, extendable for a further six months within which to study and evaluate the possible effects of the planned measures and to communicate the findings to it;
- iv. It must cooperate with the notified States by providing them, on request, with any additional data and information that is available and necessary for an accurate evaluation and will not implement or permit the implementation of the planned measures without the consent of the notified States;
- v. If other state parties consider the measures to be inconsistent with Article 3 (7) or (10), consultations and negotiations must ensue for an equitable resolution of the situation having regard to the rights and legitimate interests of the other States and implementation should

not take place for a period of 6 months during the consultations if so requested by the other states;

- vi. If no notification has been given and the other states believe that the planned measures may have a significant adverse effect upon them, they have the right to request to be appropriately informed and to submit a document in support of their belief and set consultations in motion;
- vii. Use other than domestic or environmental use must be on a permit issued by the state authorities under the law, having regard to the rights of the other states.

In addition to these procedural requirements, the same obligations regarding sustainable use and management of the environment as set out in the other regional agreements discussed earlier also apply.

3.6.4 The Nile Basin Initiative, 1990

Similarly, the Nile Basin Initiative is a partnership among the riparian states of the Nile Basin and it seeks to develop the basin in a cooperative manner to achieve sustainable socioeconomic development through the equitable utilization of the common water resources of the Nile Basin. The Initiative is a civil arrangement amongst the nine participating states and it invites the parties to adopt obligations broadly similar to the obligations under the EAC Treaty with respect to the use of the shared Nile Basin. Any binding commitments that may result from the Initiative would stand to be implemented and enforced by member states through domestic legislation which parties would agree to adopt.

3.7 International Agreements and Conventions

3.7.1 Introduction

Tanzania is a party to many international agreements, conventions, and protocols that seek to protect the environment and ensure sustainable development. In recognition of the rights and obligations with respect to shared trans-boundary natural resources regionally and internationally, the Environmental Management Act requires implementation of environmental management measures to avoid and reduce potential trans-boundary environmental impacts that are detrimental to the interests of other states and the environment. These obligations are imposed under Part XV of the EMA. Part XII of the WRMA imposes similar obligations with regard to water. It requires the development of policies and strategies which ensure the sustainable, equitable utilization and management of trans-boundary waters. Table 3-2 gives a summary of the international commitments and agreements.

Table 3-2: Summary of the key International Commitments/Agreements and Tanzania Participation

S/No	International Commitments/ Agreements	United Republic of Tanzania
1	The UN Framework Convention on Climate Change (New York, 1992)	+
2	The World Meteorological Organization's Convention (Washington, 11 October 1947)	+

S/No	International Commitments/ Agreements	United Republic of Tanzania
3	Convention for the Protection of the World Cultural and Natural Heritage (Paris, 1972)	+
4	The Kyoto Protocol is a protocol which aims at fighting global warming. The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005	+
5	Ramsar Convention for the Internationally Important Wetlands Especially as Waterfowl Habitats (1971)	+
6	The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal (Basel, 22 March 1989)	+
7	Convention on the Environmental Impact Assessment in a Transboundary Context (EPS, Finland, 1991)	+
8	Stockholm Convention on Persistent Organic Pollutants (22 May 2001; has not come into force yet)	+
9	Convention on Biological Diversity (Rio de Janeiro, 1992)	+
10	Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)	+
11	Convention on International Trade in Endangered Species of Wild Flora and Fauna (Washington, 1973)	+
12	Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1998)	+
13	Rio Declaration on Environment and Development (UN Conference, 1992)	+

Key: "+" signed and ratified.

Source, BICO (2006), MTB/VPO/2004/2005/09

3.7.2 The United Nations Convention on Biological Diversity, 1993

This Convention, which calls for the sustainable use of biological diversity, was ratified by Tanzania in 1996. Most agro-ecological zones in the northern and southern highlands, to name but a few, and other wetlands ecosystems have a high biodiversity and may be affected in one way or another by the proposed irrigation development. Best practices for flora and fauna protection described in this SESA report.

3.7.3 The United Nations Framework Convention on Climate Change, 1992

Tanzania ratified the Convention in 1996. The Convention provides for guidance on emissions from the combustion of fossil fuels and land use change. Emissions reduction practices will be promoted by ensuring that all equipment combusting fossil fuels are well maintained and

efficiently operated and that best practices in clearing natural vegetation should be used to reduce destruction of carbon sinks.

3.7.4 The United Nations Convention to Combat Desertification, 1997

Tanzania ratified the Convention in 1997. The Convention calls for combating desertification. Tanzania is active in addressing this issue. A National Coordinating Body (NCB) has been set up in the Vice President's Office. The Office of the Vice President is the authoritative institution on policies and activities on the environment on behalf of the entire government. This office established a number of organs in May 1997 to facilitate the implementation of the Convention. These are:

- i. The National Steering Committee which is comprised of Directors and Commissioners of relevant government departments. UNDP and Tango (an umbrella NGO for environmental NGOs) are also represented in this committee. The Committee provides policy guidance on the implementation of the UNCCD;
- ii. The National Technical Committee. This is a multi-sectoral and multidisciplinary committee drawing members from different government departments, public institutions, NGOs and the Private Sector. It provides technical guidance on the NAP process;
- iii. The National Secretariat on NAP. This is made up of a team of six members. It is responsible for offering technical inputs and closely facilitates the NAP process.
- iv. The National Focal Point is housed by the Vice President's Office in the Division of Environment. A National Coordinator was designated and assigned the responsibilities of coordinating and leading the NAP Secretariat and the Technical Committee.

Efforts by the NGO community within the NAP process are coordinated by an NGO Focal Point which was chosen in their meeting on the UNCCD. An NGO Coordinating Committee to combat desertification has been established to facilitate the implementation of the Convention and network with sub-regional, regional and international NGOs active in the context of the convention.

3.7.5 The World Bank's Safeguard Policies

This SESA study has been designed to comply with all the environmental laws of the United Republic of Tanzania and the Environmental and Social Safeguard Policies of the World Bank. In this section, the Bank's safeguard policies and their applicability are briefly discussed.

The World Bank Safeguard Policies applicable are summarized in Table 3-3.

Table 3-3: World Bank Safeguard Policy

S/No	World Bank Safeguard Policy	Policy Applicability	Reasoning/Notes
1	Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)	Yes	Category A Project Direct impacts perceived External impacts perceived
2	Natural Habitats (OP 4.04, BP)	Yes	Wherever irrigation expansion will affect officially recognized Natural Habitats
3	Forestry (OP 4.36, GP 4.36)	Yes	To see to it that irrigation areas are not situated in forests; irrigation development should not involve unsustainable deforestation practices
4	Pest Management (OP 4.09)	Yes	Increase in cultivated area, hence an increase in the application of pesticides, insecticides and herbicides in absolute terms
5	Physical Cultural Resources (OP 4.11)	Yes	No significant cultural resources were identified during the field reconnaissance survey in the project area yet, triggered for Precautionary reasons. Provisions for chance-find procedures are obligatory.
6	Indigenous Peoples (OD 4.20)	Yes	Irrigation expansion and intensification should not affect distinctive indigenous ethnicity with distinct cultural characteristics
7	Involuntary Resettlement (OP/BP 4.12)	Yes	There may be small scale involuntary resettlement required for the construction of the irrigation infrastructure and large scale dams
8	Safety of Dams (OP 4.37, BP 4.37)	Yes	There are intentions to create large scale dams in the NIP and the NIMP
9	Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)	Yes	There are shared water resources in Tanzania borders
10	Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)	No	Project area is within the sovereign territory of The United Republic of Tanzania.

3.8 Analysis of the Institutional and Regulatory Environments

This section of the Strategic Environmental and Social Assessment (SESA) analyzes the institutional and regulatory environments within which the Vice President's office and the ministry responsible for irrigation policy will review, refine, and implement the NIP and the NIMP. The objective of the analysis is to develop a process by which the GoT will "mainstream" environmental issues through a periodic review and refinement of the National Irrigation Policy (NIP) and which manages National Irrigation Master Plan (NIMP) irrigation development within the

NIP. This process formed the basis for the Strategic Environmental Management and Monitoring Plan.

The SESA review and refinement process adheres to the existing legal obligations that govern environmental and water management. This SESA, thus, provides an opportunity for the assessment of the regulatory environment that determines the legal obligations that apply to the NIP and the NIMP.

Where existing legislation inadequately addresses the environmental and social concerns of stakeholders and the proposed mitigation measures, recommendations are made for the formulation of the laws and regulations that are required to provide a framework for the refinement and implementation of irrigation policy and development.

Legislation – laws and regulations – is a necessary requisite to any approved policy as it makes the policy binding and enforceable to all, including the State, which is composed of the Government and the people. An institutional environment that manages and enforces legislation is a necessary requisite for implementation of policy and its associated legislation.

3.9 Institutional Environment

3.9.1 The Vice President's Office

On February 8th, 2005, the Environment Management Act (No. 20), 2004, was signed into law. This act provides the legal and institutional framework for the sustainable management of the environment. Part VII of EMA No. 20 of 2004 provides details of the administrative and institutional framework for the environmental management in Tanzania. All environmental issues in Tanzania are regulated and controlled by the State Minister, Vice President's Office - Environment. Thus the Vice President's Office is responsible for monitoring environmental planning, monitoring, and management as well as policy issues throughout the country. The Minister responsible for the Environment is the Minister of State in the Vice-President's Office – Environment. The Minister is responsible for all matters relating to environmental regulation and management. With regard to this SESA, it is the final approval authority.

This Minister approves SESA reports. The Minister may also delegate the power of approval for an EIA to the DOE, Local Government Authorities or Sector Ministries. The Minister also:

- i. Prescribes (in the regulations) the qualifications of persons who may conduct an EIA;
- ii. Reviews NEMC reports on the approval of an EIS;
- iii. Issues EIA certificate for the project subject to an EIA; and
- iv. Suspends EIA certificate in case of non-compliance. National Environmental Advisory Committee

The National Environmental Advisory Committee (NEAC) is the top advisory body to the State Minister, Vice President's Office, Environment or to any sector ministry on any matter concerning the environment. The NEAC is comprised of members from various fields of environmental management in the public sector, the private sector and the general population. The members of the NEAC are specified in the first schedule of the EMA No. 20 of 2004. The Permanent Secretary, Vice President's Office, chairs the NEAC. Other members include:

- i. Director of Environment – Secretary;

- ii. Director General of National Environment Management Council;
- iii. Commissioners for Minerals and Energy;
- iv. Representatives from Attorney General and Ministry of Community Development
- v. Directors of Sector Ministries, including Local Government, Disaster Management, Roads, Human Settlement, etc;
- vi. Chief Government Chemist; and
- vii. Representative from Higher Learning Institution, Civil Societies Organizations and Private Sector.

3.9.2 Division of Environment

The Division of Environment (DoE) deals with the development of environmental policy and coordination of its implementation. It also plays an advisory role to the government on all matters pertaining to environmental management. It is the institution responsible for reviewing SESA's and for recommending approval or disapproval of the SESA.

The Division of Environment has the following overall functions:-

- i. Formulation of policy on Environment;
- ii. Co-ordination and Monitoring of Environmental issues;
- iii. Environmental Planning; and
- iv. Policy-oriented Environmental Research.

3.9.3 National Environment Management Council

The National Environment Management Council (NEMC) has the overall responsibility of undertaking enforcement, compliance, review, and monitoring of Environmental Impact Assessments. The NEMC is responsible for ensuring that all development projects in Tanzania comply with all relevant environmental laws. The Environment Management Act (Cap 20), 2004 specifically states that NEMC's role is to review and recommend for approval EIA's. It also enforces and ensures compliance of the national environmental quality standards.

The NEMC is mandated to:

- i. Review Environmental Impact Statements (EIS) and conduct environmental monitoring and auditing of projects and facilities;
- ii. Undertake and co-ordinate research, investigation and surveys in the field of environment and collect, and disseminate information;
- iii. Carry-out research and surveys for the proper management and conservation of environment;
- iv. Render advice and technical support to entities engaged in natural resources and environmental management;
- v. Initiate and evolve procedures and safeguards for the prevention of accidents which may cause environmental degradation;

- vi. Enhance environmental education and public awareness; and establish and operate national environmental information system for sound environmental management;
- vii. Publish and disseminate manuals, codes and guidelines relating to environmental management and prevention or abatement of environmental degradation;
- viii. Issue restoration and recommend for easements orders, and save prohibition notice; and
- ix. Train District Facilitation Team Members (DFTs) and Zonal Environmental Specialists to carry out monitoring.

NEMC also undertakes any other functions as assigned by the Minister such as Integrated Coastal Zone Management (ICZM) (<http://www.nemctan.org/mandate.htm>). Once NEMC approves an EIA for a project that abstracts water from rivers, the relevant River Basin Office is responsible for issuing and managing the water use permits.

3.9.4 Committees on the Environment

3.9.4.1 Regional Policy Committee

The NEP mandates that there shall be a policy committee on the environment at the regional level. This committee is composed of the region's District Commissioners and chaired by the Regional Commissioner. This committee "...shall deal with matters of regional interest affecting the environment; and shall provide policy guidance or propose policy measures and actions.

3.9.4.2 District, Ward, and Village Committees

The NEP further stipulates that the Regional Environmental Policy Committee (REPC) shall be assisted by District, Ward and Village Committees on the Environment (respectively DCE, WCE, and VCE), which are under the auspices of their respective District, Ward and Village Councils. These Committees shall be responsible for coordinating and advising on obstacles to the implementation of environmental policy and programmes; to promoting environmental awareness; and to gather and disseminate information on the environment relating to the district, ward or village.

3.10 Environmental Regulatory Environment

3.10.1 Environmental Management Act, No. 20 of 2004

The Environmental Management Act, No. 20 of 2004 (EMA) codifies the Tanzanian policy on the management of all matters that impact on the environment. Although there is other legislation that deals with specific aspects of the environment, the EMA is the legislation guiding all environmental matters and all other legislation that deals with the environment must be compliant with the environmental management principles set forth in the (EMA). According to section 2 of the EMA, "environment" covers all the physical attributes of the surroundings of human beings, including land, water, climate, micro-organisms, the biological factors of animals and plants, cultural resources, aesthetics, and socio-economic factors, including the natural and the built environment and their interaction. "Environmental management" requires the protection, conservation and sustainable use of the various elements of the environment (section 2, EMA). "Sustainable use" and "sustainable development" require the maintenance of the carrying capacity of supporting ecosystems through use or development of the environment without compromising the ability of future generations to meet their needs (section 2, EMA).

3.10.2 Strategic Environmental Assessment Regulations, 2008

It is mandatory, under Part VII of EMA, that any proposed laws, national policies, strategies, plans or undertakings, be subject to a Strategic Environmental Assessment to assess the potential effects of the proposal on the sustainable management of the environment. In the irrigation development sector, there is a range of environmental concerns that must be addressed.

This regulation sets forth the requirements of a SESA conducted in Tanzania. This regulation requires that the potential environmental impacts of a piece of legislation, policy, plan, strategy or program are taken into consideration at the earliest possible stage in the decision making process. The regulations stipulate that environmental considerations should be on par with economic and social considerations.

The objective of any strategic environmental assessment conducted under the Act or under any other written law is to:

- i. Ensure that environmental concerns are thoroughly considered in drafting bills, regulations, plans, strategies, or programs;
- ii. Enable the public to contribute to the consideration of environmental concerns in the preparation of bills, regulations, plans, strategies, or programs;
- iii. Establish clear, transparent, and effective procedures for the formulation of bills, regulations, policies, strategies, plans, or programs; and
- iv. Integrate environmental concerns into measures and instruments designed to further sustainable development.

The Director of Environment is responsible for coordination of consultation in relation to the strategic environmental assessment, and the Sector Environmental Coordinator ensures that strategic environment assessment of Bills, regulations, policies, strategies, programmes or plans as provided for under these regulations and the Act is carried out in the respective sector Ministry and all parastatal organizations under its respective jurisdiction.

The Sector Ministry submits to the Minister of State in the Vice-President's Office – Environment, a Strategic Environmental Assessment Report prepared in the format as specified below:

- i. An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant Bill, regulations, policy, strategy, plans and programmes;
- ii. The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the Bill, regulations, policy, strategy, plan or programme;
- iii. The environmental characteristics of areas likely to be significantly affected;
- iv. Any existing environmental problems which are relevant to the Bill, regulations, policy, strategy, plan or programme;
- v. The environmental protection objectives, established at national level, which are relevant to the Bill, regulations, policy, strategy, plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation;
- vi. The likely significant effects on the environment, including short, medium and long-term effects, magnitude and extent of impact, likelihood of occurrence, reversibility, permanent and temporary effects, positive and negative effects, and secondary, cumulative and

- synergistic effects, on issues such as biodiversity, population, social, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage, including architectural and archaeological heritage, landscape, and the inter-relationship them;
- vii. The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the Bill, regulations, policy, strategy, plan or programme;
 - viii. An outline of the reasons for the selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;
 - ix. A description of the variables and measures envisaged for monitoring;
 - x. A non-technical summary of the information provided under items i to ix, and
 - xi. Comprehensive Swahili version of the non-technical summary.

3.11 Water Resources Regulatory Environment

3.11.1 Introduction

The Water Resources Management Act, 2009 (WRMA) introduced integrated water resources management principles into the management of Tanzania's water resources. A widely accepted definition of IWRM is that by the Global Water Partnership:

“a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.”

IWRM recognizes the inter-connected nature of the hydrological cycle and promotes a river basin perspective to the management of water resources, even where the basins cross administrative and political boundaries. The WRMA defines water resource management as planning the development of water resources, implementing the plans and all measures for allocation, conservation and controlling the use of the water resource, all with public participation. It calls for development without compromising the environment, seeking a balance that supports the natural systems and the social systems that define the ever-growing demand, disposal and pollution of water, and social sustainability.

A growing demand for food, growing competition between agriculture and other subsectors, such as hydropower generation, for water, insufficient safe drinking water, inadequate infrastructure, low land and water productivity, deterioration in the environment from soil erosion, water logging and salinization all attest to the need for the integrated and co-ordinated approach to the water resource management required by the WRMA.

3.11.2 Water Resources Management Act: 2009

Section 6 (2) of the WRMA sets water allocation priorities to be:

- i. First, for domestic use;
- ii. Second, for environmental flow; and
- iii. Third, subject to the availability of water, for socio-economic activities.

Irrigation is in the socio-economic category. Before any planned major water project is implemented, a Strategic Environmental Assessment is required to assess the impact of the water project (section 8, Part II of the WRMA); and before a proposed irrigation development is implemented, an EIA must be carried out (section 9, Part II of the WRMA).

Section 20, WRMA, establishes the National Water Board. The first schedule of the WRMA sets forth the membership of the National Water Board. Irrigation is specifically indicated as a sector that is to be represented on the National Water Board. Section 22 establishes the Basin Water Boards. The second schedule of the WRMA sets forth the membership of the Basin Water Boards. The second schedule, unlike the first schedule, does not specifically indicate that irrigation is to be represented. Agriculture is to be represented as is the Ministry responsible for water. It can only be assumed that irrigation will be represented through the member responsible for representing the agricultural sector.

Allocation of water to the competing demands for water in any basin area will be granted by the issuance of water use permits and will be based on the water resource-management plans in place and the availability of water in the basin concerned, subject to the prescribed allocation priorities.

In addition to issuing water use permits, the Basin Water Boards shall grant or renew:

- i. Discharge permit;
- ii. Groundwater permit;
- iii. Easements; and
- iv. Any Water Users Association (WUAs) established under Part VIII, WRMA.

The Basin Water Board shall maintain a water register for the registration of all permits, easements, and WUAs. The information shall be forwarded to the Director of Water Resources who shall establish a National Water Register of Water use Permits, Discharge Permits, Groundwater Permits, easements granted under the WRMA, and WUAs established under the WRMA.

One of the main duties, Part V, of the WRMA is the development of 5-year National Integrated Water Resource Management Plan. This national plan is prepared using the integrated water resources management plans prepared by the Basin Water Boards and the Catchment Water Committees. The plans determine the available water resources against the demands for water at the respective levels. These water-resource management plans are supposed to show whether the demands for water can be supported by the available resources and if not, water-demand management programmes should be a component of the plans.

Water resource management planning provided for under Part V of the WRMA requires the irrigation sector to play an active role in ensuring that its needs are considered and catered for within the framework of the plans at each level. The inclusiveness of the WRMA allows the representation of all interests in water in any basin.

3.11.3 Water Use Permits

Anyone who diverts, dams, stores, abstracts, or uses water from any surface or underground water source or for any such purpose constructs or maintains any works shall apply for a Water Use Permit (section 43, Part VII of the WRMA). Irrigation, as a water user, requires a water use

permit to use water. The WRMA sets out provisions subject to which permits will be issued and these include provisions relating to quantities to be abstracted, pollution, the proper drainage of the land and the review of permit allocations under conditions of drought or low flows.

The WRMA is a new Act. Many regulations to facilitate its implementation are in the process of being developed. The regulations will prescribe or give guidelines as to the discharge by basin water boards of their functions in the management, regulation, protection, monitoring and conservation of water resources. Water permits are currently being issued even though the water resources management plans are not yet in place as these too are still to be prepared.

The irrigation sector will also have to deal with issues relating to the classification of water as required under section 32 of the WRMA. Depending on the class to which a water resource has been assigned, the use of the water from the particular resource must be subject to the need to meet the quality requirements for the source. Particular water uses for in-stream or land based activities may be prohibited or regulated in order to protect particular water resources.

3.11.4 Groundwater Use Permit

Permits are also required for the abstraction and use of groundwater in any basin. Section 54, Part VII, requires that, "...any person who intends to construct, sink, enlarge, or deepen a well or borehole in a Groundwater Controlled Area declared under section 38 or any other area, shall apply for a Groundwater permit."

Whether or not groundwater can be used for irrigation will depend on the conditions set by the Basin Water Board in the permit. The conditions will be determined by considering basin wide and aquifer wide demands and the safe yield from any aquifer for purposes of sustainable abstraction (section 61 of the WRMA).

3.11.5 Discharge Permits

Section 63, Part VII, WRMA, stipulates that anyone, "...who wishes to discharge effluents from any commercial, industrial or agricultural source or from any sewerage works or trade waste systems or from any other source into surface water of underground strata shall apply to the Basin Water Board for a Discharge Permit...".

3.11.6 Water Users Associations

Section 80, Part VIII, indicates that Water Users Associations (WUAs) may be formed "...by the agreement of the majority of a group of water users (Irrigation, Livestock, Domestic, Industry Mining, Fisheries ets)". "The association of water users...shall comprise ...any user of water from a common stream irrespective of the purpose of that use.

The specified purposes for which WUAs may be formed are any one or a combination of the following:

- i. The management, distribution and conservation of water from a shared water source;
- ii. The joint acquisition and operation of any permit;
- iii. The resolution of conflicts between members of the association with regard to the joint use of a water resource;
- iv. Collection of water user fees on behalf of the Basin Water Board;
- v. Representing the special interests and values relating to water used for public purpose such as in a conservation area.

However, once a WUA is registered, all water users in the area using the common source of water, irrespective of the purpose of the individual uses, will be required to become members of the WUA and will be bound by the constitution of the WUA. WUAs in the context of the WRMA are not confined to irrigation as is the cases in some jurisdictions but embrace all water users in any given area. They should therefore not be construed as organizations of irrigators.

3.12 Land Resources Regulatory Environment

3.12.1 Land Tenure

A number of statutes deal with land tenure in Tanzania. The Land Act classifies land into general land which is land governed by the Land Act, 1999; reserved lands, which are lands designated for various purposes as described in the foregoing paragraphs and governed by the different Acts as described therein; and village land governed mainly by the Village Land Act, 1999. Compensation for the compulsory acquisition of land is also provided for by the Land Acquisition Act, 1967.

3.12.2 Land Tenure and Irrigation Development

The NIP and NIMP raise the concern that the lack of secure tenure to land and the long drawn out procedures involved when seeking to transfer rights of occupancy are not conducive to efficient processing of commercial loans from financial institutions. For irrigation development to proceed at the accelerated rate envisaged under the NIP and NIMP, it has been argued that rights in land and their transfer must give individuals intending to invest in agro-industry confidence in the system. In agro-finance just as in any other lending situation, security is a necessity. It can be the land, the infrastructure on the land, plant and equipment, crops or livestock. This wide range of possible collateral cover could be exploited to give irrigation development the impetus it requires but property rights must be clearly defined to make it easy and possible for financiers to enforce their rights in the event of failure by borrowers to discharge their loan obligations. This is necessary to allow the investment that is required for the capital-intensive development of the irrigation sector.

Amendments to the land Acts following their enactment in 1999 show an incremental enhancement of the commercial value of the right of occupancy. By virtue of these amendments, the right of occupancy has been accorded a tradable value. Correspondingly, the rights that go with mortgages have also been enhanced to permit lenders to recover on their investments. However, the mechanisms for enforcing rights under a mortgage agreement are far from swift. Under section 123 of the LA, foreclosures are outlawed. The process of disposition of land under Sub-Part 3 of the LA, which cannot be carried out without the intermediation and approval of the land Commissioner, is also far from swift. Restrictions with respect to the mortgaging of village land provided for under section 113 of the LA are just as stringent.

In brief, the current position is that there is a right of occupancy/lease in land (also available to a foreign individual or corporation for investment purposes) of up to 99 years. The right has a ceiling as to the size of land. The land must be surveyed and registered. It must have a tradable value that can be mortgaged. The right must be capable of disposition, revocable for non compliance with any conditions; and liable to compulsory acquisition on compensation

An alternative approach to the current position obviously calls for a policy decision that would:

- i. Liberalize the disposition process;
- ii. Respect the sanctity of contract and limit courts intervention to interpretation and enforcement of the wishes of the parties

- iii. Permit foreclosures or allow a swift process of enforcement of mortgages; and
- iv. Devise efficient mechanisms to facilitate transfer of rights in land.

Other regulations in place in support of the implementation of the aspects of the foregoing are as follows:

- i. Land (Disposition of Right of Occupancy) Regulations, 2001 (L.N. No. 74 of 2001);
- ii. Land (Conditions of Rights of Occupancy) Regulations, 2001 (L.N. No. 77 of 2001);
- iii. Land (Ceilings on Land Occupancy) Regulations, 2001 (L.N. No. 80 of 2001); and
- iv. Land (Small Mortgages) Regulations, 2001 (L.N. No. 75 of 2001).

The descriptive titles are indicative of the content and therefore are self-explanatory.

3.12.3 Compensation for Compulsory Acquisition of Rights in Land

The right to compensation for loss of a granted right of occupancy or a customary right of occupancy acquired whether in pursuance of provisions of the Land Act or Village Land Act, is asserted in accordance with the following regulations, which set out the framework within which claims for and payment of compensation takes place.

3.12.3.1 Land (Compensation Claims) Regulations, 2001 (L.N. No. 79 of 2001)

These regulations set out the procedure for making claims for compensation and the forms of compensation payable. They apply to all claims for compensation in relation to all rights in land acquired whether under the Land Act or the Village Land Act. It is provided that compensation will be monetary or, at the option of the government, a combination of all or any of a plot of land of comparable quality, extent and productive potential as the land acquired, a building(s) of comparable quality, extent and use as the building(s) acquired, plants and seedlings or a supply of grain and foodstuffs for a specified period.

3.12.3.2 Land (Assessment of the Value of Land for Compensation) Regulations, (L.N. No. 78 of 2001)

This instrument regulates the valuation of land for purposes of compensation. Compensation is payable for loss of interest in land includes the value of un-exhausted improvements, disturbance allowance, transport allowance, accommodation allowance and loss of profits. The manner of determining the monetary value for each of these items is set out in the regulations.

Section 3 (f) of the Act stipulates that one has “to take it to account that Land has value and that value is taken into consideration any transaction affecting that interest.” This means if you acquire land, one will have to compensate owners for bare land in addition to un-exhausted improvements.

Section 3 (g) of the Act, requires “to pay full, fair and prompt compensation to any person whose right of occupancy or recognized long standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the state under this act or is acquired under the Land Acquisition Act.” Registered Professional Specialist will determine the amount of compensation payable on the market value of land or property and the concept of opportunity cost. Also the Act contains provisions of critical environmental importance. One of important

fundamental principles of the Land Act 1999 is “to ensure that land is used productively and that any such use complies with the principles of sustainable development”.

3.12.3.3 Land (Management of the Land Compensation Fund) Regulations, 2001 (G.N. No. 82 of 2001)

The regulations apply to all application or claims for compensation against the government or Local authority or any public body or Institution and they also cover compensation which may be claimed by occupier. These regulations constitute the Board of the Land Compensation Fund. Its function is to verify claims forwarded to it by the commissioner for lands after they have been made by claimants and to make payments out of the Fund.

3.12.3.4 The Land (Schemes of Regularization) Regulation, 2001

Under the Land Act, 1999 Section 60(1) an area can be declared to be a regularization area. Regularization of an area involves the following: For avoidance of doubt, no scheme or regularization shall be implemented until occupation and uses of land by those persons living and working in the area have been recorded, adjudicated, classified and registered. It is therefore evident that in the regularization process, demolition of houses for building schools, health facilities, roads or and line infrastructure might occur in certain cases. If that happens, some people will certainly be affected by a resettlement exercise.

3.12.4 Land Acquisition Act, 1967

The general power for the acquisition of land required for any public purpose is governed by the Land Acquisition Act (LAA). Amongst purposes regarded as a public purpose is the acquisition of land for development of agricultural land or for use by any persons who is considered should be granted land for agricultural development (section 4 of the LAA). This Act outlines the procedures for the acquisition of the land and the determination and payment of compensation for the land and any improvements on the land. Where alternative land has been given in exchange for the acquired land, or where the land is land referred to in the Rural Farmlands (Acquisition and Re-grant) Act, Chapter 22 (which is essentially public land leased from or held on a grant based on contract), no compensation is payable for the land. Significant under this Act is the short period of notice (six weeks) within which persons occupying land that is acquired for a public purpose are required to vacate the land. Further, vacation of the land will be required whether compensation has or has not been paid. Promptness in the determination and payment of the compensation is not a requirement under this Act quite unlike the situation under the Land Act and the Village Land Act.

3.12.5 Land Use Planning Act, 2007

Before allocating land to any use, the Land Use Planning Act (LUPA) requires that land use plans that are prepared by the land use planning authorities at the national, district and village levels be adhered to in order to ensure national co-ordination and physical development within zonal land use frameworks. Under Part V, LUPA calls for co-ordination of various land use management activities undertaken by any lead agencies to get any land use considerations integrated into development policies, plans, programmes and projects. Because land use framework plans are subjected to EIA, inter and intra district and inter-sectoral co-ordination among lead agencies is required to enable coordinated physical development and systematic land use in each zone, region, district and village. Under section 27 of LUPA, areas planned for irrigation development must take cognizance of any land use plans in place, especially as these must contain land suitability assessments consisting of:

- i. Technical reports on the physical characteristics and resources of the land;
- ii. Description and analyses of current use and general condition of the land;
- iii. Suitability of the land for the proposed land uses;
- iv. Community needs in the area or zone; and
- v. An EIA.

Land use plans must, in terms of section 28 of LUPA, contain proposals with regard to, among many others:

- i. The determination and designation of land for various uses including cropland, rangeland, forestland, water sources, farming and industry;
- ii. Preservation of traditional or protected or other sensitive areas, parks, game reserves, etc;
- iii. Preservation of quality and flow of water in dams, rivers, lakes or aquifers;
- iv. Preservation of any outstanding geographical, ecological and archeological features; and
- v. Promotion of regulation of the scope of any agricultural or pastoral activity.

Land use plans can be modified if stakeholders, with good reason, demand it.

Under section 71 of the EMA, the Minister responsible for the environment can give general or specific environmental and land-use planning directives to be incorporated or taken into account in the allocation of land to any use under LUPA.

3.12.6 Reversal of Land Uses

In section 1 (4) of the Land Act, land is classified into three categories: general land, reserved land and village land. Reserved land encompasses land reserved, set aside or designated under the provisions of various Acts as earlier dealt with such as under the WCA, the National Parks Act, the Forest Act, the Ngorongoro Conservation Act, etc. Under section 1(7), the President has power, by order published in the Gazette, to transfer or exchange land from one category of land to another category. Under section 5 of the Land Act, any reserved land can be transferred to village land. In the case of transfers of reserved land, any transfer must be subject to the provisions of the law governing the particular type of reserved land. For example, in terms of the National Parks Act, a declaration of a national park cannot be revoked except with the authority of Parliament. In terms of section 29 of the Forest Act (as read with section 23 which sets out the procedure for revocation), the Minister can revoke a declaration of a forest provided the procedures set out in section 23 of the Forest Act are complied with. Neither the WCA nor the EMA have similar provisions with regard to the revocation of designated wetlands. It seems therefore that the transfer of reserved land to general land or to village land under the Land Act is one way available for the revocation of the protection of wetlands. Apart from these provisions, there seems to be no direct provisions for the revocation of designations of wetland reserves.

If it is conceivable that in some instances consideration may have to be given to some revocations of some of the land from reserved or protected land and village land to general land to allow for the reallocation of land to commercial irrigation.

3.13 Identified Potentially Significant Issues

As discussed in Section 5 of this SESA, the NIP organizes its 137 policy statements into ten (10) policy categories. On the basis of functional similarity of intent, this SESA re-grouped the 137 policy statements into six (6) themes enabling a systematic and focused analysis of the potential impacts of the NIP proposals.

Amongst the broad categories of issues that have been identified as arising out of the NIP and NIMP, the following have a bearing on the legal aspects of this SESA:

- i. The regulatory framework: its scope, enforcement and compliance issues and the necessary legislative changes in support of irrigation development;
- ii. Land tenure issues: the nature of rights in land, demarcation of irrigated land, improvement of the institutional organization of irrigation schemes and legislative changes in support of irrigation development; and
- iii. Water resource management: the development of large scale water storage structures; inter-basin water transfers and regulation of use of groundwater.

3.13.1 General legal Considerations

The NIP and NIMP raise a broad range of legal issues that must be addressed in order to permit a smooth and efficacious implementation of the declared irrigation policies, which anticipate a very significant expansion of the irrigation sector.

The expansion of the irrigation sector at the level anticipated in the NIP has environmental, land tenure, trans-boundary, organizational/institutional and social implications with their associated legal implications.

3.13.2 Protection of Environmentally Sensitive Areas and Wildlife Habitat Networks

The criteria used by the NIMP to define the level of development potential are the availability of land, water and human resources. It is possible that the revealed potential irrigable area includes fragile ecosystems (e.g., the wetlands). This is being analyzed and reported. Tanzania is a signatory to a number of international agreements, conventions and protocols that give her a set of international obligations.

3.13.3 Protected Species

The first and more general issue relates to the protection of game species roaming from Protected Areas into the irrigated lands. Furthermore, several rare and protected species are found within the aquatic systems, many of which are sensitive to changes in hydrology and water quality.

3.13.4 Surface and Ground Water Quality

The irrigation development potential is assessed from the water resources potential, land resources potential, and socio economic aspects while other factors like water quality are not factored in. There is a need to revise the potential area considering the quality of water.

3.13.5 Land Issues

A fundamental issue relates to land tenure rights for persons within irrigated land. This issue lies at the very core of irrigation development. The NIP and NIMP point to the need for reforming the land tenure system to introduce land ownership and sales systems (for example freehold or long leasehold), which are necessary to facilitate the high level of capital investment required for the capital-intensive development of the irrigation sector.

3.13.6 Involuntary Resettlement

The envisioned expansion of the irrigation area may result in the displacement of people from their homes and land. This particularly applies to the construction of dams with their associated impoundment of areas.

Any involuntary resettlement will be dealt with in accordance with the resettlement criteria set in the Environmental and Social Management Framework (ESMF) and the Resettlement Policy Framework (RPF) documents which are operative documents for the ASDP environmental safeguards.

3.13.7 Institutional Arrangements in Irrigation

The lack of clarity with respect to the organizational/institutional arrangements governing the irrigation sector whereby home ministry is not clearly or statutory fixed

3.13.8 Inadequate Enforcement of Existing Laws and Regulations

Lack of enforcement of the law: stakeholders have expressed the opinion that without proper enforcement, policies, laws and regulations will have no meaning.

All issues are addressed in the legal review and analysis under the appropriate subjects.

3.14 Legal Framework for Irrigation Development and Management

3.14.1 Introduction

Both the NIP and NIMP raise concerns regarding inadequacies in the legal and institutional set up for the development and management of the irrigation sector. This comes against the background of both dwindling financial support for irrigation from the government and the failure in the organizational set up of the irrigators in delivering desired results. Part of the failure has been attributed to weaknesses in the organizational structure used coupled with inadequate allocation of money to do the following at the level of Best Professional Practice:

- i. Feasibility studies;
- ii. Environmental examinations and assessments;
- iii. Design;
- iv. Construction management; and
- v. Management, Operations and Maintenance (MOM) of irrigation infrastructure.

On p. 61 of the NIMP, concerns are expressed about forming irrigators' organizations (groups) by registering them as co-operative societies. It is considered that irrigators associations are more proper as they indicate more dedication to irrigation interventions.

3.14.2 Emerging Trends

With regard to a legal/regulatory management framework for the irrigation sector, it is proposed that, for the accelerated development of irrigation to take place as by the NIP and NIMP, there must be a separation of irrigation interests from other interests to permit proper focus on irrigation matters. This will strengthen irrigation development. Separate legislation for the irrigation sector is considered imperative to emphasize its importance as a sector.

State funding of irrigation systems, both in Tanzania and elsewhere, has proved unsustainable. This has resulted in the substantial deterioration of infrastructure, with systems in major disrepair and unable to meet farmer demands for water. Different approaches for the management, operation and maintenance of small holder irrigation infrastructure have been emerging in different parts of the world. For systems that are reliant on state funding, a growing international momentum is to introduce users into irrigation management, whether in the form of participatory irrigation management (PIM) or irrigation management transfer (IMT). These management models involve users participating, at different levels, in MOM.

3.14.3 Participatory Irrigation Management (PIM)

Participation in irrigation management by water users can be at different stages in the project cycle. Farmers can be involved in system management functions, such as planning, design, operation, maintenance, rehabilitation and mobilization of resources. Moreover, involvement can be at various levels of the irrigation system depending, at any given time, on the capacity of users to undertake particular functions, from the field channel level to the system level. Introduction of PIM does not refer to a specific manner of user participation but to different levels, modes or intensity of such participation that would increase farmer responsibility and authority in management processes.

3.14.4 Irrigation Management Transfer (IMT)

Irrigation Management Transfer (IMT) on the other hand refers to a process of the handover of some irrigation management functions from a public agency to a private sector entity, a non-government organization, a local government, or to a local-level organization with farmers at its base.

The most common are transfers of management responsibility from a centralized government irrigation agency to an independent local-level non-profit organization which is either controlled by the water users of the irrigation system or in which water users have a substantial control in the process and are required to be financially independent. It must be noted this refers to a transfer of the management of the infrastructure and not a transfer of ownership of the infrastructure.

3.14.5 Irrigation Entities

The organization of the entities involved in PIM or IMT is a key aspect in the success of irrigation development. The entities have taken various forms and in some instances, the variations are in name only rather than substance. In some instances, the particular form of the organization involved has not met the needs of the users.

3.14.6 The Co-operative Society

Long used by farmers, the co-operative society has been one option commonly employed as the irrigation entity for purposes of PIM or IMT. The principles governing the institutional structure of a co-operative society have long been established and are often governed by legislation and the by-laws made by the members of the society.

3.14.7 Irrigators Organizations (IOs)

Irrigators Organizations (IOs) are the lowest appropriate level of management of irrigation schemes. The main functions of these organizations include management, distribution and conservation of water for irrigating their schemes, acquisition of water use permits from the respective Basin Water Offices, resolution of conflicts among members of the organizations related to the joint use of a water resource and collection of water charges for operation and maintenance and payment of water user fees to the Basin Water Offices.

3.14.8 Other Types of Irrigation Organizations

Other entities such as Irrigation Association, Irrigation Trust are similar entities which provide, manage and operate shared infrastructure for the collection and delivery of water (irrigation systems) or for the drainage of land (drainage systems). They have very much the same organizational structure as referred to above and uniformly, all the organizations, co-operative societies and WUAs included, are, in more cases than not, bodies corporate with perpetual succession, capable of suing and being sued in their corporate names and capable of owning property. This status is commonly legislated.

The fundamental difference between irrigation services and other services, such as offered by a co-operative society, is not always understood. Irrigation services are often communal by nature since farmers in an area usually have no choice but to use a common water source. Other services such as agricultural inputs supply do not have the same character. Farmers can refuse a service of this kind if it fails to satisfy them but farmers cannot refuse the irrigation service, whether this service satisfies them or not. In addition, the profit motive inherent in co-operative societies is not characteristic of the co-operation required in irrigation services. It is for these reasons that irrigation water users demand a separate legal framework, supplemented by rules, regulations or by-laws, within which to manage irrigation affairs.

3.15 Irrigation Trusts

Different forms of legislation have been developed for different jurisdictions and have inevitably been influenced by the level of sophistication of irrigation development and water resources management in that jurisdiction. Nevertheless, as already pointed out, the basic similarities across jurisdictions persist. A recent example of the type of legislation enacted for these purposes is the South Australia Irrigation Act 2009 in which irrigation entities are referred to as irrigation trusts. The Act provides a framework for the management and operation of shared infrastructure for irrigation or drainage. Some of the features of the Act are:

- i. It enables farmers wishing to establish an entity to provide, manage and operate shared infrastructure for the collection and delivery of water (irrigation systems) or for the drainage of land (drainage systems) to apply to the Minister for the establishment of a trust to provide an irrigation system or a drainage system (or both) in connection with farming operations conducted by persons who will become members of the trust;
- ii. The trust must comply with requirements prescribed by the regulations; and
- iii. Irrigation trusts are legal entities.

The trust can have a set of rules relating to the membership, management or operations of the trust which:

- i. Must comply with any prescribed requirements;
- ii. May provide for or regulate the times at which irrigation water may be used; and
- iii. May provide for other matters to facilitate the effective management of an irrigation or drainage system provided by the trust.

The rules of a trust bind the trust as a legal entity as well as the members to the trust. The trust must have a presiding member and may have a deputy presiding member, both appointed from within the trust's membership at a meeting of the trust. The trust may appoint a board of management to carry out the day to day operations of the trust and to manage its general affairs.

Any two (2) or more irrigation trusts may, by resolution of each trust, amalgamate into a single irrigation trust. A trust can deliver or drain water under an agreement with a person who is not a member of the trust. It can take all reasonable steps to ensure that it operates in a financially responsible manner. It may seek to raise and maintain adequate capital to provide for infrastructure maintenance, replacement and improvements and, depending on the scope of its operations and plans, extensions and expansions.

A trust has wide-ranging powers such as:

- i. Construction;
- ii. Inspection;
- iii. Set and collect fees;
- iv. Enforcement; and
- v. Borrow money.

3.16 Constitution, By-Laws of an Irrigation Entity

3.16.1 Constitution

A constitution adopted by an irrigation entity commonly includes the following:

- i. Legal status and basis of authority;
- ii. Basic roles and structure of the organization;
- iii. Area of jurisdiction;
- iv. Criteria for membership (which usually require people who reside within the irrigated area or who use water from the irrigation system for non-agricultural purposes to be members) have provision for inclusion of non-agricultural water users;
- v. Basic rights, powers and obligations of the organization and its members;
- vi. Structure of leadership; and
- vii. Method for amending constitution.

3.16.2 By-Laws

By-laws are the specific implementing regulations and rules of an irrigation entity. It is the manner by which members agree to bind themselves to use the irrigation system within the limits of the water use permit and other constraints to ensure water use within the allowable limits.

The following are the basic elements that are commonly included in by-laws:

- i. Procedure for admitting and terminating members;
- ii. Leadership positions and functions;
- iii. Procedure for selecting and removing leaders;
- iv. Tenure of leaders in office;
- v. Description of water delivery and maintenance objectives and rules;
- vi. Rules and sanctions about irrigation service payments;
- vii. Rules and sanctions about abstracting more water than allocated;
- viii. Decision-making procedure for policy and tactical decisions;

- ix. Procedure for entering into contracts;
- x. Protocol for forming federations and having external relations; and
- xi. Procedure for amending by-laws.

The example from the South Australia Irrigation Act and the summary of the basic elements of an irrigation organization's constitution and by-laws are a fair representation of the legislative and regulatory framework that has been put in place in other countries as necessary for the management of irrigation systems whether the approach is PIM or IMT. It is also common practice for the basic form of the constitution to be part of the schedule to the irrigation law, as is the fourth schedule of the WRMA for WUAs. Even model by-laws for adaptation and adoption by organizations are often part of the legislation as this serves to simplify the whole establishment process for the organizations.

Whether a country decides to pursue the PIM or the IMT model requires a policy decision on the part of the government following further studies into the matter. The capacity of irrigators to take up PIM, IMT or a locally developed model has to be evaluated first in the specific context of the government's declared NIP and NIMP with a view to ascertain which of these models will, in Tanzania's specific circumstances, best achieve the aimed for accelerated growth in the irrigation sector. The Government's own role in irrigation must first be clearly articulated as this will in turn determine the roles the irrigators have to be prepared to assume. Not only MOM, whether of the entire system or just the head works and main system, has to be considered. There is also the question of allocating the responsibility for capital costs for the development of water resources and the rehabilitation of major works. There is also the question of determining annual MOM costs and for allocating responsibility for annual MOM costs.

The desire by government to wean off the sector from government dependence must be balanced against the on-the-ground realities of each situation. Therefore, from the beginning of the irrigation scheme development process, clear and realistic written plans have to be agreed to between the government, as represented by the irrigation agency, and the irrigation stakeholders. It is necessary that both the government and the irrigators investigate, discuss, and agree on such issues as cost recovery (i.e., the percentage to be recovered, crop yield improvement levels to be achieved before recovery begins, payment schedules, and other variables) as well as the issue of how to achieve financial sustainability and the allowable sources of money – grants, subsidies, and loans.

3.17 Enforcement

The WRMA, the EMA, the LA and the VLA are all still relatively new pieces of legislation that have introduced some new principles in the management of the natural resources which fall to be managed under them. One of the challenges in getting the institutional arrangements set up under the individual pieces of legislation for the implementation of the law lies in there being insufficient resources for that purpose. The other challenge also lies in the fact that the laws are not yet fully understood by all officials and the general public at different administrative levels.

The WRMA is the most recent of the Acts. It requires the establishment of basin water boards, catchment and sub-catchment committees and water user associations. Until these institutions are established and are operational, having become familiar with their functions, the enforcement of the Act will not occur as intended. Similarly, the regulations required for the implementation of the Act must be developed, as they constitute the means by which the law is enforced. The process of establishing these institutions and the development of the necessary regulations are underway. In the meantime, water use permits are being issued without much regard to the new

considerations for water allocation in any basin. The national, basin and catchment water resources management plans are also still in the process of being developed in accordance with the new Act.

Under the EMA, the Minister responsible for the environment is in overall charge of all matters relating to the environment. Nevertheless, sector ministries have charge over any environmental legislation within their portfolios, and the primary responsibility for the development and enforcement of the legislation lies with the sector ministry through its sector environmental section that the EMA requires to be established in each ministry. If the sector ministry is derelict in its responsibility for enforcing the environmental regulations for which it is responsible, then the minister responsible for the environment has an obligation under the EMA to develop and implement the law as necessary. There is also a regional structure for the management and oversight of environmental matters.

The National Environment Management Council is tasked with, amongst other responsibilities, the enforcement, compliance, review and monitoring of EIAs. It is also tasked with carrying out environmental audits in respect of any project or undertaking that is likely to have a significant impact on the environment. The NEMC is a very important institution in enforcement. If it ensures that a high-quality EIA is conducted, this will facilitate the enforcement as the periodic environmental audits should monitor and compel compliance.

The enforcement of any innovations brought about by the land laws has been hampered by the lack of adequate resources. The surveying of land for the grant of rights of occupancy, the establishment of a land registry and the process of registration require resources to be tackled effectively. This is necessary for the trading in land rights to work. As regards the village lands where much is done at the village level by the village assembly and the village council, by-laws will need to be developed to guide them in carrying out the regularizing of rights in land in compliance with the VLA. This should simplify what may appear to be complex and assist in achieving some certainty in land demarcations especially for irrigation purposes.

3.18 Summary of Recommendations

The following paragraphs summarize the recommendations stemming from the analysis of the institutional and the regulatory environments.

There is the need to prepare EIA guidelines specific to irrigation to obviate the need to discuss these with every proponent in irrigation development the issues, institutions, persons to be addressed, methodologies to be employed and the scope of the EIA. For example, given that irrigation development may be allowed in a conservation area in terms of section 35 of the WCA, an EIA for an irrigation scheme needs to cover the question of treatment of protected animals straying into irrigation areas. The scope of the EIA will in turn have an impact on enforcement of compliance with the law through follow-up audits.

The GoT has to give consideration to adopting an alternative approach to facilitate trade in land that would:

- i. Liberalize the disposition process;
- ii. Respect the sanctity of contract and limit courts intervention to interpretation and enforcement of the wishes of the parties or permit foreclosures;
- iii. Allow a swift process of enforcement of mortgages; and
- iv. Devise efficient mechanisms to facilitate transfer of rights in land.

There is a need to speed up of the process of formalizing the holding of land rights in the villages as this will assist in the organization of irrigation land and determine the demarcations between irrigation land and non-irrigation land for purposes of its recognition as such under the Land Use Planning Act and protecting it from encroachment. The development of model by-laws by local authorities for adoption by and use by village authorities in the discharge of their functions in respect of land management as this would simplify the discharge of their functions. Similarly, there is a need to develop a swift process for granting rights of occupancy to general land.

Many Integrated Pest Management (IPM) initiatives in the country have produced results and recommendations. There is a sufficient knowledge base and capacity in the national research institutes and the extension services for the formulation of the necessary regulations or guidelines for use by farmers in the management of pesticides. The regulations should cover which persistent organic pollutants should be proscribed in the context of an increase in irrigation activities.

Based on the provisions of the World Bank policy on Involuntary Resettlement, consideration is to be given to the adoption of regulations that would include revised processes for dealing with persons displaced through a compulsory acquisition of their land for purposes of development projects such as irrigation development and the construction of dams. The World Bank Policy provides sufficient guidelines and content for the regulations that could be considered. The opportunity could be taken in such legislation to address the rights and interests of specific groups of people among the displaced persons.

It is further recommended that a study be undertaken to consider an approach suitable to Tanzania that involves irrigators in the management, operation and maintenance of irrigation infrastructure, be it PIM, IMT or any variation thereof.

All policies and legislations advocate conservation and may enhance each other in this aspect during implementation of the NIMP, on the other hand there are areas where different policies and legislations contradict e.g buffer distances from water sources, precedence of one policy and legislation over the other.

For example while the Environmental Management Act of 2004 requires a buffer of about 60m from a water body the Forest Act of 2002 requires a 30m, the Water Resources Management Act No. 11 of 2009 requires 60 to 260m depending on the size of the water body. Although the Agricultural and livestock policy advocates 30m buffer from the water bodies it also emphasizes on farming in wetland areas during dry seasons. On conflicts the EMA Act no. 20 of 2004 will prevail on 60m distance.

4 SCOPING

4.1 Introduction

The scoping exercise aimed at identifying important facts related to the implementation of the NIP and NIMP with respect to environmental and social impacts. Therefore the scoping exercise for this SESA identified Issues, concerns and potential impacts

4.2 Scoping Approach

The approach for all stages of the scoping exercises was participatory. This is in accordance to the Environmental Management Act No. 20 of 2004 section 14, that requires public participation in the environmental decision making process. This section provides further guidance on public rights to information access and participation in decision making (Section 178(1)). Therefore consultations were held with a wide range of stakeholders, including, but not limited to: irrigators, government officials, business people, and local and international Non-Governmental Organization staff. Details on the consultation processes are provided in section 2.2 of Chapter 2.

4.3 Key Issues and Concerns

The details on key social and environmental (biological, physical) issues and concerns are presented in Table 4-1. Issues and concerns are regarded as HIGH Priority when raised by many stakeholders or observed in many locations consulted.

Table 4-1: Key Issues and Concerns raised by Stakeholders

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
Socio- Economic				
1	Inadequate funding and delays in disbursement	Construction of irrigation infrastructure has been slow due to delays in disbursement of funds coupled with the problem of inadequate budgets.	Retarded growth in irrigation development	HIGH
2	Inadequate access to micro-credits by farmers.	<ul style="list-style-type: none"> • Small holder farmers lack adequate capital for investment in irrigation coupled with limited provision of financial support (e.g. access to micro-credits) • Small holder farmers are not facilitated or sensitized to seek support for active engagement in irrigation investments and related economic opportunities 	<ul style="list-style-type: none"> • Deterioration in livelihoods of small holder farmers and • Poverty reduction efforts are undermined 	MEDIUM
3	Conflicts over water uses within irrigation schemes and between upstream and downstream users	Over abstraction and poor management of water resources by upstream irrigators denying adequate water supply for downstream uses – which leads to water use conflicts, including conflicts between farmers and livestock owners arising from disagreements over water use or livestock damaging irrigation infrastructure	Unsustainable irrigation development (socially, environmentally, and economically)	HIGH
4	Low productivity in irrigation schemes	Poor agricultural practices and management of land and irrigation water leading to low yields and water productivity	<ul style="list-style-type: none"> • Low household income and increased risks of food insecurity 	HIGH
5	Inadequate land use planning and allocation of irrigation land	Land use planning and enforcement are critical in ensuring the sustainability of newly developed irrigation schemes. Some of existing irrigation schemes were developed in absence of land use plans. Also equitable allocation of irrigation land is vital for irrigation development.	Inadequate land use planning and enforcement of the plans would result in degradation, misuse, and waste of productive resources and lose of opportunities for economic and social development.	MEDIUM
6	Inefficient marketing	Producer prices for agricultural produce are generally	<ul style="list-style-type: none"> • Poverty reduction efforts are 	HIGH

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
	systems for agricultural products.	very low and there are no dependable and affordable storage facilities, which would allow the farmers to sell when prices are high. Farmers have to sell their produce immediately after harvest at low prices	undermined and livelihood of small farmers deteriorates <ul style="list-style-type: none"> • Inefficient utilization of irrigation schemes 	
7	Immigration of people into irrigation schemes	Irrigation development will increase influx of seasonal or temporary laborers, creating uprooting local communities to make way for projects and introducing new cultures and behaviors. Currently, there are no comprehensive plans that guide these developments to minimize impacts to the social fabric of the irrigation areas.	<ul style="list-style-type: none"> • Population movement may cause changes in local and traditional behavior and may accelerate the spread of sexually transmitted diseases, especially HIV/AIDS • Negative cultural changes may result, including breakdown in social security and safety, youth delinquency, early pregnancies, and the breakdown of social systems, relationships and networks that have supported the societies for a long time 	MEDIUM
8	Inadequate farm management, Operation and Maintenance (O&M) skills.	Small scale farmers inadequate skills and capacity in good agricultural practices and O&M	Low agricultural productivity, low income and retardation in economic growth	HIGH
9	Ineffective monitoring and evaluation system for irrigation schemes.	Some of irrigation schemes are not subjected to joint regular implementation reviews and annual external financial and procurement audit reviews aimed for closely monitoring of both financial and physical performance of the irrigation schemes	No feedback leading to poor performance of irrigation	MEDIUM
10	Inadequate compliance to irrigation scheme development guidelines.	While there are guidelines that have been developed and which should be followed when establishing new irrigation schemes, experience shows that these guidelines are rarely followed	Unsustainable irrigation development	MEDIUM

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
11	Inadequate contribution and participation in Operation & Maintenance activities by farmers.	The contribution and participation of farmers in Operation and Maintenance is generally low	Dilapidated irrigation infrastructure will lead to decline in land and water productivity and hence decline in the welfare of irrigators.	HIGH
12	Exploitation of child labor in the irrigation schemes.	Labor shortage in irrigation schemes, especially during planting/transplanting, weeding and harvesting necessitates farmers in some areas to use child labor and in so doing denying children to attend schools	Decline in pre-primary and primary school enrolment and hence increase in illiteracy	LOW
13	Lack of reliable and sustainable water sources for irrigation.	Water supply for irrigation is largely unreliable. Most schemes are constrained with inadequate water supply.	Low farm productivity and income which in turn result in retarded economic growth	HIGH
14	Human-Wildlife attacks/accidents.	Irrigated land close to protected areas usually shares water with wildlife from a common source. Human-wildlife attacks/accidents are common when water becomes scarce and when animals destroy crops. Animals die when rivers dry up.	Low production and reduced revenues from tourism and professional hunting	MEDIUM
15	Non compliance to the resettlement plans and agreements during establishment of new irrigation/or expansion of the existing schemes.	Resettlement policy not well known at grass root level. In general the process of facilitating the resettlement is unclear.	Deterioration of livelihoods of resettled households	LOW
16	Vandalism of irrigation infrastructures, border raids and boundary disputes	Irrigation infrastructures are vandalized in some irrigation schemes resulting in significance Loss and thus increasing cost of O & M	Social instability and retarded economic growth	MEDIUM
17	Inadequate access to social services	The majority of rural farmers have limited access to potable water, health care, schools, and roads. They have to travel long distances to access basic social	• Low productivity of labor and increased poverty	MEDIUM

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
		services, which reduces time for undertaking agricultural activities	• Increase in rural to urban migration	
Physical Environment				
18	Some of the irrigation schemes lack cross bridges for livestock and human in canals hence causing destructions in canals. Most of irrigation canals are not lined and lack of on farm road.	Investments in most irrigation schemes are arranged without ensuring local accesses to the rivers and other important sites including stock routes and wildlife corridors.	<ul style="list-style-type: none"> • Loss of crops, human life and destruction of irrigation infrastructure may occur • Loss of irrigation water • Destruction of farms when undertaking irrigation activities 	MEDIUM
19	Dam construction creating water bodies	Construction of dams may lead into increase in water-borne and water related diseases.	<ul style="list-style-type: none"> • Inundation of facilities • Outbreak of water associated diseases 	MEDIUM
20	Poor compaction of earth canal and mismanagement of water within irrigation schemes results into localized soil erosion	Mismanagement of water within irrigation schemes and poor compaction of earth canal exacerbate the localized soil erosion	<ul style="list-style-type: none"> • Increased sedimentation in canals and rivers. • Loss of arable land and low crop productivity 	HIGH
21	Irrigating using saline water and over-watering in some schemes result into increased salinity.	As water dries saline environment is formed. Land become useless and may end up with desertification	Loss of arable land and low crop productivity rendering desertification	LOW
22	Loss of farms, habitat for flora and fauna as a result of clearing and	Bush clearing during construction of irrigation infrastructure and inundation due to damming may result into loss of farms, habitat for fauna and flora,	<ul style="list-style-type: none"> • Soil erosion/ land degradation • Habitat loss 	MEDIUM

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
	inundation for damming	and land degradation.	<ul style="list-style-type: none"> • Biodiversity decline 	
23	Cultivation, tree cutting on the river banks and illegal abstractions of water from river accelerate degradation of land near the river banks.	Cultivation, tree cutting on the river banks and illegal water abstractions from rivers in unimproved irrigation schemes accelerate degradation of land near the river banks. This is normally done using temporary intakes made of tree logs, grass and mud. The tree logs and mud are cut near the riverbanks causing instability in riverbanks and in some cases subjecting the river to change its course.	<ul style="list-style-type: none"> • Change in river courses and creation of meanders. • Soil erosion • Loss of biodiversity resulting from degradation of riparian ecosystems 	MEDIUM
24	Inadequate drainage systems which complies with recognized safety measures in irrigation systems leading into flooding damages	Although irrigation schemes are planned to control water inflow, flooding still occurs. Most irrigation schemes lack adequate drainage and do not comply with safety measures. Flooding damages irrigation systems and can cause injuries and drowning.	<ul style="list-style-type: none"> • Destruction of irrigation schemes • Increase in maintenance costs • Water logging and reduced crop productivity 	MEDIUM
25	High levels of sedimentation in the irrigation schemes resulting from other land uses activities within the catchment	Sediments are the main problem in some of the irrigation schemes in Tanzania. The source of sediments in irrigation schemes is the soil erosion taking place in the catchment area and river banks upstream. The medium and large floods always carry heavy bed and suspended loads, which are deposited when the velocity decrease at the intake sites until the sediments accumulate up to the weir crest level and then is deposited in front and behind the intake gates of the head works.	<ul style="list-style-type: none"> • Destruction of irrigation infrastructures and peoples' property • Reduction in farm size • Reduced soil and crop productivity • Reduced storage of reservoirs 	MEDIUM
26	Inadequate on-farm water management (flooding of schemes) without considering downstream water users	If irrigators draw the amount of water that is not in conformity with crop optimal water requirement and this constitutes water wastage and gross water mismanagement that could be wisely used by other users in the downstream including hydropower	Water flow reduction downstream of the irrigation schemes leads to adverse effects on the ecosystem thereby creating water use conflicts among the users.	LOW

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
		generation, domestic water supply, livestock, fishing and maintaining the ecological functioning of wetlands.		
Biological Environment				
27	Pollution of land and water bodies due to fertilizers and agrochemical utilization	Utilization of chemical fertilizers is needed for maintaining the agricultural production at high level however inappropriate application and the use of toxic chemical elements bring a risk to both plants, human health as well as the natural eco-system especially for aquatic species.	<ul style="list-style-type: none"> • Human and natural ecosystem health impairment. • Mortality or morbidity of flora and fauna, • Bioaccumulation of toxic substances 	HIGH
28	Degradation of irrigation water quality due to industrial and domestic effluents, as well as pollution from animal excreta.	Industrial and domestic effluents, as well as pollution from animal production, can lead to the degradation of irrigation water quality. This is largely attributable to absence of integrated water resources management that among others, accounts for the location of potential contamination sources while planning the irrigation project.	Degradation of irrigation water quality can lead to poor crop production and quality of the products.	LOW
29	Implications on aquatic and water sensitive biodiversity and wildlife Habitats due to possible reduction in environmental Flows	Majority of the schemes are in seasonal rivers, which are already water stressed. Furthermore flows in permanent rivers are decreasing over time with potential to further decrease due to abstraction for irrigation	<ul style="list-style-type: none"> • Reduced environmental Flows with negative consequences on aquatic and water Sensitive species • Loss of wildlife habitats and biodiversity 	HIGH
30	Degradation of River Catchments and Riparian Ecosystems	Some of the river catchments in irrigation schemes are highly degraded by both downstream and upstream users	Loss of water sensitive species dependent on the riparian ecosystems	HIGH
31	Degradation of ecologically sensitive areas	Some of the irrigation schemes are established in ecologically sensitive areas such as wildlife corridors, protected areas and water catchment areas/forests.	<ul style="list-style-type: none"> • Habitats fragmentation, • Loss of gene flow among 	MEDIUM

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
			<p>populations</p> <ul style="list-style-type: none"> • Decline of wildlife populations to below minimum viable levels. • Local extinction of sensitive flora and fauna 	
32	Blockage of fish movement and consequent Interference with Fish Migration and Breeding	There is no scheme that has created fish bridges at their water intakes or dam sites.	<p>Creation of physical barriers to fish and other aquatic organisms movement</p> <p>Interference with flow regimes and reduction in flood periods in some cases which will affect fish migratory behavior</p>	LOW
33	Single resource management approach on irrigation scheme planning	<ul style="list-style-type: none"> • Without integrated water resources management and land use management plan, implementation of the NIMP and NIP may become disastrous with respect to environmental flows and biodiversity conservation • Most important, all the irrigation schemes have neither Integrated Water Resource Management Plan nor Integrated Land Use Plans and thus no one would expect their management to follow an integrated approach to resources management 	<ul style="list-style-type: none"> • Conflicts in resource uses • Unbalanced resources utilization/ exploitation 	HIGH
Institutional and Legal				
34	Unclear institutional setup and line of command in irrigation services provision	Presently there is no effective established institutional structure for irrigation development in Tanzania. As a result there is lack of autonomy in service delivery and a statutory ministerial placement.	<ul style="list-style-type: none"> • Uncoordinated irrigation research and limited outreach to farmers • Increased costs as a result of movement from one ministry to another • Unclear line of command 	HIGH

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
			<ul style="list-style-type: none"> • Unproductive and marginalized irrigation development 	
35	Insufficient human resources at Zonal Irrigation Unit offices, District Council offices and at Schemes	Currently technical inputs in the design and operation of the irrigation scheme at both zonal and district level is insufficient	<ul style="list-style-type: none"> • Increase in substandard and inefficient irrigation schemes • Low productivity in the schemes • demoralization and overstressing the existing staff • Delayed implementation 	HIGH
36	NIMP and NIP are not well understood at the Zonal and District levels	<ul style="list-style-type: none"> • Generally there is limited awareness on NIP/NIMP and thus implementation will be difficult • Not easy to enforce the by-laws 	<ul style="list-style-type: none"> • Low productivity at the irrigation schemes • Poor implementation • Disincentive to irrigated agriculture • Increase in conflict among different irrigation stakeholder 	HIGH
37	Insufficient local qualified contractors to construct irrigation infrastructures.	<p>Use of unqualified contractors leads into delays in construction of irrigation schemes and construction of schemes that are not environmentally friendly and of low standard</p> <p>Some contractors have to be outsourced from very far.</p>	<ul style="list-style-type: none"> • Delayed production and hence impacting the local livelihoods • Degradation of ecological systems 	LOW
38	Inadequacy of well established Irrigator Organizations (IO).	IOs are important in the operation and management of irrigation schemes (maintenance, marketing conflict resolution, etc)	<ul style="list-style-type: none"> • Loss of water productivity • Uncontrolled abstraction • Increase in water use conflicts • Poor O and M • Loss of livelihood 	HIGH

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
39	Inadequate incentives for the private sector to participate in irrigation.	<ul style="list-style-type: none"> • Irrigation requires high investments which cannot be achieved without proper incentive mechanisms • Unavailability of a package comprising design, land title deeds, water use permit and fully or partially developed irrigation systems 	<ul style="list-style-type: none"> • Few private investors in irrigation • Unsustainable irrigation development • Burden to the government 	HIGH
40	Inadequate research and development in irrigation sector	<ul style="list-style-type: none"> • Research institutions are not adequately financially capacitated to undertake research in irrigation • Most irrigation practices are not based on research informed decision and implementation 	<ul style="list-style-type: none"> • Low efficiency • Low production and productivity • Low research outputs 	MEDIUM
41	Issuance of water use permits which does not conform to available water	Permits are issued based on flat rate while the actual is quite different this lead to over abstraction of water from water sources. No pumping test or measurement to control the water quantity and quality permitted	<ul style="list-style-type: none"> • Reduced environmental flows • Degradation of aquatic biodiversity • Reduced quantity of water for sharing • Conflict over water use • Loss of revenue by BWOs 	HIGH
Health and Sanitation				
42	Expansion of irrigation schemes does not take into consideration of health and sanitation infrastructure	<ul style="list-style-type: none"> • Some of the farmers live very far from their farms that might lead to poor environmental sanitation as there are no sanitation facilities at the farms. • Population migration to the irrigation schemes amplifies the situation 	<ul style="list-style-type: none"> • Increase in water associated diseases • Deterioration of community health • Increased health cost • Reduction in manpower • Reduced livelihood 	LOW
Crosscutting				

S/N	Issues and concerns	Significances	Potential Negative impact	Priority
43	Increase in HIV/Aids incidences in the irrigation schemes	As immigration of people to areas with irrigation infrastructure has been increasing so the rate of HIV/Aids infections in these areas	<ul style="list-style-type: none"> • Reduction of labor force in agriculture production • Increase in orphans and street children 	MEDIUM
44	Uncertainty of water supplies due to Climate change.	<ul style="list-style-type: none"> • Recent trends in Climate indicate shifts/variability in rainfall and temperature which have led to uncertainty in water availability • Increased drought incidences are likely to reduce available water for irrigation while Increase floods may destruct irrigation systems extreme events (droughts/ floods) 	<ul style="list-style-type: none"> • Unpredictable droughts and floods crop failure • Loss of livelihood • Increased food insecurity • Deprived ecosystem services • Increase in maintenance cost • Reduction of water availability for irrigation 	HIGH
45	Inequitable sharing of irrigation benefits (gender inequality)	Currently income from irrigated agriculture is male dominated. Women and children are only involved in crop production but they are not effectively involved in planning of revenue expenditure.	Increased gender inequality in terms of decision making, income and empowerment	MEDIUM

4.4 Identification of Alternatives

The identification of alternatives was based on the NIP and NIMP generic quest of achieving sustainable irrigation development. Within this framework, the NIP and NIMP were used as guiding documents in the identification of alternatives. The statements put emphasis on promoting different types of irrigation each conforming to cross-cutting and cross-sectoral policy categories. Ultimately six alternatives or options were identified as detailed in section 2.2.8.

4.5 Scoping Results

The SESA scoping concluded that the intended implementation of the NIP and NIMP will have a positive impact on development through improvement of local, regional and national economies. To achieve this however requires adherence to necessary national and international guidelines that will minimize environmental and social impacts locally within the reach of the irrigation schemes and the country at large.

Among the potential major negative impacts emanating from the implementation of the NIP and NIMP are ecological with negative implications on biodiversity and degradation of the environment (shrinkage of wetlands ecosystems, encroachment into ecologically sensitive areas - wildlife corridors, forest reserves and riparian ecosystems and drying of water sources). Further sociological impacts would include population increase due to immigration competition for resources hence conflicts over resource use.

Based on national and international guidelines on SESAs, the following are recommended:

- i. All proposed management approaches to irrigation systems and related activities in respective irrigation schemes must be done within the context of existing regulations, policies, plans and programs in environmental and natural resources management and protection.
- ii. The identifiable potential environmental and social impacts direct, indirect and cumulative impacts of implementing NIP and NIMP must be mitigated
- iii. Protection of the ecology of each irrigation scheme whether small, medium, or large, commercial or non commercial should be seen as key to ensuring sustainability of the irrigation areas as some of them will likely be established in ecologically sensitive areas.
- iv. The capacity of competent institutions within the LGAs and communities must be addressed to help monitor and enforce compliance with provisions of national laws, regulations, standards, and/or conditions that might be stipulated under different plans.
- v. Existing and potential opportunities for the proposed irrigation development to contribute to expected development in the short to long term must be identified.
- vi. Public sensitization on expected changes and the potential opportunities that can be realized through implementation of NIP and NIMP should given due priority.

5 THE NATIONAL IRRIGATION POLICY

5.1 Purpose of the Policy

The National Irrigation Policy provides a baseline for a focused development of the irrigation sector in Tanzania. The Policy covers the activities and interventions required for the sector to effectively contribute towards enhancement of production and productivity in the agriculture sector (URT, 2010a). The NIP (section 2.4) among other areas highlights the need for the development and management of irrigation schemes and to the increased use of available water resources.

5.2 Policy Objectives

The main objective is to ensure sustainable availability of water for irrigation and its efficient use for enhanced crop productivity and profitability. This will contribute to food security and poverty reduction. The specific objectives are:

- i. To accelerate investment in the irrigation sector by both public and private sector players;
- ii. To ensure that the use of Irrigation Development Funds follow proper legal procedure;
- iii. To promote efficient water use in irrigation systems;
- iv. To abide by the Integrated Water Resources Management approach in irrigation development and management;
- v. To ensure that irrigation development is technically feasible, economically viable, socially desirable and environmentally sustainable;
- vi. To ensure optimal water use in irrigation to facilitate intensification and diversification of irrigated crops, including pasture and aquaculture;
- vii. To ensure the use of demand-driven, productive and profitable irrigation development models that are responsive to market opportunities;
- viii. To strengthen institutional capacity at all levels for the planning, implementation and management of irrigation development;
- ix. To empower beneficiaries for effective participation at all levels in irrigation planning, implementation, operation and management;
- x. To strengthen research, technical support services, development and dissemination of new practices, innovations and technologies on irrigation and drainage; and
- xi. To mainstream cross-cutting and cross-sectoral issues such as gender, HIV/AIDS, environment, health, land and water in irrigation development.

5.3 Description

The NIP has 137 policy statements grouped into ten (10) policy categories. For each of the categories, the NIP presents issues, objectives, and policy statements. The ten (10) policy categories are:

- i. Investment for Irrigation Development in Tanzania;
- ii. Management of Irrigation Schemes;

- iii. Irrigation Research and Development;
- iv. Promotion of Appropriate Irrigation Technologies;
- v. Production and Productivity in Irrigation Schemes;
- vi. Training and Human Resources Development;
- vii. Institutional Capacity;
- viii. Financing Mechanism;
- ix. Cross-sectoral Issues; and
- x. Cross-cutting Issues.

In addition, the NIP further categorizes Tanzanian irrigation schemes by type:

- i. Unimproved traditional irrigation schemes;
- ii. Improved traditional irrigation schemes;
- iii. Unimproved rain water harvesting irrigation schemes;
- iv. Improved rain water harvesting irrigation schemes;
- v. Smallholder (small, medium and large scale) irrigation schemes; and
- vi. Commercial (small, medium, and large scale) irrigation schemes.

The objectives, issues, and policy statement for each category of irrigation is also provided. Each policy category has many statements; however, within each category there is one or more statements that are central to expressing the intent of the category. Table 5-1 presents a summary of the main policy statement for each policy category.

Table 5-1: Policy Categories and the Associated Policy Statements

S/No	CATEGORY	POLICY STATEMENT
1	Investment for Irrigation Development -Unimproved Traditional Irrigation Schemes	Continue to support the improvement of traditional irrigation schemes infrastructures and software;
2	Investment for Irrigation Development - Improved Traditional Irrigation Schemes	Promote and encourage Public Private Partnership (PPP) in the development and management of improved and new irrigation schemes;
3	Investment for Irrigation Development - Unimproved Rain Water Harvesting Irrigation Schemes	Support the improvement of traditional water harvesting infrastructures and software;
4	Investment for Irrigation Development - Improved Rain Water Harvesting Irrigation Schemes	Support the rehabilitation, remodeling and upgrading of improved RWH irrigation schemes on the basis of cost sharing and cost recovery;
5	New Irrigation Smallholder (Small scale, medium and large) Irrigation Schemes	Promote the demand-driven irrigation scheme identification;
6	New Irrigation Commercial (Small scale, medium and large) Irrigation Schemes	Promote the demand-driven commercial irrigation scheme identification;
7	Existing Irrigation Commercial (Small scale, medium and large) Irrigation Schemes	Support the existing commercial irrigation schemes in need of more irrigation water to solicit for other possible sources;
8	Management of Traditional, Improved and Water Harvesting Irrigation Schemes	Support capacity building for irrigators organizations for effective management of irrigation schemes;
9	Management of Large Scale Irrigation Schemes	The Government will ensure that smallholder farmers in large scale irrigation schemes form strong and effective farmers' organizations capable to operate the schemes;
10	Irrigation Research and Development	Ensure that research in irrigation is initiated and sustained with a focus on enhanced performance of irrigation interventions;
11	Promotion of Appropriate Irrigation Technologies	Promote the use of appropriate technologies and innovations by practitioners for irrigation development

S/No	CATEGORY	POLICY STATEMENT
		and mitigation of negative impacts of global warming and climate change;
12	Production and Productivity in Irrigation Schemes	In collaboration with the private sector ensure timely availability of agricultural machinery and inputs in irrigation schemes;
13	Training and Human Resources Development	The Government in collaboration with other stakeholders will ensure that Institutions of Higher Learning incorporates issues pertaining to irrigation development in their curricula;
14	Institutional Capacity National Level	Establish an effective institutional set up and coordination mechanism for the irrigation sector;
15	Local Government Authorities	Improve and upgrade the status of the District Subject Matter Specialist for irrigation to the level of District Irrigation Office;
16	Irrigators Organizations	Strengthen the Irrigators Organizations to ensure effective management of their irrigation schemes and full participation in Integrated Water Resources Management;
17	Farmers/Irrigators	Ensure that awareness is created among irrigators on their roles and responsibilities in initiation, implementation and management of their irrigation schemes;
18	Private Sector	Continue to have dialogue with the private sector on matters related to irrigation development in Tanzania;
19	Non-Governmental Organizations (NGOs)	Continue to facilitate registration and establishment of an effective coordination mechanism of NGOs that are interested in irrigation interventions;
20	Financing Mechanism	In collaboration with other stakeholders ensure that, funds for irrigation interventions are made available adequately and timely throughout the execution period;

S/No	CATEGORY	POLICY STATEMENT
21	Cross-sectoral Issues - Water Resources	Promote improved management practices and the use of technologies with a high water use efficiencies;
22	Cross-sectoral Issues - Land	Facilitate the demarcation and registration of all irrigation potential area and irrigated land;
23	Cross-sectoral Issues - Public Health and Safety	Create awareness on public health risks such as malaria, bilharziasis, typhoid, worms, HIV/AIDS etc. associated with irrigated agriculture and provide preventive measures that are available to mitigate or avoid such risks;
24	Cross-cutting Issues - Environment	Ensure that environmental issues are addressed in all irrigation interventions in accordance with Environmental Management Act No. 20 of 2004;
25	Cross-cutting Issues - Gender	Encourage a fair representation of both women and men in irrigators organizations;
26	Cross-cutting Issues - HIV/AIDS	The Government in collaboration with other stakeholders will sensitize to raise the irrigators awareness on the public health risks accruing to HIV/AIDS and measures that are available to mitigate or avoid such risks.

5.4 Analysis of the Policy

Many statements in the NIP are repetitive. These were categorized and pooled together into six (6) policy themes. Pooling the policy statements together may however leave out a policy statement that could have important implementation implications. Recognising this, attempt was therefore made ensure that the policy themes and their strategic elements capture all the important policy messages. The policy themes and their strategic elements are:

- i. Regulatory Framework and Institutional strengthening, which includes:
 - a) Good governance;
 - b) Legislative changes in support of irrigation development and creation of enabling environment to attract private investors and financiers in the irrigation sector; and
 - c) Enforcement and compliance.
 - d) Support for private sector involvement in irrigation investment, provision of inputs, and operation and maintenance of schemes;
 - e) Capacity building and support to NGOs, irrigators, Water User Organizations and irrigation related farmers' organizations;
 - f) Extension services, training and technical facilitations;
 - g) Support for data collection and management; and
 - h) Irrigation Research and Development.
 - i) Management of irrigation schemes
- ii. Financing mechanisms and funding support for irrigation development, which includes:
 - a) Establishment of an irrigation development fund and the provision of financial support. For example, facilitating access to micro-credit schemes and
 - b) Investment for irrigation development for all types of irrigation scheme.
- iii. Land tenure and ownership rights, which includes:
 - a) Demarcation and registration of irrigated land and
 - b) Improvement of all irrigation schemes, from the head works to the tail gates, including land leveling where necessary.
- iv. Water Resources Development, which includes:
 - a) Assessment of groundwater potentials and advocating its use;
 - b) Development of large scale water storage structures; and
 - c) Potential inter-basin water transfers.
- v. Promote the development and management of irrigation schemes.
 - a) Support capacity building for irrigators' organizations for effective management of irrigation schemes
 - b) Promote and encourage Public Private Partnership (PPP) in the development and management of improved and new irrigation schemes
 - c) Ensure that research in irrigation is initiated and sustained with a focus on enhanced performance of irrigation interventions;
- vi. Mainsteam cross-cutting issues in irrigation development:
 - a) Ensure that environmental and social issues are addressed in all irrigation interventions;

- b) Ensure Gender mainstreaming
- c) Create Public health and safety awareness including HIV/AIDS;

5.5 Potentially Significant Policy Issues

The policy analysis of the NIP's 137 policy statements identified the strategic environmental considerations at the policy level. The field investigations and the public consultations enabled the identification of the potential impacts and the resources, institutional and legislative, that are available to implement and monitor the management plan.

Amongst the potential impacts that have been identified as arising out of the NIP and NIMP, the following have a bearing on the legal aspects of this SESA:

- i. the regulatory framework-its scope, enforcement and compliance issues and the necessary legislative changes in support of irrigation development;
- ii. land tenure issues: the nature of rights in land, demarcation of irrigated land, improvement of the institutional organization of irrigation schemes and legislative changes in support of irrigation development;
- iii. water resources management: the development of large scale water storage structures; inter-basin water transfers and regulation of use of groundwater (Inception Report, 2010).

6 THE NATIONAL IRRIGATION MASTER PLAN

6.1 Purpose of the Plan

The purpose of the NIMP was to revise and update the National Irrigation Development Plan (NIDP), 1994. The NIDP addressed food security issues in order to alleviate many of the existing constraints to irrigation development. In the succeeding years, the NIDP alleviated many of the constraints facing irrigation development. However, some constraints remained. The NIMP was prepared to alleviate the remaining constraints.

6.2 Plan Objectives

In consideration of the strategic activities and interventions stipulated in the Agricultural Sector Development Strategy (ASDS), the philosophy employed in the NIDP and the results of the study to develop the NIMP, “Sustainable Irrigation Development” was selected as a purpose of the NIMP with emphasis on comprehensive measures through “Effective Use of National Resources”, to largely contribute to attainment of the primary objective of ASDS.

The Study was to be executed in three phases. The objectives of each phase are as follows:

Phase 1: Formulate the Master Plan for Irrigation Development at national level with target year of 2017.

Phase 2: Prepare the Action Plan for candidate irrigation schemes selected in the Master Plan Study.

Phase 3: Conduct the Verification Study for the bottleneck items for successful implementation of the schemes.

Only the first phase was completed. The NIMP is the output of the first phase.

The completed Phase 1 work of NIMP can be divided into two categories. The first is to prepare the basic concept for the master plan based on analysis of data collected, which was carried out from November 5, 2001 to February 1, 2002. During this period, an inventory survey was also conducted to identify the irrigation schemes to be rehabilitated and to be newly constructed on the district basis. The second category works to formulate the master plan for irrigation development taking into consideration the results of the inventory survey, problem analysis and Project Cycle Management workshops, which were conducted for 4 months from May 11, 2002 to September 6, 2002.

6.3 Criteria used by the National Irrigation Master Plan to Prioritize and to Select Priority Schemes

NIMP chapter six (6) sets forth the criteria used to prioritize and select potential irrigation schemes. Usually assessments of the potential area to be developed for irrigation consider the water resources potential and land resources potential. This NIMP, however, also takes into account the socio-economic potential, especially marketing. The areas of high, medium, and low irrigation priority were determined by preparing and overlaying the assessment maps for the respective potentials – water, land, and socio-economic. However, issues of land ownership were not considered as a criterion for delineation of potential irrigation area. It is likely that most of the identified irrigation potential areas are presently under individual or group ownership.

6.3.1 Water Resources Potential

To assess the water resources potential, it is necessary to estimate the macro water balance for mainland Tanzania. Mean annual rainfall and mean annual run-off, which are major factors in the hydrological cycle, were estimated utilizing existing hydro-meteorological data observed

at 143 stations. The amount of groundwater recharge and basin evapo-transpiration from river basins was also calculated on the basis of hydrological information

Table 6-1: Hydrological Balance by River Basin

S/N	Drainage River Basins	Catchment Area (km ²)	Inflow	Outflow			Remarks
			Annual Mean Rainfall * (mm)	Annual Mean Runoff * (mm)	Evapo-transpiration from the Basin ** (mm)	Groundwater Recharge *** (mm)	
I	Pangani River Basin	56,300	1,001.9	31.5	966	4.0	Into the Indian Ocean drainage system
II	Ruvu/Wami River Basin	72,930	765.1	51.7	710	3.0	Into the Indian Ocean drainage system
III	Rufiji River Basin	177,420	988.3	185.9	799	3.0	Into the Indian Ocean drainage system
IV	Ruvuma River and Southern Coast Basin	103,720	1050.0	20.5	1,028	2.0	Into the Indian Ocean drainage system
V	Lake Nyasa Basin	39,520	1,672.5	344.6	1,324	4.0	Into the Indian Ocean drainage system
VI	Internal Drainage Basin	153,800	619.0	36.6	577	5.0	Into the Internal drainage system
VII	Lake Rukwa Basin	88,180	1,095.0	105.5	985	6.0	Into the Lake Rukwa drainage system
VIII	Lake Tanganyika Basin	151,900	1,173.6	124.7	1,045	4.0	Into the Atlantic Ocean drainage system
IX	Lake Victoria Basin	79,570	1,111.1	18.6	1,087	6.0	Into the Mediterranean Sea drainage system
	Total	923,340	997.5	97.0	89.6	4.0	

* These were analyzed under this Study using data of 143 gauging stations.

** These were estimated deducting (Runoff) and (Groundwater recharge) from (Rainfall)

*** These were tentatively estimated consulting the groundwater potential map in "Rapid Water Resources Assessment, 1995"

Source: URT (2002a)

Table 6-1 presents the NIMP information on estimated water use in 2002.

Table 6-2: Estimated Water Use

S/N	Drainage River Basins	Annual Mean Runoff (Million m ³)	Groundwater Recharge (Million m ³)	Present Water Use			
				Domestic water supply * Upper (population 1000) Lower (Million m ³)	Irrigation supply ** Upper (Area: ha) Lower (Million m ³)	Livestock supply *** Upper (heads: 1000) Lower (Million m ³)	Hydropower Upper (MW) Lower (Million m ³)
I	Pangani River Basin	1,773.5	225.5	3,507.7 57.6	46,347.0	2,675.9 14.8	75.0 (422.7)
II	Ruvu/Wami River Basin	3,770.5	218.8	4,172.8 68.5	10,326.0 268.8	561.8 6.1	0.0 -
III	Rufiji River Basin	32,975.3	532.3	4,551.1 74.8	35,027.0 1,183.9	1,534.5 22.8	280.0 -
IV	Ruvuma River and Southern Coast Basin	2,126.3	207.4	2,208.1 36.3	6,263.0 187.9	595.8 1.8	- -
V	Lake Nyasa Basin	13,618.6	158.1	856.1 14.1	2,833.0 78.6	328.7 3.1	- -
VI	Internal Drainage Basin	5,629.1	769.0	4,455.4 73.2	29,239.0 876.1	4,776.8 63.3	- -
VII	Lake Rukwa Basin	9,214.8	525.1	1,674.3 27.5	12,417.0 319.3	498.0 9.6	- -
VIII	Lake Tanganyika Basin	18,941.9	607.6	4,692.7 77.1	7,416.0 185.4	3,011.3 46.1	- -
IX	Lake Victoria Basin	1,480.0	477.4	3,901.3 64.1	7,122.0 111.5	2,239.1 39.5	- -
	Total	89,529.9	3,724.9	30,019.5 493.1	156,995.0 4,416.6	16,221.9 207.2	- -

* Population of each basin was estimated recombining region-wise population in 1998 on the basis of geophysical factors.

** These data in irrigation supply were estimated on the basis of the present irrigated areas which were referred in several sources.

*** Heads of livestock (cattle, goats and sheep) in each basin were estimated recombining the data in the District Integrated Agricultural Survey 1998/99 on the basis of geophysical factors 30lit/day and 5lit/day of water requirement are applied for a cattle and a goat respectively.

Source: URT (2002a)

6.3.2 Land Resources Potential

The major criteria for classifying land suitability are slope, physical condition of the land, susceptibility to soil erosion and floods. Based on these criteria, a land suitability map was prepared. The NIMP identified 128 land units, and each land unit was briefly described based on various viewpoints including slope and salinity. The land units were classified into three major classes of potential land resources for irrigation development:

- i. Highly suitable,
- ii. Moderately suitable, and
- iii. Marginal.

Since protected areas for example: Forest Reserves, National Parks, Game Reserves and Conservation Areas are not permitted to be developed, they were eliminated from the potential development areas. Marginal land such as mountainous ranges, steeply sloping land and saline areas were also eliminated from the potential area.

Marginal soils such as saline soils were further eliminated from the potential area. Finally, the moderately suitable potential areas were converted to highly potential areas provided that the land unit and soil type were both classified as highly suitable.

6.3.3 Socio-economic Factors

Factors considered for assessment of socio-economic potential were:

- i. Size of market,
- ii. Distance to market and its accessibility, and
- iii. Availability of agricultural labor/population.

The NIMP assessment used population density, road density and food deficit as indicators of the three factors listed above.

To estimate population and road densities, all districts are classified into two groups, having higher or lower densities as compared with the average population and road density in the Mainland. Population density is estimated using the district area and the estimated population for 2002.

The Socio-Economic Profiles present the length of roads in the respective districts while food deficit was evaluated from the results of questionnaire survey (2002) and inspection by the National Food Security Department, MAFS. The deficit scores 2 points and surplus one point. Finally, the socio-economic potential is expressed by total scores; high potential for 6 points, medium potential for 4 to 5 points, and low potential for 3 points.

Based on the results of the study 25 districts, out of 99, are categorized as a high potential area from socio-economic viewpoints, 58 districts as a medium potential area and 16 districts as a low potential area. With new developments in the road infrastructure and population dynamics it can be seen that potential areas have changed thus a need for review.

6.4 Identification of Irrigation Development Potential Area

The potential area for irrigation development was determined by a study of water resources, land resources and socio-economic potentials. The determination was made by assessing and combining the scores of these three potentials and associating the quantities of each potential to a specified geographic feature, overlaying these three assessment maps and then high, moderate and severe areas are roughly identified. The locations of high, medium and low potential areas in potential are shown in Appendix 1 GIS Maps.

According to this map, the High Potential Areas are largely split among four places. The first location is in Mara, Mwanza and Kagera regions. The second place is in Arusha and Kilimanjaro regions. The third place is in Morogoro region. The fourth place lies at Mbeya and Iringa regions. The Medium Potential Areas are mostly located around the high potential areas. The Low Potential Areas are scattered over the whole country.

The study results show the total area of 94.8 million ha, consisting of:

- i. 2.3 million ha for “High Potential Area”,
- ii. 4.8 million ha for “Medium Potential Area”,
- iii. 22.3 million ha of “Low Potential Area”,
- iv. 31.1 million ha for “Forest/Marginal Area”,
- v. 7.3 million ha for “Water Body”, and
- vi. 27.1 million ha for “Protected Area”.

6.5 National Irrigation Master Plan: Lessons learnt from National Irrigation Development Plan (NIDP) 1994

The NIMP identified three major constraints which caused the unsatisfactory implementation of the NIDP. These are:

- i. Lack of appropriate technical approach to scheme implementation,
- ii. Inadequate institutional building; and
- iii. Lack of financial resource as discussed in Sub-clause 4.2.3 of the NIMP.

The NIMP proposes two approaches to deal with the constraints. These are:

- i. Subject-wise Improvement and
- ii. Scheme-wise Development.

These approaches provide a comprehensive means of working toward sustainable irrigation development. Subject-wise Improvement aims at the creation of an appropriate environment for sustainable irrigation development, mainly with a view to enhance quality. Scheme-wise Development aims at the expansion of irrigation area and to increase commercialization through effective use of national resources, including financial resources. The NIMP proposes that the Subject-wise Improvement Programme and Scheme-wise Development Programme is to be prepared considering five elements:

- i. Economic Soundness;
- ii. Technically Appropriate;
- iii. Socio-logically Sustainable;
- iv. Institutionally Reliable; and
- v. Environmentally Friendly.

The NIMP sets forth a stage-wise capacity building program that is designed to enable the DITS to identify, design, construct, and operate a variety of irrigation schemes within Tanzania. The first step is to develop the division's human resources through hiring and training.

Once human resource capability is at acceptable levels, the NIMP proposes that the institutional structure of the DITS and other key stakeholder agencies be refined to enhance their environmental management capacity.

7 BASELINE DATA

The existing situation, "baseline", refers to the collection of information on the current status of biophysical, social and economic variables in an area of interest. Baseline data were collected for two main purposes:

- i. To provide a description of the status and trends of environmental factors (e.g., air pollutant concentrations) against which predicted changes can be compared and evaluated in terms of importance, and
- ii. To provide a means of detecting actual change by monitoring once a project has been initiated.

Collection of baseline data was designed to satisfy information requirements relevant to SESA analysis as contained in the ToR, and only baseline data needed to assist in the prediction of the impacts was collected.

Based on the objectives of the NIMP, the baseline data set forth in Section 7 is presented in order to develop an understanding of the physical, biological, and socio-economic environments within which the NIP and the NIMP will be implemented.

7.1 Existing Situation of Irrigation Schemes

The existing situation of the irrigation practices is presented in relation to the categories of irrigation schemes which are: Traditional Irrigation Schemes, Rain Water Harvesting (RWH) Irrigation Schemes, Improved Irrigation Schemes, and Large Scale Commercial Irrigated Farms.

The Traditional irrigation schemes are characterized by poor infrastructure, poor water management and low yields. Crop yields are typically in the range of 0.8 - 1.0 t/ha and 1.8 - 2.0 t/ha for maize and paddy respectively. The existing infrastructure starting from the headworks up to the fields are all temporal, poorly constructed and pose difficulty in overall water management resulting to low water use efficiencies. This contributes substantially to water losses and overall poor performance of these schemes. Due to poor water management and absence of drainage infrastructure, salinity and water logging problems are common in some traditional irrigation schemes.

Most rain water harvesting based irrigation schemes are found in the arid and semi-arid areas of central and western part of Tanzania. Such schemes involve either direct taping of rain water in bonded fields or diversion of rainwater run-offs from seasonal and ephemeral rivers. Farmers who are irrigating using RWH techniques which are diversion of runoff or ponding rainwater in bunds, suffer from poor infrastructure for diverting harvested water and lack control of water in the bunds. They also suffer from unreliable rainfall. As a result they are characterized by poor water management and low yields or complete crop failure.

The Improved irrigation schemes have permanent structures and facilities for irrigation, drainage and flood protection and have been designed with full water control and measurement to assist in water delivery and management. The performance of improved irrigation schemes has some improvement in terms of water management, water use efficiency and crop yields as compared to the traditional irrigation schemes. For example, average yields of 4.0 to 5.0 t/ha are common.

Privately owned irrigation schemes have permanent structures and facilities for irrigation, drainage and flood protection and have been designed with full water control and measurement. Most of them especially in the horticultural and floricultural industry are performing well with higher water use efficiency. The private sector is confronted with inadequate incentive schemes such as assurance of land ownership, water availability and accessibility and leveraging mechanism for investment.

Private sector involvement covers not only the investment and management of the commercial farms and estates, but also includes the provision of support services and facilities. The contribution of the private sector which is engaged in service provision for irrigation equipment particularly water pumps, drip and sprinkler equipment, has significant impact to the sector. Service provision for construction and consultancy are still very low.

Despite the well managed private irrigation schemes, most smallholder irrigation schemes have management problems which include poor operation and maintenance of the infrastructure, poor leadership, inadequate skills on the part of farmers on the management of irrigation schemes and poor on-farm irrigation and drainage water management.

7.2 Irrigation Research and Development

Appropriate interventions including research are not yet adequately pursued in those areas. There is little research undertaking in irrigation for ensuring proper planning, design, development, management and operation and maintenance of irrigation schemes, consequently there are scanty appropriate recommendations that integrate water and other resources relevant to irrigated agriculture.

Few research activities undertaken have largely been academic in the sense that practical problems facing irrigation schemes and farmers are not addressed to provide required technological support for improvement of productivity and profitability.

7.3 Promotion of Appropriate Irrigation Technologies

The appropriate technologies with higher water use efficiency emanated from research findings and new innovations on irrigation infrastructure are not adequately adopted by irrigators. The importance of using storage dams and appropriate technologies such as drip and sprinkler irrigation methods; ground water for irrigation and use of appropriate sources of energy (non conventional) such as wind mills, solar power and draught-animal power are not widely used in Tanzania at the moment.

Urban and peri-urban irrigated agriculture is gaining momentum in urban areas using water from domestic water supplies and untreated waste waters. Although this type of agricultural practice has a potential to contribute towards production of horticultural crops, it is not regulated thus causing healthy hazards, over-stressing domestic water supply and interfering with urban planning.

7.4 Institutional Capacity

The existing institutions responsible for irrigation development in Tanzania are characterized by inadequate establishments; inadequate and weak data base; low skills and awareness on the roles and responsibilities of the stakeholders; inadequate financing; weak enforcement of by-laws; inadequate equipment, facilities and number of qualified staff and absence of irrigation legal framework. Linkages between relevant institutions are weak and their respective roles and responsibilities are not clearly defined to the detriment of effective irrigation development.

The present institutional set up of the irrigation division does not meet the demand of the fast growing irrigation sector. There is no legally established irrigation regulation to control the quality of irrigation interventions. There is inadequate number of qualified staff in all levels and relevant professions, inadequate financing and inadequate equipment and facilities. All these contribute to low capacity at the national level and Local Government Authorities.

Farmers under their organization have limited funds and capacity in financial management, weak leadership, low awareness on the need to pay water user fees, low willingness to pay these fees, and limited capacity for enforcement of the by-laws. Irrigators' organizations also have limited capacity for ensuring effective and sustainable crop production in irrigation schemes.

The participation of Private Sector in construction, consultancy services, support services and management in irrigation development in Tanzania is very low. Despite the desirability of involving them the capacity to provide such services to the irrigation sector is limited.

A number of NGOs are already active in Tanzania's irrigation sector. The operations of the majority of these NGOs are financed by a range of sources including the Government and its Development Partners. However, there are still not many NGOs that have the necessary capacity or technical competence in irrigation interventions. Moreover, the existence of most of the NGOs and the range of their areas of operation are not well known by the beneficiaries.

The requirement for initial investment cost in developing irrigation infrastructure is relatively larger compared to other interventions in agricultural development and in most cases during planning stage for development of irrigation schemes, activities relating to studies, designs, preparation of tender documents and supervision of works are not adequately financed and this leads to ineffectiveness during project execution and low quality of work output. Furthermore the best period for construction of irrigation infrastructure which is the dry season is mainly from June to October. This best period does not coincide with the financial cycle of the Government which begins in July ending up in June, so no funds are made available until sometimes in the end of September.

7.5 Key Issues

The key issues are the potential impacts on water resources, land, public health and social - economic matters.

Irrigation practices in Tanzania is characterized by low water use efficiency, low water productivity and absence of a mechanism for exercising socio-economic mobility of water and over dependency on surface water as a major source for irrigation development. In addition, irrigation also happens to be one user that has been in the centre of most water use conflicts amongst themselves and/or with other users if not well organized under a Water Users Organization can easily be subjected to water use conflicts as a result of inequitable water allocations.

Little consideration which has been given to water sources conservation and catchment management has negative impacts on water availability to downstream users and inappropriate water use practices and the resulting degradation threaten the sustainability of ecosystem, human health, food security and productivity; and constrain investment in various social and economic sectors.

Most of the cultivated area under irrigation is held by small-scale smallholder farmers who hold it through customary right of occupancy and most of them are unaware of the importance of land registration for title deeds. Land administration procedures are not streamlined to the extent that the granting of title deeds is painstakingly slow. On the other hand, land can become waterlogged or chemically compromised as a result of poor irrigation and drainage.

Moreover in most cases land earmarked or developed under irrigation has no protection against conversion into other uses. Another fundamental problem land is that inappropriate land use practices results into accelerated run-off, reduced groundwater recharge, soil erosion and increased sediment transported by rivers and silt accumulation in reservoirs and irrigation systems.

Women are playing a major role in developing and practicing irrigated agriculture but are hampered by low level of social status in the community, illiteracy, low entrepreneur skills, inadequate access to productive resources and services.

Public health risks associated with the practice of irrigation include HIV/AIDS. This is more pronounced in areas with large scale commercial farms which attract interaction of many people, thus making them more vulnerable to HIV/AIDS pandemic. The level of the effect is not under rated in rural areas where smallholder irrigation farming is dominant. As a consequence in both cases, the reduction of manpower that is required on the intensified activities in an irrigation scheme results.

Despite of the negative potential impacts under the irrigation sector irrigated agriculture has contributed to the improvement of crop production, productivity and profitability to the farmers in particular and the nation at large. For example, production in irrigated agriculture is higher by 3-4 times than that under rain fed agriculture.

7.6 Physical Environment Data

7.6.1 Geology and Groundwater Hydrology

The geology greatly influences the type and distribution of the groundwater courses. This influence is manifested mainly through the spatial distribution of rocks and soils with varying permeability and porosity. Ground water resources occur only on areas with soils and rocks of moderate to high permeability and porosity. Where the permeability and porosity is low, the availability of exploitable ground water is generally low, although the converse is not necessarily true.

Groundwater is an essential resource and a major source of safe (potable) water. Water from springs and wells is used for agricultural, industrial, public, and private uses. However, the availability of groundwater is highly variable. The continued access to and the development of safe and reliable supplies of groundwater are important issues that the Government of Tanzania and many international and private organizations are working on.

Groundwater supplies are developed from aquifers, which must yield water in sufficient quantities to be economically useful.

An aquifer is geologic formations that contain pores or open spaces (interstices) that are filled with water and interconnected, and these interstices must be large enough to transmit water toward wells at a useful rate. An aquifer may be imagined as a huge natural reservoir or system of reservoirs in rock whose capacity is the total volume of interstices that are filled with water.

Generally, the Precambrian basement complex, Karoo super group, Post Karoo sedimentary formations and volcanic and alluvium deposits represents the geology of Tanzania. In the crystalline basement of the central plateau, groundwater flow is restricted to joints and fractures and is therefore limited. Sandstones and conglomerates of Karoo are characterized by groundwater occurrence associated with primary porosity and inter granular flow, which may locally be enhanced by secondary porosity created by fracturing. In the coastal sedimentary formations that attain a thickness of more than 200 m, has an aquifer lithology of limestone, sandstones and sand.

The greatest aquifer potential in Tanzania lies, within the volcanic pyroclastic and volcano alluvium deposits found in the slopes of Mount Kilimanjaro. This type of aquifer extends as further as to the Kenyan territory.

Tanzania's groundwater resources have not been thoroughly investigated except in the Internal Drainage Basin which was thoroughly investigated by a Japanese International Cooperation Agency (JICA, 2008).

7.6.2 Aquifer Formations in Tanzania

The generalized aquifer formations in Tanzania are summarized in Table 7 -1. They can be categorized as follows:

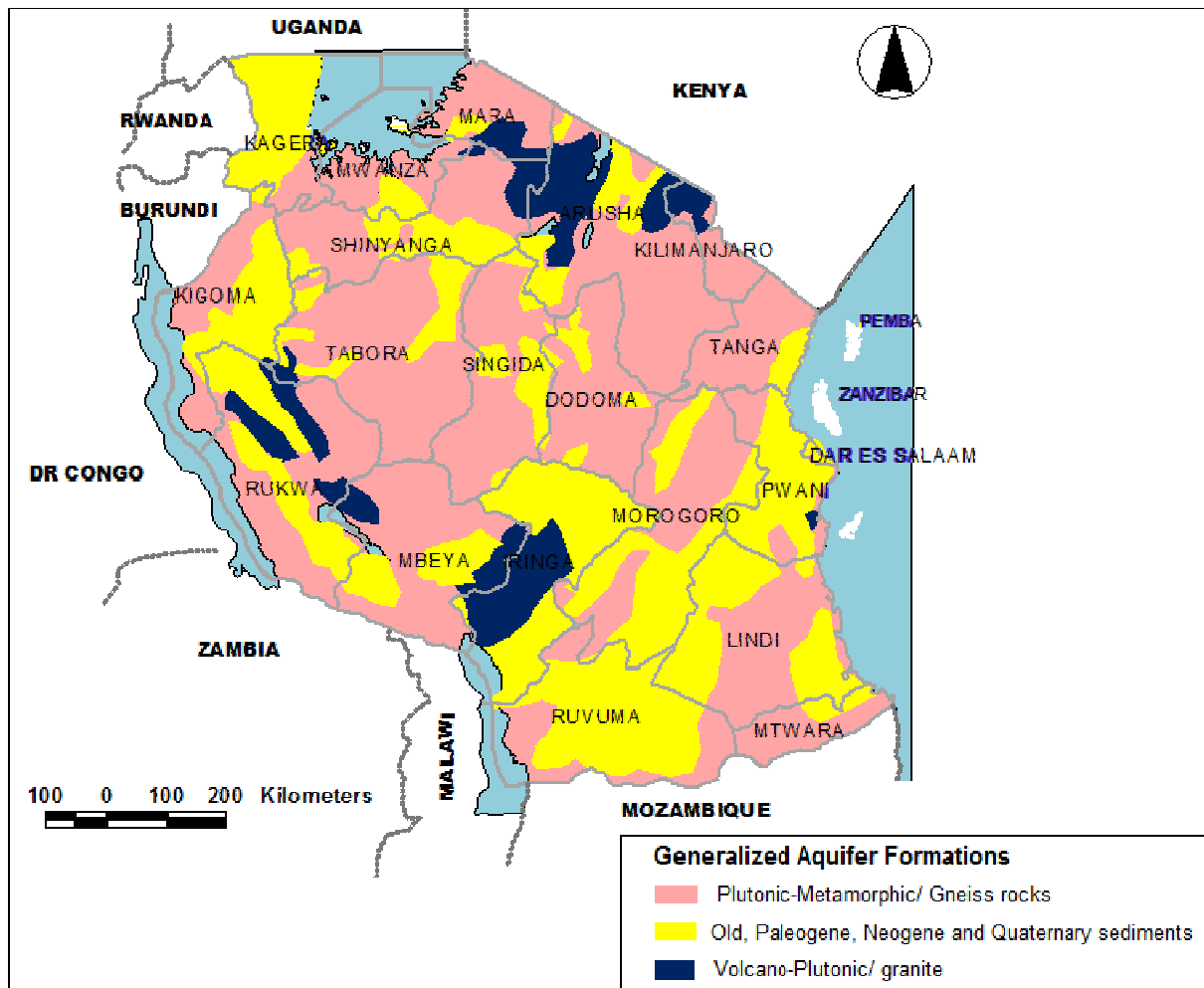
- i. In most regions and notably in Mtwara, Coast, Morogoro, Ruvuma, Shinyanga, Kilimanjaro, Kagera, Lindi, Mwanza and Mbeya the dominant water bearing formations are unconsolidated sand and gravels.
- ii. In region such as Singida, Mara, Iringa, Kigoma, Dodoma, Rukwa and Manyara the water bearing formations are predominantly weathered and/or fractured Granites/Gneisses. Arusha is dominated by igneous rocks and the water bearing zones are mostly in weathered and fractured lava flows.
- iii. In Tanga region, the semi-consolidated marine sediments and the Karoo sandstones are mostly the water bearing zones.

Table 7-1: Generalized Aquifer formations and percentage area coverage in Tanzania

Category	Aquifer Type	Main lithological units	Percentage Area
1.	Old, Paleogene, Neogene and Quaternary sediments	Alluvial: sand, gravel, silt, mud Lacustrine: sand, silt, limestone, tuff Terrestrial: sand, gravel, laterite, silcrete, calcrete; Fluvial: marine, sand, gravel, silt, limestone	20%
2.	Volcano-Plutonic/ granite	Black clay soil, yellow altered ash, white pumice and ash breccias, paleosoil with clay and volcanic rocks, alluvial deposits, sand with basalt, weathered basalt	15%
3.	Plutonic-Metamorphic/ Gneiss rocks	Marble; quartzite, graphitic schist, chlorite, amphibolite, mica and kyanite schist, hornblende biotite and garnet gneiss, acid gneiss, granulite, charnockite, magmatite; mudstone, shale and phyllite, arkose, quartzite, conglomerate, limestone	65%

Source: Atlas of United Republic of Tanzania (URT, 1976)

The Old, Paleogene, Neogene and Quaternary sediments are mostly unconsolidated and semi-consolidated where the old sediments occur. The Volcano-Plutonic are mostly consolidated and the Plutonic-Metamorphic are also consolidated except when weathered. Boreholes drilled in the 1st and 2nd category (Table 7-1) are expected to be fairly homogenous depth-wise, mostly sediments in the first and volcanic and granites in the latter. In the 3rd category, typical sections usually include unconsolidated superficial deposits, weathered granites/gneiss, fractured granite/gneiss and solid bedrock. Figure 7-1 presents the distribution of aquifer categories by regions (additional environmental maps are presented in Appendix 1).



Source: Baumann *et al.*,(2005)

Figure 7-1: Distribution of Aquifer Categories by Regions

The current problems facing groundwater resources exploration, development and management for urban and rural dwellers in the country include:

- i. Overexploitation

- ii. Decrease of yields in boreholes (e.g. some of boreholes in Sanawari area, operated by the Arusha Urban Water and Sanitation Authority;
- iii. Poor workmanship during construction of boreholes which leads to caving in of boreholes and opening up deeper aquifers to pollution sources;
- iv. Human activities approaching positions/location of boreholes;
- v. Inadequate public awareness on the importance and potential sources of pollution of groundwater resources;
- vi. Role of private sector in ground water development and management not yet well recognized;
- vii. Lack of data: data is scattered, fragmented and usually incomplete;
- viii. Lack of groundwater monitoring networks;
- ix. Lack of groundwater resources management plans;
- x. Increased climate variability and change, bringing about uncertainty in terms of rates of replenishment.

7.6.3 Topography

Landforms are the shapes assumed by the surface of the land. The generalized existing topography for each irrigation zone are summarized in Table 7.2 and they can be categorized as:

Flat (a horizontal or very gently sloping surface), Undulating (an irregular surface composed of random, gently sloped rises and declivities, with only moderate differences in elevation), Depression (any lowering of the earth surface, such as pits, basins, valley etc), Slope (any inclination of the land surface from the horizontal), Rolling (similar to undulating with more pronounced irregularities), Hilly (sharply accentuated, with steep slope but rising only to a moderate height).

Table 7-2: Summary of existing Topography for each Zone

S/N	Irrigation Zone	Existing Topography
1	Morogoro	Hilly, slope and level to flat
2	Mwanza	Rolling, undulating and level to flat
3	Tabora	Sloping, rolling and level to flat
4	Mtwara	Sloppy and rolling
5	Central	Sloppy, undulating, rolling and hilly
6	Kilimanjaro	Sloppy, undulating, rolling and hilly
7	Mbeya	Sloppy, undulating, rolling, hilly and level to flat

Source: Atlas of United Republic of Tanzania (URT, 1976)

Undulating and sloping were found to be the predominant landform types in areas potential for irrigation development in Tanzania, these have resulted primarily from natural erosion.

As soil erosion has a direct negative influence on soil fertility by removing and burying the upper layer of fertile soils, it is recommended that a proper system of soil conservation be established during irrigation development. Leveling of the farms is essential where surface irrigation will be deployed. Other methods such as drip irrigation should be practiced in hilly areas where mainly short root crops are grown.

7.6.4 Soils

Soils play an important role in the hydrological cycle through their influence on evapotranspiration, surface runoff and ground water recharge. Sandy soils have high permeability resulting in little or no surface runoff except where the surface has become compacted. Clay soils have lower permeability than sandy soils, and surface runoff is common. Soil water retention capacity is an important determinant of evapotranspiration and recharge. Fine-grained soils with high retention capacities favor evapotranspiration and recharge. Coarse soils with low water retention capacities allow rainfall to quickly infiltrate below the root zone, decreasing evaporative losses but increasing recharge.

During prolonged dry spells, clay soils may develop cracks and enable rapid infiltration, but, following resumption of the rains, they tend to swell, closing the cracks and reducing recharge.

Thick, low permeability soils can be an effective agent in preventing or minimizing ground water pollution and, hence, in the protection of aquifers. Thin, high permeability soil layers, such as sandy soils offer very little protection to underlying freshwater lenses. Loamy sand and sandy loam soil textures indicate good physical condition and thus high potential for Agricultural use. Heavy soils such as clay, clay loam and sand clay soils texture are usually found to be associated with drainage and/or tillage problems. Consequently these types of soil have a relative low capacity for agricultural use. Despite the fact that heavy soils have a higher fertility than light soils, both types require improvement for increasing the crop production.

In this study the soils were characterized according to simple morphological characteristics, which distinguishing soil types (soil texture, and drainage), and based on the description of the soil genesis soil orders were depicted. The generalized existing Soil types and order for each irrigation zone are summarized in Table 7.3.

Loamy sand and sandy loams were found to be the predominant soil textures. These textures indicates that Tanzania soils are in good physical condition and thus of high potential for agricultural use. Heavy soil, such as clay, clay loam and sandy clay soil textures cover a small part of Tanzania and are usually found to be associated with drainage and or tillage problems.

Consequently these types of soils have a relatively low capacity for agricultural use. Despite the fact that heavy soils have a higher fertility than light soils, both types required improvement for increasing the crop production.

The results show that in Tanzania drainage does not in general represent a serious problem in soils for agricultural use because the large part of the land enjoys good drainage. Well drained soils process a higher degree of humidification and experience a higher degree weathering, which promote the availability of nutrients for plant growth. It is also of note that these soils in most instances are suitable for agricultural practices, planting, tillage and harvesting. In contrast, poor or excessively drained soils represent only a small part of Tanzania land and thus they cannot be considered to cause any major problem for agricultural development at the present time.

Table 7-3: Summary of identified Soil types and order

S/N	Irrigation Zone	Identified Soil types and Order
1	Morogoro	soils are mainly sandy clay with excessive drainage and loamy sand with imperfect drainage belonging to Entisol and Ultisol soil order.
2	Mwanza	soils are mainly loamy sand with good drainage, and clay with imperfect drainage belonging to Oxisol, Vertisol and Entisol soil order.
3	Tabora	soils are mainly loamy sand with imperfect drainage, loam with good drainage and sandy clay loam with good drainage belonging to Oxisol and Ultisol soil order.
4	Mtwara	soils are mainly sandy loam with good drainage and loamy sand with good drainage belonging to Entisol and Inceptisol soil order.
5	Central	soils are mainly clay with poor drainage, loamy sand with imperfect drainage, and loam with good drainage belonging to Vertisol, Ultisol, and Entisol soil order.
6	Kilimanjaro	soils are mainly clay with poor drainage, and clay with moderate good drainage belonging to mainly Vertisol soil order.
7	Mbeya	Soils are mainly sandy with good drainage and clay with poor drainage belonging to mainly Vertisol and Ultisol soil order.

Source: Atlas of United Republic of Tanzania (URT, 1976)

Soil orders, based on profile development and established according to the degree of the process of soil formation were identified. The following are the soil order which were recognized:

- i. Entisol (mineral soils characterized by freshly weathered, coarse fragments, shallow depth and the absence of B horizon (sub-soil) development), Vertisol(mineral soils characterized by cracks micro relief, black color and the absence of B horizon development in most instances),Inceptisol (mineral soil having a recent stage of development, and newly differenced B horizon), Ultisol (mineral soils having strong structural development, clay accumulations in the B horizon and with discontinuous iron pan (plinthite is a thin, hard layer of deposited iron),Oxisol (mineral soils without clay accumulation in most instances, having weak structural development, continuous iron pan and indistinct soil boundaries).
- ii. Entisol, vertisol and inceptisol order are soil of a low degree of development and hence possess a poor degree of fertility. Fertilizer/Manure is needed for these types of soil if irrigated agriculture is too practiced. Utisol and oxisol orders are soils with a higher degree development and are suitable for irrigated agriculture because of their higher fertility.

It can be concluded that in Tanzania drainage does not in general represent a serious problem in soils for agricultural use because the large part of the land enjoys good drainage, therefore

surface drainage is recommended. In general, soils of Tanzania have a relatively low degree of fertility and therefore fertilizers will be applied in many instances, and this needs to be properly done to avoid polluting the environment.

7.6.5 Climate

The climate is one of the major influences on the availability of naturally occurring fresh water. For Tanzania, there are two geographic factors of major importance to climatic conditions. These factors are latitude, and its position at the eastern edge of the Africa continent adjacent to the warm Indian Ocean.

Tanzania is situated between 1 and 11 degrees southern latitude, and the major characteristics of its climate are closely related to this position so close to the equator. The climate is tropical, with high temperatures in the lowland areas, low wind speeds, high humidity in the air and most typical of all these features, the absence of cold season.

In the area adjacent to the Indian Ocean, the general circulation of the atmosphere exhibits large seasonal changes. These have important consequences for the climate of Tanzania, mainly because they control the seasonal distribution of rainfall, cloudiness and surface wind directions. Tanzania receives relatively modest amounts of rainfall, and seasonal variations are large. These features are mainly caused by the changes in the general circulation over the eastern Africa, during the course of the year.

The area is influenced by warm, moist, northeasterly and southeasterly trade winds. The doldrums occur at the Equator, and are characterized by low pressure, strong vertical movement (convection) and atmospheric instabilities with high solar radiation and temperatures, and heavy precipitation. However, there are anomalous dry areas within the country. The Inter-tropical Convergence Zone (ITCZ) where the northeasterly and southeasterly trade winds meet, in the southern hemisphere occurs in Tanzania.

This feature is controlling mechanism of the climate, but occurs at different time scales, ranging from diurnal convection, easterly waves, tropical cyclones, thirty – sixty –day oscillations, monsoons, quasi-biannual oscillations, semi-decadal El Niño South Oscillation (ENSO) to a long-term climate changes including global warming and the “Green House Effect”.

In Tanzania precipitation occurs predominantly as rainfall. Other forms of precipitation, particularly dew condensation and fog interception, may occur in highland areas, but these are relatively minor forms of precipitation in comparison with rainfall. For this reason, emphasis is placed on rainfall and the important characteristics of rainfall from the water resources viewpoint are its spatial and temporal distribution.

Rainfall is by far the most variable climatic element in Tanzania. It displays large variations from year to year and in many parts of the country the seasons of the year differ mainly in rainfall.

7.6.6 Water Resources

Tanzania is endowed with extensive water resources. The estimates by U.N. Food and Agricultural Organization (FAO) in 2008 indicate that Tanzania had 96.27 km³ of renewable water resources per year, which correspond to 2,266 m³ per person-year (<http://natcomreport.com/Tanzania/pdf-new/water.pdf>). Recent estimates indicate that Tanzania watershed generates about 89 km³ of renewable water resources annually of which about 40km³ is groundwater. In total, this translates to an annual per capita amount of water of about 2,150 cubic metres of water by 2010 for an estimated population of 40 million people. Due to population growth, increase in water demand to meet requirements for various socio-economic activities, pollution and climate change this amount is going to decrease to about 1,500 cubic

metres per capita per annum by 2025 and Tanzania would then be in a water stress situation (<http://www.maji.go.tz/userfiles/speech%20pdf.pdf>).

The water resources are unevenly distributed both in time and space. During the dry season, which usually lasts from June to October, even large rivers can dry up or their flow declines substantially. Some parts of the country receive, on average, up to 3,000 mm of rain per year, while in other regions (e.g. Dodoma Region, or the Rift Valley) yearly rainfall averages 600 mm.

Tanzania is presently divided into nine river basins for purposes of water resources management, which include; (i) Pangani (ii) Wami-Ruvu, (iii) Rufiji, (iv) Ruvuma and Southern Coast, (v) Lake Nyasa, (vi) Lake Rukwa, (vii) Lake Tanganyika, (viii) Lake Victoria and (ix) the Internal Drainage.

Table 7-4: Summary of Surface and Groundwater in Water Basins

S/N	Water Basins	Description and characteristics
1	Wami-Ruvu	Consists of two main river systems (Wami draining 40,000km ² and Ruvu 17,700km ² as well as the coastal rivers south of Dar es Salaam. Mean Annual rainfall (MAR) is about 765.1 mm. The annual mean runoff (AMR) is about 3,770.5 MCM, while groundwater recharge is about 218.8 MCM.
2	Pangani	Covers an area of about 53,600km ² . The main rivers are Pangani, Uмба, Msangazi, Zigi and Mkulumuzi. The MAR is between 600 and 2,000 mm/year, and the AMR is 1,773.5 MCM. Groundwater recharge is around 225.2 MCM.
3	Rufiji	Covers an area of 177,420 km ² (about 20% of Tanzania). Major draining rivers are Great Ruaha (83,979), Kilombero (39,990), Luwegu (26,300) and Rufiji (27,160). Except for the lower parts of the basin, which experience two rainy seasons, the largest portion is characterized by unimodal rainfall. The MAR varies from 400mm/year in the drier areas to 2000mm/year in wetter parts. The AMR is 32,975.3 MCM. Groundwater recharge is around 532.3 MCM.
4	Ruvuma and Southern Coast	Has a drainage area of 103,720km ² . The MAR is 1050mm/year, and the AMR is 2,126.3 MCM. Groundwater recharge is around 207.4 MCM.
5	Lake Nyasa	A transboundary basin, drainage area of 132,000km ² , of which 37,000km ² is from Tanzania side. Major rivers are Songwe, Kiwira, Luforio, Ruhuhu and Rumakali. The basin MAR is about 1672 mm/year, while the AMR is 13,618.6 MCM. Groundwater recharge is estimated at 158.1 MCM.
6	Lake Rukwa	Has a drainage area of 88,180 km ² . Rungwe River draining an area of 20,000km ² is a largest river in the basin. Water in the basin is mainly for domestic water supply for major urban centres Mbeya

S/N	Water Basins	Description and characteristics
		and Sumbawanga and other smaller towns. The basin MAR is about 900 mm/year, while the AMR is 9,214.8 MCM. Groundwater recharge is estimated at 529.1 MCM.
7	Lake Tanganyika	Has a drainage area of 151,900km ² . Large rivers draining the basin are Malagarasi (130,000 km ²) and Ugalla (52,000km ²). The MAR is 1,173.6mm/year, and the AMR is 18,941.9 MCM. Groundwater recharge is around 607.6 MCM.
8	Lake Victoria	Has a drainage area of 79,570km ² . Variable rainfall is received depending on location. In the eastern part, rainfall is bimodal with yearly average of 500 to 1000 mm/year up to 1600 mm/year in highlands, while in the southern part in Mwanza, the pattern is unimodal with yearly average rainfall of 750 to 1100mm. The western part around Bukoba receives rainfall almost throughout the year to about 2000mm per year. The AMR is about 1480 MCM and groundwater recharge is around 477.4 MCM.
9	Internal Drainage	Situated in semi arid region of Tanzania, with a catchment area of 153,800km ² . The MAR ranges from 500 mm/year to 900 mm/year in the highlands. The annual mean runoff (AMR) is about 5,629.1 MCM, while groundwater recharge is about 767.0 MCM. Major drainage systems include Lake Eyasi system, Lake Manyara system and Bubu complex.

Source: <http://www.maji.go.tz/basins/nine.php>; Shaghude (2006); URT, (2006)

7.6.7 Surface Water Hydrology

Surface water refers to water found on the surface of the earth (e.g. lakes, rivers, streams, ponds, reservoirs and other forms of wetlands) and these are very typical to most Tanzanian basins. Some of the surface water resources depend on rainfall supply for their sustained existence. Nevertheless, during recent decades, precipitation trends in the region have become unpredictable. Erratic onsets of the rains are a recent common phenomenon. Currently, rainfall distribution is poor, affecting rain fed agriculture and food security in the region. Surface water abstraction for agriculture, industrial and domestic usage has intensified. Considering this predicament, alternative sources of water (e.g. rainwater harvesting) are being explored to ensure increased agricultural production and food security and more areas for agricultural expansion are being proposed.

Whilst that is being considered, the understanding of hydrological response patterns of various surface water ecosystems is inevitable for ensuring water supply and ecosystems integrity.

The need for hydrological data to assess the potential of a site or area depends to some degree on the type and scale of the likely exploitation of the water resource.

The management of surface water hydrological data to assess the potential of a site or area depends to some degree on the type and scale of likely exploitation of the water resource. The management of surface water resources may include water supply for domestic or industrial purposes, hydroelectric power production, irrigation or flood control. Each of these uses

requires long term river flow series data for the estimation of water availability and the optimal design of works.

However, different types of water resources project have different scales of consumption, and therefore different priorities in terms of flow series. Furthermore, they have different horizons of predictability in terms of location and quantity. For example, water supply demands for domestic purposes can in general be forecast with sufficient precision over a reasonable time scale by analysis of statistics of population and water use.

The use of surface water for irrigation, which is generally required most when river flows are low, usually implies the need for reservoir storage. The determination of reservoir yields through simulation studies requires hydrological analysis of annual flow volumes and their variability becomes of critical importance. The volumes of water consumed in irrigation are relatively great and these have to be considered against other sectoral water needs. Comparisons of water demand for the various categories of use may be put into perspective by approximate estimates of the volumes of water required by the various water needs including irrigation.

The design of most river engineering projects requires information on flood magnitudes; thus high flow records are essential to extract annual maximum series or peaks over threshold series for analysis. Therefore, the question which the hydrologist is called upon to answer is whether or not a river has sufficient capacity to meet the estimated sectoral demands of water. As accurate an answer as possible is necessary for the design of facilities with maximum efficiency with minimum expenses.

7.6.8 Water Quality

There are problems of water quality for water used in irrigation. Some water may not meet the required irrigation water standards. In many cases, the return flows from irrigation schemes are polluted with agrochemicals and fertilizers. The major sources of pollution in the basin are classified into:

- i. Industrial pollution where by some of the industries discharge partially treated effluents into the river. These industries have treatment units which produce effluents that do not comply with effluent standards;
- ii. Agrochemical pollution where improper use of pesticides contributes to water pollution which finally reaches water streams; and
- iii. Urban pollution caused by human settlements along the river. Discharge of untreated domestic waste (Solid and Liquid) in the rivers causes potential degradation of the water quality.

Two monitoring networks exist, namely surface water and ground water monitoring networks. Monitoring is done to ensure the quality of the water in the water bodies are as per the recommended standard and the effluent discharged into the water bodies complies with the required effluent standard of receiving water. The monitored parameters include Temperature, pH, Turbidity, Conductivity, Phosphate, Dissolved Oxygen and Biochemical Oxygen Demand (BOD₅).

Water Quality Data to Establish the Baseline Situation

The DITS undertakes baseline studies to assess the suitability of water quality for irrigation use (i.e. potential for salinisation and soil water logging) prior to development of any irrigation project in Tanzania as a legal requirement under EMA Cap 191. This mechanism has generated an extensive data set, but data management has been poor, so access to these data

and thus utility for review and assessment is hindered by poor data management (e.g. Mato, 2002).

There is no emphasis in the DITS assessment on the potential of the scheme to affect other uses so there is little effort to collect baseline water quality data from the receiving waters. There is a national water quality monitoring program in Tanzania, but data from receiving waters is very limited and the potential impact of irrigation has not been a focus. In general, the monitoring of receiving water quality has been poorly co-ordinated and funded at the national level.

At the scheme and basin level, there have been several detailed studies, which provide information relevant to the situation in Tanzania and give insight into the impact of agriculture relative to baseline levels of salinity, sediment, nutrients and biocides.

7.6.9 Data and Capability Gaps

Co-ordinated management and storage of data is a significant capability gap in the water sector bureaucracy. These capabilities in the Ministry responsible for irrigation are weak. The division of Irrigation has developed a database relevant to its needs for irrigated schemes but it does not hold any water quality data. There are no programs in place within the Ministry responsible for Irrigation to monitor for impacts of irrigation on water quality downstream but if measured is not for this purpose.

The Water Laboratory Services Division (WLS) of the Ministry of Water has conducted baseline surveys on receiving water quality monitoring throughout Tanzania and also analyses the (major ion) water quality of all irrigations schemes prior to inception, but these data have not been collated or managed in any form.

7.7 Water Quality Problems in Tanzania Associated with Irrigation

7.7.1 Case study – Water Resource Allocation in the Eastern Usangu Wetlands

The most detailed studies of the potential impacts of irrigation in Tanzania have been made by the RBMSIIP project in the Greater Ruaha basin and the Usangu wetlands (World Bank 2004); (SMUWC 2001a,b). There has been an important debate over the relative impacts of cattle grazing and irrigation on the hydrology and the water quality of the Great Ruaha River.

The NIMP argues that sustainable irrigation can be conducted in the basin by “improving methods and modality of irrigation water use” (URT, 2002). Others e.g. (Mtahiko *et al.*, 2006) have also argued that perennial flow in the GRR can only be restored by dry weather irrigators returning at least 25% ($4 \text{ m}^3 \text{ s}^{-1}$) of the water to the river and the removal of all livestock from the eastern Usangu wetlands.

The SMUWC project made a detailed two year study of water quality in the Usangu wetlands and downstream of the irrigated farms by (SMUWC, 2001c). The study reported that there was:

- i. no evidence of salinization;
- ii. very low loads of artificial fertilizer or agro-chemicals in the catchment although indications of higher applications of fertilizer in the large rice farms;
- iii. Sediments exported from the upper catchment were generally low, but there was substantial export of suspended sediment (estimated at 30,000 tons per year) from irrigation schemes into the Eastern Wetland, which has degraded fisheries in the Eastern Wetland.

7.7.2 Case study - Water and Soil Chemistry Impacts on Sustainable Irrigation in Bahi and Chali

This study focused on the potential impacts of source water salinity and alkalinity on the productivity of the irrigation schemes in the dry lands of Tanzania. This paper examined salinity and alkalinity problems in two schemes (Bahi and Chali) and found problems of soil sodicity in both schemes (Kiunsi, 2006).

7.7.3 The Kirusix Valley (L. Manyara)

The Kirusix Valley in the Internal Drainage Basin is an irrigation area with smallholders, large-scale irrigators (sugarcane plantations) and agro industries. Lake Manyara is a receiving water body for nutrient and other agro-chemical exports from these diffuse and point sources.

One documented consequence of the lake eutrophication was a mass die-off of flamingos. These birds are specialist feeders on a particular species of microalgae (*Spirulina*) which flourish in soda lakes like Manyara. The changed nutrient balance in the lake altered the composition of the micro-algae and a toxic blue green algal species replaced *Spirulina* and poisoned the flamingos (Lugomela et al., 2006). This is an example of the sensitivity of aquatic ecosystems to nutrient loads and the unpredictable consequence of altering ecological balances.

7.8 Land Use

The results of analyzed data show that land use in low altitude areas include: aquatic agriculture, Aquatic closed to open grass including sparse trees and shrubs (fresh water, permanent and temporarily flooded), aquatic closed to open trees shrubs and woody vegetation such as Mangrove (brackish water), Aquatic closed to open trees, shrubs and woody vegetation (freshwater permanent or temporarily flooded, bare rock with shallow sand and tidal areas, salt flats, very stony and stony soil, closed trees, irrigated and post flood herbaceous crops, loose and shifting sands, bare soils, dunes sand banks and beaches.

For the medium and high altitude area, land use include: open to closed grassland, open to very open trees, rainfed herbaceous crops (large to medium continuous fields), rainfed shrub crops, tree crops, irrigated crops, forest plantations, sparse vegetation, tree and shrubs savannah. Land use found in both low, medium and high altitude areas include: swamps and urban areas. Irrigation development may involve the changing from one land use to another. This process should therefore be done carefully so as to ensure the integrity of the environment.

7.9 Key Issues

The following list of key relevant issues for the physical environment has been noted:

- i. In general, soils of Tanzania have a relatively low degree of fertility and therefore it is desirable that fertilizers be added in many instances;
- ii. Proper system of soil conservation is necessary during irrigation development;
- iii. Leveling of the farms is essential where surface irrigation will be deployed;
- iv. Alternative methods such as drip irrigation should be practiced in hilly areas;
- v. Irrigation development means changing from one land use to another and this should be done carefully so that nature and environment are kept better; and
- vi. There are significant data gaps in the long term record for surface hydrology and for climatic data.

7.10 Biological Environment Data

The sources of data were mainly through literature survey and some selected cases of direct field observation. In literature survey irrigation reports, publications, management plans and strategies at national, regional, district, ward, village and project level were scanned to obtain ecological information about a given irrigation project and surrounding areas. The process involved liaison with different governmental, non- governmental organization (NGOs) officials and private farmers practicing irrigation, including visiting of various offices in or outside project site. In each of the irrigation potential areas or projects the following conditions were used to guide the process of data acquisition:

- i. Existence of the project/ basin management plans;
- ii. Whether the irrigation project is new or old;
- iii. Whether it involves expansion or rehabilitation; and
- iv. Existence of monitoring plans or protocols for biodiversity and water resources.

In both literature and field observation information on the flora and fauna were summarized in terms of their habitat type and status, species composition and status (rare, threatened, vulnerable and endangered according to current IUCN red list), species abundance in terms of presence-absence, the ecological significance of the species (both locally, nationally and internationally) and finally aggregated by water basins of Tanzania.

7.10.1 Terrestrial Fauna

Tanzania has over 4 million wild mammals which include about 316 species and subspecies, notably antelopes, zebra, elephant, hippopotamus, rhinoceros, giraffe, lions, buffalo and various types of primates (Munishi and Chitiki, 2006). The species composition of the different River Basins in Tanzania and the IUCN Red List of Threatened Species Tanzania are given in Appendices 5 and 9 respectively).

There are about 827 species of breeding birds, ranging in size from ostrich to warblers. Whereas insects consist of more than 60,000 species, including species of economic importance like bees and disease vectors such as mosquitoes. There are at least 25 species of reptiles and amphibians and 25 poisonous varieties among the 100 species of snakes as well as hundreds of fish species (*ibid*). For the purpose of this assignment the main dominant flora of Tanzania is given based on the nine water basins namely Pangani River Basin, Ruvuma River and the Southern Coast Basin, Rufiji River Basin, Lake Rukwa Basin, Lake Tanganyika Basin, Lake Victoria Basin, Ruvu/Wami River Basin, Internal Drainage basin and Lake Nyasa Basin (Figure 7-2).

The resident species in any river basin is a reflection of suitable conditions for the species to survive. In this respect the existing natural conditions are the most suitable for the current species to exist. Any disturbance to the natural conditions will likely change the suitability of the habitat for the species that exist naturally. Irrigation development will in one way or another create disturbance in the different areas where it will be practiced. Such disturbances will likely be severe where irrigation expansion is planned and where the planned irrigation is large scale. This is because irrigation expansion will likely annex natural areas and sometimes interfere with the ecology of a given area. Most significant is expansion of irrigation into ecologically sensitive habitats such as forest reserves, wildlife corridors, riparian ecosystems and other protected areas which will result into high impacts on biodiversity of these areas. While this is the case, the irrigation potential of the country need be harnessed. But this should not be at the expense of ecological/environmental quality. Irrigation expansion/development therefore should be planned within the context of ecological integrity and environmental sustainability.



Figure 7-2: Major Water Basins of Tanzania

7.10.1.1 Pangani River Basin

The coastal portion of this eco-region contains parts of two Endemic Bird Areas (Coastal Forests and Eastern Arc Mountains): wetland birds, including the largest known colony of *Ardea cinerea* from East Africa and significant numbers of *Egretta ardesiaca*, *Dendrocygna bicolor*, *Charadrius pecuarius*, *Sterna nilotica*, *Chlidonias hybridus*, and *Rynchops flavirostri* (Appendix 9). The presence of Endemic Bird Areas in this basin implies that there are bird species which may not be found anywhere else outside this habitat. As birds are very sensitive to disturbance unplanned irrigation development/expansion will likely drive some of the birds to extinction as their habitats are destroyed.

7.10.1.2 Ruvuma River and the Southern Coast Basin

Lower Ruvuma River provide extensive habitat for a rich avifauna, including large numbers of weavers. The habitat contains over 150 species of resident birds and 37 Palaeartic birds of which 22 are regular visitors. The site holds populations of the vulnerable lesser kestrel (*Falco naumanni*), and the locally rare pallid harrier (*Circus macrourus*), and great snipe (*Gallinago media*). The basin is home to at least 2,400 African elephants and a globally significant population of at least 4,460 Roosevelt's sable antelope. The area therefore contains several rare species of birds which are already threatened. Irrigation development will likely increase the pressure on already stressed birds. The African Elephant (*Loxodonta africana*) is in the vulnerable category meaning that its conservation is inevitable. This basin also contains one of the very important wildlife corridors in southern Tanzania – the Selous – Niassa Corridor, providing a significant biological link between the two reserves of the Selous Game Reserve (47,000 km²) of Tanzania a UNESCO World Heritage-Site and the Niassa Game Reserve (42,400 km²) of Mozambique (Ecosystems East Africa Ltd. Tanzania, 2010).

7.10.1.3 Rufiji River Basin

Habitat for more than 400 bird species of which more than 50% are endemic. Of significance the Usangu flats along the Ruaha River supports at least 418 bird species. Some of the most transparent endemic species include the Kilombero weaver (*Ploceus burnieri*), *Dendrocygna Bicolor*, *Balearica regulorum*, and *Plectropterus gambensis* the Kihansi spray toad (*Nectophrynoides asperginis*), Puku antelope (*Kobus vardonii*) in Kilombero.

An area containing 50% endemic species is worth conserving for biodiversity reasons. This therefore calls for proper planning of irrigation development to ensure that there is no too much habitat degradation for these endemic species with their resultant negative impacts on the biodiversity of the area.

7.10.1.4 Lake Rukwa Basin

Lake Rukwa basin has several prominent mammal fauna found in the miombo woodlands and grasslands around the lake, water basin and in the lake and neighboring swamps. The bird fauna is also very diverse with at least 360 species.

7.10.1.5 Lake Tanganyika Basin

The basin contains approximately in excess of 230 different species of birds with more than 20,000 water birds and several species of mammals. Of significance it contains about 10-20 per cent of the rare global shoebill population, and between 5-10 per cent of the global wattled crane population and a rare antelope. The wetlands of Malagarassi are therefore important areas of endemism the disturbance of which will endanger some of the resident threatened species.

7.10.1.6 Lake Victoria Basin

Fishing birds such as gulls, terns, pelicans, kingfishers, commorants, little egrets, African fish eagles, Papyrus gonolek (*Luniarus mufumbiri*), Papyrus yellow wabler (*Chloropeta gracilirostris*), Madagascar Scuaco Heron (*Ardea idea*). Plovers, sandpipers and stilts dominate the water edge. Those dependent on emergent vegetation include herons, stocks, cranes and passerines (Wablers and weavers). Others include *Hipopotamus amphibious*, *Sitatunga* and *Sykes monkeys*, foxes, hyenas, mongoose, wild cats, moles, rats, leopards, warthogs. *Sitatunga*, leopards, hyenas and mongoose are among the threatened species found in this basin.

7.10.1.7 Ruvu/Wami River Basin

West of Wami river in Saadani National Park lies the most important biological asset: including 8 mammals, 10 birds, a new species of reptile (*dwarf gecko*), one amphibian (*Hyperolius parkeri*), an endemic snail and many other species of invertebrates, Zaraninge has been identified as one of the 25 global biodiversity hotspots in most urgent need of immediate conservation action.

7.10.1.8 Lake Nyasa Basin

The lake lies within the southwest corner of Tanzania covering an area of about 30,044 km². The Lake hosts highly endemic species flocks of fishes, which make up one of the richest lake fish faunas in the world (Anthony, 2011). In total, there are about 60 fish species in the ecoregion, with nearly one-third endemic. The terrestrial fauna of the basin includes the Tanzania endemic, and endangered Kipunji monkey (*Rungwecebus kipunji*), Abbott's duiker (*Cephalophus spadix*), the rare Ukinga Skink (*Mabuya brauni*). The basin is home to at list 14 species of small carnivores, 70 different species of amphibians and reptiles, 6 species of ungulates and 4 species of primates (Munishi *et al.*, 2008).

7.10.2 Terrestrial Flora

Tanzania is rich in flora ranging from aquatic species life forms to higher montane species life forms. Generally, vast area of the country is covered mainly by various forms of woodlands such as scattered wooded grasslands, Miombo woodlands, Acacia-Commiphora woodlands, acacia woodlands, thickets and bush lands. Also there are several other types of flora varying from region to region. For instance, there are dense forests of hardwood montane, lowland, sub-montane forests as well as softwood trees (mainly exotics) in various areas depending on variations in climate. For the purpose of this report the dominant flora of Tanzania is given based on the eight water basins namely Pangani River Basin, Ruvuma River and the Southern Coast Basin, Rufiji River Basin, Lake Rukwa Basin, Lake Tanganyika Basin, Lake Victoria Basin, Ruvu/Wami River Basin, Internal Drainage basin and Lake Nyasa Basin in Figure 7-2.

7.10.2.1 Pangani River Basin

The Pangani River basin consists of a variety of vegetation types along its different parts as it flows from the high altitudes on Mts Kilimanjaro and Meru to the coastal plain. The basin is composed of a relatively intact high forest ecosystem (evergreen forest) on the upper catchment passing through grassland vegetation and cultivated land with different agricultural crops in the middle to lower zone, dry woodland composed of Acacia and Combretum in the floodplain, to coastal vegetation as it approaches the ocean.

7.10.2.2 Ruvuma River and the Southern Coast Basin

The Ruvuma River and the Southern Coast Basin consists mainly of the coastal mosaic eco-region including large areas of miombo woodlands (composed of the major genera *Brachystegia*, *Julbernadia* and *Isoberlinia*), coastal dry forest and coastal scrub, riparian and

swamp forests, floodplain vegetation, and mangrove forests. Other species dominate dambos and seasonally waterlogged areas.

7.10.2.3 Lake Rukwa Basin

Gallery forests of woodland, with many *Acacia* species, grow along the tributaries that feed the lake and along the lake's edges. Floodplain vegetation surrounding, primarily grassland, with short grasses dominated by the salt-tolerant *Diplachne fusca*, *Sporobolus spicata*, and *S. robustus*.

7.10.2.4 Lake Tanganyika Basin

Lake Tanganyika is famed as a hotspot of aquatic biodiversity. The lake basin also includes areas of elevated biodiversity, and harbors important refuges for chimpanzees and other species that are threatened with extinction. In terms of flora it is characterized by a great range of vegetation cover from grasses interspersed with trees, deciduous forest, savannah mosaics and woodland. The major plant species of the basin include *Loudetialia*, *Themeda bulbine*, *Beckeropsidelia unisetae*, *Acacia nefasia*, *Uapaca spp*, *Cynometra alexandri*, *Gilbertiodendron dewevrei*, *Lebronia bushaie*, *Newtonia buchanani*, *Staudtia macrocarpa*, *Strombosia scheffleri*, *Entandrophragma spp*, *Gilbertiodendron spp*, *Beilschmiedia oblongifolia*, *Combretodendron spp*

7.10.2.5 Lake Victoria Basin

Dominant terrestrial vegetation comprises dry forest and woodland (*Julbernardia sp.*, *Brachystegia spp.*, *Combretum spp.* and *Acacia spp.*).

7.10.2.6 Ruvu/Wami River Basin

The basin is mainly dominated by Miombo woodlands, constituting the *Julbernardia* and *Brachystegia spp*, *Combretum spp* and *Acacia sp*; the lowland coastal forest (Zaraninge forest); Mangrove forest with *Avicennia marina* and three species of Rhizophoraceae (*Rhizophora mucronata* or mkoko, *Bruguiera gymnorrhiza* or msindi and *Ceriops tasgal* or mkandaa).

7.10.2.7 Lake Nyasa Basin

The basin is dominated by Afromontane vegetation consisting of a mosaic of moist evergreen forest and grassland dominated by *Brachystegia spp* and *Julbernardia spp*; permanent swamp areas are characterized by *Cyperus spp*, *Typha spp*; and seasonal swamp areas dominated by *Hyparrhenia spp.*, *Setaria spp.*, *Panicum spp.*, *Bothriochloa spp.*, *Cynodon spp.* and *Chloris spp.*

7.10.3 Aquatic Flora

7.10.3.1 Pangani River Basin

The basin has a variety of aquatic flora among the major ones being *Suaeda monoica*, *Polygonum senegalensis* and *Costus afer*.

7.10.3.2 Ruvuma River and the Southern Coast Basin

The basins are dominated by high biomass nitrogen fixing phytoplankton: *Trichodesmium spp.* and other harmful species from genus *Pseudonitzschia* and *Gambiaediscus*.

7.10.3.3 Lake Tanganyika Basin

Lake Tanganyika is exceptional not only for its high level of species richness (animals, plants and protists estimated at over 1,400 species (Coulter, 1991), but also for high levels of endemism exhibited among several taxa.

7.10.3.4 Lake Victoria Basin

Dominant macrophytes in the basin include *Cyperus papyrus*, *Miscanthidium violaceum*, *Phragmites mauritanus*, and *Typha domingensis*. These species are water dependent and thus reduced water levels due to excessive abstraction will likely reduce their abundance and possibly drive them to extinction (Munishi and Chitiki, 2006).

7.10.3.5 Ruvu/Wami River Basin

Dominant macrophytes in the basin include: *Cyperus papyrus*, *Miscanthidium violaceum*, *Phragmites mauritanus*, and *Typha domingensis*.

7.10.3.6 Lake Nyasa Basin

The basin contains some swamp areas characterized by *Cyperus spp*, *Typha spp*, *Vossia cuspidata*, *Pennisetum purpureum* and *Echinochloa pyramidalis*.

7.10.4 Aquatic Fauna

7.10.4.1 Pangani River Basin

About one-third of the approximately thirty-five known freshwater fish species are endemic to Pangani river basin. Cyprinids are the best-represented element of the fish fauna, together with cichlids, anguillids, rivulines, mochokids, and other families also *Garra dembeensis* exist although not endemic to the region. More than 15 species of fish occur in Lake Jipe, including more than 5 endemic species.

7.10.4.2 Ruvuma River and the Southern Coast Basin

The basin has Zooplankton of *Calanoida spp* in higher abundance, especially during the northern monsoon seasons. In addition there are also exist groups of macrofauna, such as Molluscs, Gastropods, Annelids, Foraminifera, Crustaceans and Echinoderms. A variety of fish species also exists, such as Characins, Anguillid eels, Rivulins, Cyprinids, Gobies, and Mochokids are the common species groups in the fresh waters of this river basin. Further, about thirty percent of the nearly 100 described fish species are endemic to this basin including the Rondo Dwarf Galago (*Galago rondoensis*).

7.10.4.3 Rufiji River Basin

Aquatic mammals that live in the ecoregion include marsh mongoose (*Atilax paludinosus*), the vulnerable Jackson's Mongoose (*Bdeogale jacksoni*), African clawless otter (*Oryx capensis*), and hippopotamus (*Hippopotamus amphibius*). Dugong (*Dugong dugon*) listed by IUCN as vulnerable.

7.10.4.4 Lake Rukwa Basin

In total, there are about 60 fish species in the basin, with nearly one-third endemic. A variety of habitats are available to fish in the lake and its tributaries. Several small fish species, inhabit the aquatic macrophytes on the lake margins endemic fish species flocks of the cichlid genus *Haplochromis* and the catfish genus *Chiloglanis* (family Mochokidae); Others include white-winged terns (*Chlidonias leucopterus*). Other aquatic fauna include the marsh mongoose, spotted-necked otter, African clawless otter and hippopotamus. The Nile crocodile occur in high densities.

7.10.4.5 Lake Tanganyika Basin

Lake Tanganyika has over 470 fish species (described and undescribed), including about 300 cichlids and over 170 non-cichlids. It is the only lake with species-rich lineages of substrate-brooding as well as mouth-brooding cichlids. Lake Tanganyika is exceptional not only for its high level of species richness (animals, plants and protists estimated at over 1,400 species, but

also for high levels of endemism exhibited among several taxa. Fish, copepods, ostracods, shrimp, crabs, and molluscs are all represented by high numbers of endemic species. For instance, 74 of 85 species of ostracods (87%) and 33 of 68 species of copepods (49%) are endemic and contribute significantly to the fish populations and species diversity of Lake Tanganyika. The fish species important for food include the *Oreochromis spp*, *Alestes spp*, *Clarias gareipinus* and *Synodontis spp*.

7.10.4.6 Lake Victoria Basin

A total of 31 amphibians, 28 reptilian and 44 mammalian species have been recorded on various sites in the Lake Victoria basin. About 100 native fish species endemic to the lake have been entered in the IUCN Red List of endangered species within the past 20 years

7.10.4.7 Lake Nyasa Basin

This basin is home for up to 15% of the world's freshwater fish species, with more than 600 endemic species in total, Songwe River provides suitable spawning grounds for fish that migrate upstream to spawn.

7.10.5 Sensitive Habitats Including Wetlands

In this report sensitive habitats are those which could be negatively impacted by any kind of irrigation intervention whether at small scale or large scale (McCartney *et al.*, 2007; McCartney and Masiyandima, 2004). Such habitats include areas of ecological importance in Tanzania like wildlife protected areas, wetland areas, including small valley bottom wetlands (Figure 7-3), Wildlife Corridors, Nature Reserves, Forest Reserves (protective and productive), Riparian ecosystems in lakes, rivers and along the coast (estuarine and delta). In cases of wetland areas Ramsar definition is adopted that (Ramsar Secretariat, 1971):

"Wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty, including areas of marine water, the depth of which does not exceed six meters at low tide". Wetlands may incorporate riparian and coastal zones adjacent to the wetlands and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands".

Using this definition, wetlands in Tanzania have been classified into six categories according to their origins and land physiography (Figure 7-3).

7.10.5.1 Highland Headwater Wetlands

Wetlands usually located in headwaters of rivers in mountainous eco-regions. Normally the wetlands are located at the spring sources providing sources of water to the river systems. Such environments are associated with rainforests with high annual rainfall.

7.10.5.2 Freshwater Estuarine Wetlands

Wetlands formed along the lake shores associated with meandering of rivers due to low gradient depositing sediments as they enter the lakes. Freshwater estuarine wetlands are important fish, bird and mammal habitats.

7.10.5.3 Internal Headwater Systems

Occur in low rainfall environments. Inland drainage wetland such as Lakes Natron, Eyasi and Manyara are significant regular breeding ground for flamingos and other birds and the terrestrial land adjacent to these lakes are often inhabited by wildlife of major tourist attraction in Tanzania.

7.10.5.4 Rivers and Inland Floodplain Wetlands

Inland flood plains comprise of those plains usually formed in low altitudes whereby the river floods seasonally during the rain seasons. They include permanent and seasonal freshwater swamps, marshes and seasonal floodplains, distributed over some of the country's major river systems. The major floodplains are inhabited by variety of wildlife such as crocodiles, hippopotamus, various antelopes, elephant and buffalo and birds. Floodplains also inhabit important plants which are sometimes habitat specific.

7.10.5.5 Man-made Wetlands

In Tanzania there are several man-made wetlands/reservoirs. These include Mtera (610 km²); Nyumba ya Mungu (180 km²); Hombolo (15 km²); and Kidatu (10 km²). Others include Msoga (Bagamoyo), Ulyanyama (Sikonge), Igigwa (Sikonge), Mwamapuli (Igunga), Kahama Nhalanga (Nzega), Buigiri (Chamwino), Kisangwa (Bunda), Budushi (Nzega), Chilolwe (Musoma), Ikowa (Chamwino) and many other small reservoirs.

7.10.5.6 Marine and Coastal Wetlands

The marine and coastal wetlands comprise of areas where the river enters the sea usually forming deltas. Main Rivers which form marine wetlands includes Rufiji, Ruvu Matandu Pangani, Wami, Lukuledi, Mbemkuru, and Ruvuma. Of these the Rufiji Delta is the most extensive and ecologically/biologically important.

According to various sources of information, there are other large mammals to which the wetland provides ideal and important habitat, including elephant, buffalo, hippopotamus, African slender-snouted and Nile crocodile, zebra, waterbuck, topi and reedbuck. There are also predators such as lion, leopard, hyena and wild dog. The wetlands are of particular importance to a number of water birds, including the rare and secretive shoebill (*Balaeniceps rex*) and the wattled crane (*Bugeranus carunculatus*) in Malagarasi Moyowosi which supports 10-20 per cent of the global shoebill population, and between 5-10 per cent of the global wattled crane population. In addition, this wetland provides habitat for several hundred different bird species, a personal list of positive identifications by the conservationist has reached approximately 230 different species while a count of water birds showed that there is an excess of 20,000 birds utilizing this site. The wetland is important to an estimated 51 indigenous fish species, including an estimated 10 species endemic to this river basin, such as the *Orthochronis malagariensis*.

It is evident that the Malagarasi-Moyowosi Ramsar Site is an important biodiversity hotspot, hosting a large diversity of species of both flora and fauna. It is this diverse biota which sustains the natural process of the ecosystem, which in turn provides important socio-economic benefits to the people of this area. Malagarasi Moyowosi ecosystem/wetlands are habitats for the rare antelope Sitatunga (*Tragelaphus spekei*) with the largest population in E. Africa, adapted to living in permanent swamp areas. Mammal species include elephant, buffalo, hippopotamus, African slender-snouted and Nile crocodile, zebra, waterbuck, topi and reedbuck. There are also predators such as lion, leopard, hyena and wild dog.

Tanzania has four (4) Ramsar sites totaling 4,868,424 hectares. Table 7-5 lists the wetlands that GoT has designated as being of significant value to Tanzania and to the international community.

Table 7-5: Tanzanian Ramsar Sites

S/N	Site	Date of Designation	Region/Province/State	Area (Ha)	Coordinates
1	Kilombero Valley Floodplain	25/04/02	Morogoro Region	796,735	08°40'S 036°10'E
2	Lake Natron Basin	04/07/01	Arusha Region	224,781	02°21'S 036°00'E
3	Malagarasi-Muyovozi Wetlands	13/04/00	Kigoma, Shinyanga, & Tabora	3,250,000	05°00'S 031°00'E
4	Rufiji-Mafia-Kilwa Marine Ramsar Site	29/10/04	Coast, Lindi Regions	596,908	08°08'S 039°38'E

7.10.6 Wildlife Corridors in Tanzania

According to Jones *et al.*, (2009), there are at least 31 potential wildlife corridors in Tanzania, which are basically grouped into five types namely: (1) Unconfined corridors, (2) Uncultivated area between protected areas without documentation on animal movement. (3) Continuous or semi-continuous non agricultural land between protected areas with anecdotal information on animal movement, (4) Known animal routes between two protected areas, (5) Potential connectivity of important habitats. These corridors include: Bujingigila corridor Mt. Rungwe-Livingstone, Burigi - Akagera, Burigi-Moyowosi/Kigosi, Gombe Kwitanga corridor, Gombe-Mukungu-Rukamabasi, Greater Gombe ecosystem-Masito Ugalla, Igando-Igawa, Katavi-Mahale, Katavi/ Rukwa/Lukwati-Rungwa/ Kisigo/ Muhesi, Kilimanjaro Amboseli (Kitendeni), Loazi-Kalombo, Loazi-Ntantwa/Lwafi, Manyara Ranch-Lake Natron, Manyara-Ngorongoro (Upper Kitete/selela), Muhezi-Swaga Swaga, Selous Niasa (Western and Eastern Routes), Makuyuni, Mkungumero/Kimotoroki, Tarangore-Simanjiro, Tarangire Manyara (Kwakuchinja), Udzungwa-Mikumi, Udzungwa-Ruaha, Udzungwa –Selous, Udzungwa scap-kilombero NR (Mngeta), Uluguru North-South, Usambara East (Derema), Usambara West, Wamimbiki – Handeni (Southern masai steppe), Wamimbiki-Jukumu/Gonabi/Nothern Selous, Wamimbiki-Mikumi, Wami Mbiki – Saadani (Jones et al., 2009).

Some of these corridors coincide with the identified high irrigation potential areas. In this respect, irrigation expansion in the high potential areas will likely impact on wildlife movement and in the worst case scenario impair gene flow among wildlife populations with potential for extinction of some wildlife species. Further encroachment into wildlife corridors may result into increased human – wildlife conflicts resulting from wildlife crop damage inflicting a socio-ecological problem which may even result into inefficient operation of the irrigation schemes. Serious planning is therefore required to enable harmony between nature and irrigation schemes in this case.

7.10.7 Natural Sites of Significant Size

The natural sites of significant size include:

1. **The Great Lakes in the Northern and Western:** These include the land of the Great Lakes to the north of Lake Victoria, source of the River Nile, Lake Tanganyika, the second deepest lake in the world at 772.4 meters which supports a huge population of freshwater fish, forming one of the most biologically rich aquatic habitats on earth. Lake Natron, famous for its extraordinarily large population of flamingos especially the lesser flamingo (Natron is the only known breeding ground for the lesser flamingo), as well as antelope species such as gerenuk, lesser kudu and oryx.
2. **The Great Rift Valley:** The Rift Valley harbor inland lakes such as Lake Natron, Lake Manyara and Lake Nyasa. The western Rift Valley engulfs Lakes Tanganyika and Rukwa. These are unique ecosystems which require conservation planning when it comes to irrigation development.
3. **Mount Kilimanjaro-** At over five thousand meters above sea level, the snow-capped and the world's highest free-standing mountain, with important evergreen forest which has influence on the regional climatic conditions. This area is quite significant to the hydrology of the Pangani Basin.
4. **Lake Eyasi:** Just beyond the Rift Valley escarpment lies the soda lake of Eyasi, under the shadow of the extinct Oldeani volcano.
5. **Lake Natron and Oldonyo Lengai:** A soda lake famous for its large population of flamingos and a single known breeding site for lesser flamingo.

6. **Mount Meru:** The second-highest mountain in Tanzania and refigure for buffalo and elephant shelter in the fig tree forests, crater lakes attract a multitude of bird life, and lesser game.

7. **Ngorongoro Crater:** Often called "African Eden" and 'the eighth natural wonder of the world,' Ngorongoro Crater is one of the most famous landmarks in Africa. Large populations of lion, gazelle, zebra, and wildebeest inhabit the crater floor and the endangered black rhino is often viewed in the early hours of morning.

8. **Olduvai Gorge:** The stone-age site of Olduvai Gorge is known as the "cradle of mankind", and is the place where the famous skull of "Nutcracker Man" was unearthed by Dr Louis Leakey in 1959. At nearby Laetoli, the footprints of hominids thought to be 3.5 million years old were discovered by Mary Leakey 20 years later. Around Olduvai Gorge and the living volcano of Ol Donyo Lengai teem millions of wild animals, part of the enormous Serengeti ecosystem.

9. **Udzungwa Mountains:** Part of Tanzania's newest national park, the Udzungwa Mountains support a wide variety of primate species and other biodiversity.

10. **Usambara Mountains:** With some areas over 600 million years old, the Usambara Mountains are part of the Eastern Arc, one of Africa's oldest geological formations.

7.10.8 Threatened Species in Danger

Irrigation development will result in land use changes that have the potential to impact flora and fauna that is already rare and threatened, for the river basins provide important breeding habitat for all species. A list of rare and threatened species is included as an Appendix 9.

7.10.9 Key Issue

The key issues are the potential impacts on Environmental Flows, Aquatic and Water Sensitive Biodiversity and Wildlife Habitats. This is because majority of the irrigation schemes abstract water from seasonal rivers, which are already water stressed.

For example, according to the local people the flow of water in the Umwa River, where the Mibono irrigation scheme is, has been decreasing in the last ten years. This means that water abstraction for the schemes on both seasonal and permanent rivers will exert more water stress on the streams and likely reduce dry season flow as well as environmental flows affecting both aquatic life and life on riparian ecosystems. Of significant concern is the fact that there is no water monitoring plan which could assist in the detection of adverse impacts on flows.

Over abstraction of water in the Lumi River and other river upstream of Lake Jipe for vegetable and fruit irrigation has caused drying of the lake with consequences on the ecological and socio economic values of the lake. It was observed that fisheries activities stopped completely as a result of drying of the lake forcing fishermen to migrate to other wetland areas like Nyumba ya Mungu and Lakes Sagara and Nyamagoma in the Malagarasi-Moyowosi Ramsar site thus creating more exploitation pressure on the wetlands.

Reduced flows in the Pangani basin will affect negatively a variety of plant species along the riparian ecosystem especially wet bank and aquatic species (Munishi and Chitiki, 2006).

Decrease in wild mammal populations due to drying of the Kiruwa Swamps along the Pangani River is thought to be linked to water abstractions by the construction of the Nyumba ya Mungu Dam, the lower Moshi Irrigation schemes, the Kiria and Lemkuna irrigation schemes.

Avifauna species that depend on the riparian trees for nesting in the Lusu irrigation scheme Nzega district seem to have been affected by removal of Acacia trees on the riparian ecosystems.

In Kilombero river flood plains, increased water abstraction through irrigation expansion may affect the population status of the near endemic Puku antelope (*Kobus vardoni* Livingstone) which is known to be wetland dependent and sensitive to human disturbance (Hartvic et al – under preparation). Kilombero flood plains which is the largest lowland fresh water wetland in the world contain about 75% of the world's population of wetland dependent Puku (*Kobus vardoni*).

Further the endemic bird - Kilombero Weaver (*Ploceus burnieri*) whose breeding seems to be influenced by the wetland conditions especially water levels in the Kilombero River will likely be affected if the water levels decrease as a result of increased abstraction of water for irrigation.

The same species are quite sensitive to human disturbance (Bonington et al., 2010) and increased human disturbance resulting from irrigation expansion may reduce the potential habitat thus distorting the population of wildlife and avifauna species in the area especially the endemic birds which are not found anywhere else in the world.

Unplanned utilization of water for irrigation in the upper catchments of the great Ruaha (Usangu – Kapunga Rice Irrigation and the then NAFCO Mbarali Rice Irrigation Schemes) resulted into decrease in flows in the Ruaha and negative consequences on the biodiversity of the Ruaha National Park and the Great Ruaha ecosystem at large (FAO 2010).

Disappearance of the Kihansi spray toad (*Nectophrynoides asperginis*) is a result water abstraction for hydropower production in the Kihansi River. This prompts on the adverse effects which may occur as a result of unplanned over abstraction of water for irrigation.

7.10.10 Degradation of River Catchments and Riparian Ecosystems

Some of the river catchments in irrigation schemes are highly degraded by both downstream and upstream users. Expansion of irrigation schemes if not controlled will likely lead into more degradation and resultant water pollution and sedimentation with negative effects on the aquatic life.

Degradation of riparian ecosystems will likely degrade water sensitive species dependent on the riparian ecosystems. For example in the Mibono irrigation scheme degradation of riparian ecosystems has been associated with decrease in honey production, an important socio-economic activity of the local people. This was due to degradation of tree species in the riparian ecosystem and nearby forested areas especially *Brachystegia spiciformis* (muwa) which are important bee trees.

7.10.11 Degradation of Ecologically Sensitive Areas

Some of the irrigation schemes are established in ecologically sensitive areas such as wildlife corridors, protected areas and catchment forests. Irrigation activities in such areas will affect negatively the ecological integrity of these habitats including habitat fragmentation with a resultant loss of gene flow among populations and possibly driving some wildlife populations to below minimum viable levels and local extinction and may as well result into conflicts among stakeholders.

For example, the Igigwa scheme in Sikonge District is established in an area that is known to be an important wildlife corridor where elephants used to migrate from Uyui to Mpanda district.

Part of the farm layout of the Mibono irrigation scheme was constructed inside Ipemba Mpazi Forest Reserve a violation of governing forest Policy and Act but also a threat to existing biodiversity in these areas.

The Mahande Irrigation Scheme in Monduli District has been established partly on wildlife corridor between Lake Manyara and Tarangire National Parks resulting into conflicts as elephants invade paddy farms in the schemes. The Kirya irrigation scheme - Emangulai A village in Mwanga District and Lemkuna irrigation scheme in Lemkuna Village in Simanjiro district are said to have been established along a wildlife corridor from Mkomazi possibly to protected areas in Simanjiro District.

Some irrigation schemes are established by conversion of wetland areas into irrigation schemes like the Mahande irrigation scheme in Mto wa Mbu.

Remaining forest and woodland areas will be increasingly encroached through increase in irrigation intensity and population immigration. Lack of biodiversity monitoring plans and integrated land use plans will threaten the biodiversity around most irrigation schemes. Further some of the high potential irrigation sites coincide with wildlife corridors with high potential for interference with wildlife movements if not well planned (Jones *et al.*, 2009).

7.10.12 Land Degradation, Soil Erosion and Water Pollution

Lack of legal land use plans by some of the schemes and the fact that some of them have not done EIAs adequately will likely lead into haphazard land uses, encroachment of sensitive areas and consequent soil erosion and water pollution. High erosion rates caused by poor agronomic practices in different schemes will result into siltation and water pollution with consequent lowering of the water quality and subsequent effect on resident and aquatic biodiversity of these ecosystems. Lack of proper land use plans hence leading to high illegal encroachment to the catchment forests, riparian ecosystems. However other causes may come from natural calamities such as floods. For example the inland valley bottom wetlands in the Ulyanyama scheme (Sikonge District) was silted due to flood which occurred before the construction of the spillway was completed. Land degradation is also common in many other schemes which have no land use plans.

7.10.13 Impacts on Soils

Salinity problems may arise as a result of continued irrigation without proper drainage system. Examples include Mahande, Kiria, Mombo and Mkomazi Valley Irrigation schemes in Monduli, Mwanga and Korogwe Districts respectively. Salinity will likely influence the composition and diversity of aquatic life as well as terrestrial flora and fauna diversity. Further salinity will influence land productivity and may lead to low productivity of irrigation schemes. This will likely become a disincentive to irrigation development if not well attended.

7.10.14 Blockage of Fish Movement and Consequent Interference with Fish Migration and Breeding

Areas of water intake or dams in the different irrigation schemes normally create barriers to fish movement. There is no scheme that has created fish bridges at their water intakes or dam sites. This will likely affect both breeding and survival of different fish species in the different schemes.

The interference with flow regimes and reduction in flood periods in some cases will affect fish migratory behavior and will probably make any ascent by migratory fish difficult.

7.10.15 Impacts Associated with Single Resource Management Approach

Most important, all the irrigation schemes have neither Integrated Water Resource Management Plan nor Integrated Land Use Plans and thus no one would expect their

management to follow an integrated approach to resources management. Unless these are developed for the different irrigation schemes the implementation of the NIMP and NIP may become very disastrous with respect to environmental flows and biodiversity conservation. There are no environmental flow assessments in any of the streams/rivers that supply water for irrigation except for Pangani and to some extent Wami/Ruvu basin otherwise there is an expressed need to undertake such assessments to ensure no negative impacts on the ecological systems will result from irrigation expansion. There are no any biodiversity assessments that have been undertaken thus there is no baseline information on what biodiversity exists in the proposed potential irrigation sites. In this respect there is yet any plan in place to manage and conserve biodiversity. This means operation of most irrigation schemes will follow a single approach to resource management.

7.10.16 Remarks on Biological Environment

The key issues discussed here pose limitations to development and expansion of irrigation in Tanzania. However with planning and mitigation measures irrigation and conservation can go concurrently and sustainably. Most important is to put in place measures that can mitigate the expected negative ecological impacts of implementation of the NIP and the NIMP.

The different areas that are earmarked for irrigation contain substantial biological resources that need be put into consideration when planning for irrigation development/expansion. Some of the key irrigation areas contains species of conservation concern such as endemic species that are not found anywhere else in Tanzania or the world, threatened species which are likely to be driven to extinction with disturbance in their habits as well as special habitats that may not be available anywhere else such as breeding grounds for special fauna species.

While this is the case irrigation development is of significant importance to economic development and livelihoods enhancement in Tanzania. This therefore calls for proper planning of irrigation schemes considering mitigation measure as important and key to ensuring a balance between irrigation development and conservation.

7.11 Socio-economic and Cultural Data

This section provides baseline data on the relevant socio-economic information. Much of the description of the baseline information is specific for districts where the schemes investigated during the SESA study are located. The district profiles of all the districts investigated were collected. Some contain complete data sets. The data sets available are reported herein.

Table 7-6: Names of Districts and Corresponding Schemes

S/N	Name of Zone	Name of District Councils	Name of Schemes
1	Morogoro	Morogoro	Tulo-kongwa Kiroka
		Kilombero	Mkula
		Kilosa	Mwega
2	Mwanza	Rorya	Chereche
		Bunda	Nyatwali
		Shinyanga	Nduguti
3	Tabora	Sikonge	Mibono
		Nzega	Lusu
		Kibondo	Muhwanzi 'A'
4	Mtwara	Mtwara	Kitere
		Songea	Nakahuga
5	Central	Bahi	Uhelela/Mtazamo
		Chamwino	Chinangali II
			Buigiri
		Babati	Kiru-six
6	Kilimanjaro	Monduli	Mto wa Mbu (Mahande)
		Moshi	TPC/TIP/Vasso Flower Estate Ltd
7	Mbeya	Sumbawanga	Katuka
		Mbarali	Mbarali Highland Estates Ltd

Source: SESA Study, 2010

7.11.1 Demographics

The 2002 Population and Housing Censuses is the fourth after independence. The other censuses were carried out in 1967, 1978, and 1988. Censuses provide data for preparation of social and Economic development policies which are meant to support the implementation process of Tanzania Development Vision 2025. Population data are illustrated in Table 7-7

Table 7-7: Current Population in Selected Districts

S/N	Zone	District	Population Number		
			Male	Female	Total
1	Morogoro	Morogoro	10,466	10,895	21,361
		Kilombero	14,220	12,987	27,207
		Kilosa	243,329	244,862	488,191
	Mwanza	Bunda	123,978	134,452	258,930
2		Shinyanga	134,281	141,076	275,357
		Rorya			
	Tabora	Sikonge	6,236	6,263	12,499
3		Nzega	202,243	212,960	415,203
		Kibondo	199,752	214,025	413,777
4	Mtwara	Mtwara	96,669	107,901	204,570
		Songea	76,898	80,032	156,930
	Central	Bahi	85,430	94,294	179,704,
5		Chamwino	123,972	136,869	260,841
		Babati	155,678	146,575	302,253
6	Kilimanjaro	Monduli	89,676	94,840	184,516
		Moshi R	4,561	4,822	9,383
7	Mbeya	Sumbawanga	181,446	190,303	371,749
		Mbarali	114,738	119,363	234,101

Source: The 2002 Population and Housing Census, Government of Tanzania;

<http://www.statoids.com/ytz.html>

People are mainly concentrated along the coast, the fertile northern and southern highlands, and the lands bordering Lake Victoria. There are also population concentrations in the fertile and well watered far west, including the shores of Lake Tanganyika and Lake Nyasa. The relatively arid and less fertile central region is sparsely inhabited. About 80% of Tanzanians live in rural communities (Morogoro Region Social Economic Profile, 2007).

Kibondo growth rate is high compared to most districts in Tanzania due to influx of refugees from the neighboring countries of DRC and Burundi that took place since the early nineties. There was a moderate increase of 31% in 1988, but that of 2002 over 1988 is an incredible 96% increase (Kibondo District Profile, 2008).

7.11.2 Ethnic Groups

Tanzania consists mostly of members of more than 120 African groups, the majority of which speak a Bantu language. The largest ethnic groups are the Sukuma and the Nyamwezi, each representing about a fifth of the country's population (Tanzania Social economic profile, 2007). Other groups of significant size include the Haya, Makonde, Chagga, Gogo, Ha, Hehe, Nyakyusa, Ngoni, Yao, and Masai.

The groups also include people of Indian, Pakistani, and Goan origin, Arab and pockets of European communities. Less than one-fifth of the population follows traditional religions. Islam is the religion of about one-third of the people on the mainland and is dominant on Zanzibar. Roman Catholicism is the largest Christian denomination of Tanzania, with some 6 million adherents. Swahili and English are the official languages of Tanzania, but many people still use their language of their ethnic group.

7.11.3 Energy and Water Supply

More than 95% of the rural population depends on firewood as their main source of energy supply for domestic use (Morogoro Region Social Economic Profile, 2007). Charcoal, wood and kerosene are mainly used in towns. Numerous individuals sell charcoal and firewood. Charcoal is obtained from both planted and indigenous trees. The collection of fuel-wood is mainly done by women. Excessive use of charcoal and firewood has led to deforestation and land degradation.

Other sectors mainly in the town councils depend heavily on electricity and refined petroleum products such as petrol, diesel and lubricating oil. Petrol filling stations distribute refined petroleum products. Some regions, for example Kigoma, are yet to be connected to the National Transmission Grid and are currently supplied with thermal power generated by Tanzania Electric Supply Company (TANESCO). It is only TANESCO that establishes, controls, and distributes electricity. TANESCO sets tariffs for the whole country.

One third of Tanzania receives less than 800 mm of rainfall and is thus arid or semi-arid. Only one-third of the rest of the country has precipitation of above 1,000 mm. Also the long dry season, that normally extend from June to October, has an effect on low river flows and drying of water reservoirs. However, about 7 per cent of Tanzania land surface is covered by lakes which border the country apart from other inland lakes. These include lake Victoria (second largest fresh water lake in the world), Lake Tanganyika (second deepest lake in the world), and Lake Nyasa. Inland lakes include Lakes Rukwa, Eyasi and Manyara. There are also big rivers flowing to the lakes. Ground water is also another source of water for both urban and rural areas.

The largest use of water is domestic water supply. Due to increased economic activities and delivery of social activities of which all utilize water in one way or another, delivery/supply of

water has become a burden which the government cannot meet alone without the participation of the private sector. It is the government's policy to involve the beneficiaries in all water projects both in urban and rural water supply. The water sector contribution to GDP has remained at 0.2 per cent for some years, a proportion which is insignificant considering the importance of the sector to the economy. Hence the government is encouraging private investment in the water sector.

According to the Public Services Reform Program (PSRP) less than 29% of the rural and peri-urban populations have the least access to clean water and adequate sanitation services. Access to safe water in urban areas declined from 85% to 65% between 1985 and 1995 and in rural areas from 48% to 40% from 1999 to 2004 (URT, 2005b).

In Central Zone and in some parts of Tabora, the availability of natural water sources is scarce and seasonal. Rivers do not have surface discharges during the most part of dry season. In the dry season, lakes and springs are almost dry. The majority of rural population still depends on traditional water sources, like hand-dug wells, waterholes in riverbeds during the dry season or unlined and unprotected shallow wells for both human and livestock consumption.

The water sources existing throughout Tanzania's rural areas are usually unsafe and unreliable. Babati, Kilimanjaro, Morogoro, Mbeya, Songea and some areas of Mwanza get water from lakes, rivers, catchment areas, underground, dams, wells, tanks, streams, pumped water schemes, traditional water sources, ponds and springs. Generally there is inadequate domestic water in remote areas in many district councils. Coverage of water supplies in some districts is illustrated in Table 7-8.

Table 7-8: Coverage of Rural Water Supplies in Selected Districts

S/N	District	Year of Coverage	Percentage of coverage
1	Morogoro	2002	50
2	Moshi	1995	70
3	Nzega	1993	42
4	Shinyanga	2006	54.2
5	Bunda	2007	52.0
6	Songea	2007	54.2
7	Sumbawanga	2007	66.5
8	Bahi	2007	66.0

S/N	District	Year of Coverage	Percentage of coverage
9	Mbeya	1995	24.0
10	Kibondo	2006	76.3
11	Monduli	2002	58.2

Source: District Profile Reports, 1993-2007

7.11.4 Resettlement

Often the most significant social issue arising from irrigation development is resettlement of people displaced by the flooding of land and homes or the construction of canals or other works. This can be particularly disruptive to communities and in the past, such developments have caused unnecessary problems due to not involving the community at the planning stage and inadequate compensation of the affected population.

Village Land Use Plans enables land to be divided into agricultural, pasture, social services, forest and settlement/ resettlement areas. In many districts, land is yet to be surveyed. So far in some villages land boundaries have not been demarcated for distribution accordingly. This has resulted in land conflicts especially between pastoralists and farmers. However, village land in scheme areas like any other places in Tanzania is governed under the village Land Act no.5 of 1999. The village land act was enacted specifically to cater for the management of and administration of land in villages, the role of local government in land administration, land allocation and occupation. The Act empowers the village council to manage all village lands in accordance with the principles of a trustee with the villagers being the beneficiaries. In many cases, individual villagers have no title deeds but have right of occupancy under customary tenure and therefore individual rights.

Section 3 (f) of the Act stipulates that one has *“to take it to account that Land has value and that value is taken into consideration any transaction affecting that interest.”* This means if you acquire land one will have to compensate owners for bare land in addition to unexhausted improvements.

Section 3 (g) of the Act, requires *“to pay full, fair and prompt compensation to any person whose right of occupancy or recognized long standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the state under this act or is acquired under the Land Acquisition Act.”* Registered Professional Specialist will determine the amount of compensation payable on the market value of land or property based on the concept of opportunity cost.

Also the Act contains provisions of critical environmental importance. One of important fundamental principles of the Land Act 1999 is *“to ensure that land is used productively and that any such use complies with the principles of sustainable development”*.

Irrigation schemes are being initiated with the intention of contributing to National sustainable development through increased production thus contributing to poverty alleviation.

There may be involuntary resettlement required for the construction of dams and irrigation infrastructure, including the expansion of irrigated areas. Any resettlement, of whatever scale, will be handled according to the provisions of World Bank Guideline and Safeguards OP/BP 4.12, Involuntary Resettlement.

7.11.5 Human Migration

Human migration and displacement are corresponding with a breakdown in community infrastructure which results in a degree of social unrest and may contribute to malnutrition and an increased incidence of disease. Large, new irrigation schemes attract temporary populations both during construction and during peak periods of agricultural labor demands and provision for their accommodation needs to be anticipated. The problems of displacement during project construction or rehabilitation can usually be solved by providing short-term support.

7.11.6 Gender and Minority Vulnerable Groups

Changing land patterns and workloads resulting from the introduction or formalizing of irrigation are likely to affect men and women, ethnic groups and social classes unequally. Groups that use land to make their living or fulfill their household duties, e.g. for charcoal making, hunting, grazing, collecting fuel wood, growing vegetables etc. may be disadvantaged if that same land is taken over for irrigated agriculture or for building irrigation infrastructure. Historically, it has been men from the more settled and powerful groups that have had greatest access to the benefits and increased income from irrigated agriculture. Men controlled the means and instruments of production except for hand hoes and small domestic animals (chicken, ducks and rabbits). At present, women from all classes including resource weak households and women headed households are benefitting through increased income and improved nutrition as both men and women are participating equally in irrigation activities. However in some households, women are still responsible for food crop production and weeding the fields while men harvested and marketed the irrigated crops. Incomes at this level are controlled by men. With regards to food processing and technology operations of irrigated rice or other crops, both genders are deployed. Women participation in decision making has been enhanced as both men and women can compete for chairmanships in village governments or Irrigation Organizations (IOs).

Minority groups or tribal minorities and vulnerable groups can benefit from the increased economic development of a new irrigation area. However, they are often disadvantaged by irrigation development as they are excluded from the scheme because of uncertain land rights and may be pastoralists rather than farmers.

7.11.7 Employment and Economic Activities

7.11.7.1 Employment

The majority of rural household members are employed in farming, having customary division of work between adult and young, and between male and female. Hired labor is common during peak agricultural seasons. There are small shops and kiosks, and they are the main retail outlets in rural areas. Salaried employment in districts is mainly with the government and some opportunity is available with private sector such as banks and telecommunications. However, formal employment for the economically active population in different parts of districts is a major problem. There are concerns about job quality, especially for the urban youth. A high proportion of them remain unemployed, and new jobs created for young people outside agriculture are poorly paid or unpaid. With rapid rural-urban migration, the formal urban economy is unable to absorb the burgeoning urban workforce. Consequently, these are employed in the urban informal economy or remain unemployed (Decent Work Country Profile, Tanzania Mainland, 2010).

7.11.7.2 Agriculture

Agriculture is the leading sector in Tanzania's economy since it provides about 80 percent of employment, 50 percent of the nation's income and 66 percent of all foreign exchange earnings (Medium Term Plan for Growth and Poverty Reduction 2004/05 – 2006/07 Vol. I).

However, in rural areas, hand hoe is still traditionally used to prepare 85% of the cultivated land in rural areas in all districts. The use of tractors for land preparation is minimal due to high hiring costs involved. Endowed with fertile soils, good weather and sufficient rainfall in some districts i.e. Moshi, Songea, Rorya, Morogoro, Mbeya, Sumbawanga, they are ideal for cultivation of both food and cash crops. Tea, coffee, tobacco, which are the major exports are the main cash crops while wheat, maize and bananas are the main food crops. Raising of flowers and dairy farming is also undertaken i.e. in Kilimanjaro and Songea.

Among problems faced by the agricultural sector include inadequate extension services, poor transport network, and limited access to credit facilities for agricultural inputs, unreliable market outlets, low prices offered to farmers by private buyers as well as failure by the major Cooperative unions to buy crops from farmers and pay them on time.

7.11.7.3 Livestock Industry Resources

Tanzania is endowed with a livestock resource and ranks third in Africa in terms of cattle population. The estimated livestock population amounts to 18.5 million cattle, 13.1 million goats, 3.6 million sheep and 30 million indigenous chickens.

Animal husbandry is an activity practiced by both people in towns and rural areas. Zero grazing of cattle, goats, pigs and poultry is practiced i. e in Kilimanjaro and Mbeya. Livestock keeping in districts, for example in Shinyanga, is one of the major economic activities. Some of livestock population is predominantly of indigenous stock. Livestock is a necessity as it also provides people with income and high quality protein products such as meat, milk and eggs. Below is the livestock population in regions as per National Sample Census of Agriculture 2002/03 - National Report (Table 7-9).

Table 7-9: Livestock Population in Regions

S/N	REGION	Cattle	Goat	Sheep	Pigs	Poultry
1	Dodoma	802,894	685,114	121,250	43,835	1,825,867
2	Arusha	1,520,957	1,745,142	716,903	7,958	931,178
3	Kilimanjaro	598,315	605,434	267,344	155,070	1,561,340
4	Tanga	304,392	319,836	82,342	6,281	1,788,767
5	Morogoro	112,374	293,271	57,603	44,986	2,100,861
6	Pwani	124,884	68,099	7,892	3,673	1,420,152
7	Dar es salaam	19,462	73,080	7,476	12,993	525,052

S/N	REGION	Cattle	Goat	Sheep	Pigs	Poultry
8	Lindi	6,566	96,798	7,980	4,956	1,261,290
9	Mtwara	22,452	253,162	21,935	6,293	710,132
10	Ruvuma	91,929	901,024	59,119	134,951	1,555,617
11	Iringa	1,094,701	356,296	98,573	180,904	2,241,683
12	Mbeya	832,335	349,351	69,662	229,465	2,559,913
13	Singida	1,768,537	1,208,021	454,541	6,375	1,658,178
14	Tabora	1,788,618	909,469	247,201	6,286	2,507,469
15	Rukwa	407,473	250,896	13,098	58,754	1,122,432
16	Kigoma	129,519	474,103	43,025	23,698	797,537
17	Shinyanga	3,812,387	2,075,358	832,910	3,266	2,979,590
18	Kagera	813,718	857,676	64,289	145,761	918,858
19	Mwanza	2,183,546	873,009	166,864	610	2,620,818
20	Mara	1,284,033	657,085	195,202	2,409	1,521,166
21	*Manyara				50,699	699,345
	TOTAL	18,398,327	13,052,226	3,535,212	1,129,223	33,307,248

* Manyara is included in Arusha livestock population

Source: National Sample Census of Agriculture 2002/03 - National Report

Rangeland resource is estimated at 61 million hectares of which about 44 million hectares are for grazing and 17 million hectares are fallow and forestland. This resource is currently supporting about 17 million tropical livestock units (TLU). However, if the rangeland resource is well developed and managed will open up more grazing land that will support over 20 million TLU. There is therefore room for expansion of the livestock industry and hence the potential for investment opportunities.

Distribution and ownership of livestock is highly skewed with about 70% of the herd being concentrated in eight administrative regions including, Shinyanga, Mwanza, Singida, Mara, Tabora, Arusha, Manyara and Dodoma.

Shinyanga district tops the list in livestock and care is taken to sustain this. Livestock keeping in Shinyanga region as a whole is one of the major economic activities. The region's area

annually used for grazing is equivalent to 80.3 percent of the total area. Some land area, which is annually under crop production normally, gets used for grazing after crop harvests. Such dual purpose provides additional grazing area especially during the dry season.

7.11.7.4 Fishing

Fishing plays an important role in supporting the livelihoods of approximately 150,000 artisan fishermen and women in Tanzania (World Bank, 2005). It is an important economic activity for the districts and many populations in Tanzania, particularly those communities residing close to the Indian Ocean and lakes such as Rukwa, Tanganyika, Victoria and Nyasa; and dams – like the Mtera, Nyumba ya Mungu and Mindu, rivers; and streams and coastal areas of the Indian Ocean.

Fisheries contribute about 2.7 percent of the national GDP accounting for an estimated 30 percent of the country's supply of animal protein (*ibid*). For the lowest-income segments of the population, fish is generally the major animal protein consumed, because of the price of some of the cheaper fish products, and in particular of dried *dagaa*, in relation to meat and poultry. In areas lying along major lakes and rivers, fish assumes an even more predominant food security role for local inhabitants.

Fishing, especially artisanal fishing provides opportunities to gain annual earnings well above national averages for the agriculture sector. Fisheries work offers at least some chance for gainful employment in many rural localities especially where other forms of work are difficult to secure or are insufficient for them to generate enough earnings to meet household needs."

7.11.7.5 Beekeeping

Beekeeping is among activities conducted in villages' nearby forests and shrubs in small scales, whereby traditional hives are mainly used. The bee keepers use tree logs i.e. in Miombo trees and woodlands to traditionally prepare beehives. Tabora and Shinyanga districts are known for beekeeping activities. There are many nectar yielding tree species and flowery agricultural plants that are also used. In general, there are many traditional beehives than modern ones due to the high costs involved in purchasing them.

7.11.7.6 Forestry

The forestry sub sector plays an important role in maintaining ecological balance, soil protection from erosion and the conservation of water and wildlife. Forests are a source of domestic energy and industrial raw materials. Forests also provide useful Non-Timber Forest products, such as honey, beeswax, medicine, fruits and others. Failure to maintain or improve forest resources eventually leads to unsustainable conditions.

7.11.7.7 Hunting

Local hunting in Tanzania is a common phenomenon that supplies both household food and income. Wildlife provides a major source of revenue for the Tanzanian government and local people alike. Often Wildlife generates indirect development benefits at the whole-community level through the implementation of benefit-sharing mechanisms and the bulk of direct gain from wildlife is obtained through informal resource use by the local people. For example in western Serengeti wildlife provides an important source of local economic value through the sale and consumption of bushmeat (Emerton and Mfunda 1999). A high proportion of the population of the Western Serengeti is involved in hunting and it is estimated that up to 60% of households regularly consume or sell bushmeat (Evjen-Olsen, 1998). Over time, hunting has expanded from a mainly subsistence activity to one with a well-developed commercial market with bushmeat obtained in the Western Serengeti region supplying markets as far away from the Western Serengeti as Lake Victoria. Yielding an average annual income for hunters of US\$

200 in 1993 (Kauzeni and Kiwasila 1994) bushmeat sales may have a value equivalent to almost a third of average on-farm income, estimated at some US\$ 617 per household per year.

7.11.7.8 Trading

Trading in urban areas in all district councils is common as communities in rural areas tend to shop in urban areas to purchase necessities. At village level, trading is minimal and seasonal on a small scale due to low purchasing power. Farmers sell their agricultural produce to the cooperative societies. A few villagers in rural areas are involved in retail businesses mainly selling basic necessities, and bringing in goods that are not available in their areas.

7.11.8 Distribution of Income

Ownership of property in some traditional household settings in rural areas is still gender biased as men own farms and valuable items. This makes a big difference in levels of income between men and women. Unequal distribution of household income caused by social cultural barriers provided husbands control over incomes. Through gender awareness and in an attempt to cope with income shortages, women are engaging themselves in off farm and off season activities in order to get income to complement to family uses. Youth and women are using earnings from farm produce to initiate other small or petty businesses, as other means of extending their livelihoods. Income generating activities for women and youth in some areas for example horticultural activities have been promoted to facilitate women economic empowerment (PIDP Completion report, 2007).

7.11.9 Recreation and Tourism

Every district has some tourism attraction, historical sites, and war memorials i.e. in Ngorongoro, Kilimanjaro, Serengeti, Udzungwa, Lake Manyara and others. They all attract local and foreign tourists and these constitute potential markets where high standard hotels are constructed. There are hunting blocks for both local and foreign tourists in these areas. However, lack of infrastructure (roads and electricity) in some areas seems to be a major problem as some hunting block cannot be accessible and hence remain unutilized. Also the process of acquiring the hunting license takes too long to attract the individuals who want to engage themselves in the tourism sector.

In general, Tanzania has 12 National parks, the Ngorongoro Conservation area, 31 Game Reserves, 38 Game Controlled Areas and about 120 Natural Heritage Sites (MNRT 1998c and Planning Commission 2000).

7.11.10 Transportation

7.11.10.1 Road Network

There are roads of different types connecting different areas within districts. Regional roads refer to those which connect the district with the outside world. These are in good shape, although they still need some maintenance. District roads connect divisions and wards and these are in gravel and earth surface level. There are also village feeder roads which connect villages within districts and regional roads. Virtually all feeder roads are earth tracks or gravel roads in poor condition requiring rehabilitation or spot improvements. The bulk of the road network requires rehabilitation (Table 7-10).

Table 7-10: Status of Road Coverage in Selected Districts

S/N	District	Regional Roads (km)	District Roads (km)	Feeder Roads (km)	Trunk Roads (km)	Township roads (km)
1	Songea	187	257	226.9	-	-
2	Sumbawanga	1211.4	190	780.2	822.6	-
3	Bunda	102	226	225	-	60
4	Chamwino	-	138.4	602	135	-
5	Kibondo	114	354	167	125	-
6	Morogoro	-	406.8	482.2	31.5	-
7	Mtwara	286.8	544	95.2	25	-
8	Bahi	-	174.9	410	-	-
9	Shinyanga	1220	2,232	1,152	349	-
10	Monduli	156	-	528.6	96	-

Source: District Profiles 2002-2010

7.11.10.2 Railway

Tanzania is comparatively well-served by railways. The country has been able to rely on its railways rather than highways for transport between east and west. The central line between Kigoma and Dar es Salaam carries international freight and passengers in transit from Burundi, DR Congo and Rwanda to the Indian Ocean, and the branch from Tabora to Mwanza carries freight and passengers between Uganda and the Indian Ocean. Bukoba in the North West is served by a train ferry link to the railhead at Mwanza. The country also enjoys the Tanzania-Zambia Railway Authority (TAZARA) railway service which operates 1,860 km between Dar es Salaam and Kapiri Mposhi in Zambia.

7.11.10.3 Air Services

Most districts have airports. Some of these airports are owned by Tanzania Airport Authority (TAA). Some are owned by Tanzanian National Parks Authority (TANAPA) for surveillance of game reserves and some tourist companies. Air travel is through several air service providers i.e. Air Tanzania, Precision Air and others.

7.11.10.4 Communication Network

Most districts heavily depend on the services of the Tanzania Posts Corporation (TPC) for mail service and Tanzania Telecommunications Company Ltd (TTCL) for telephone, telex and fax services. There is at least one post office, one sub-post office, radio call services and radio

services in every district. There is also at least an e-mail service station in every district. Of late the districts have witnessed a growing demand and supply of internet services and cellular phones – Vodacom, Tigo, Zain and Zantel. This has been spurred by the introduction of a competitive free market for telecommunication services. Some religious organizations, police force and health facilities use radio calls for communication.

7.12 Health and Sanitation

7.12.1 Health Impact Analysis Based on District Data

The relationship between public health and irrigation at the administrative District level was assessed. The urban districts were excluded and the rural districts were ranked according to the irrigated area². The twelve districts with the lowest irrigation areas (irrigation area less than 100 Ha) were grouped as the representative sample of population from non-irrigated areas. The 21 rural districts with the highest area of irrigated land (that is where the irrigated area was either >1% of the district area or >2500 Ha) were grouped as the sample representing people living in irrigated areas in Tanzania. See Table 7- 8 for a summary and Table 7-10 for details of the districts used in the analysis.

The total population of the non-irrigated sample was 2.3 million, which was about 40% of the population living in the irrigated districts (6.4 million) although the total land area of the two samples was similar.

7.12.2 No Irrigation Case

While the irrigation-related health impacts due to water-borne disease can carry a heavy private and social cost, the reduction in poverty associated with irrigation may be expected to translate into improved public health in communities living both in and around irrigation schemes (Lipton, 2007; Lipton *et al.*, 2002).

We recognize that integration of all public health data to the district level does reduce the resolving power of the analysis. However, a ‘ripple effect’ can be expected to expand the impact of irrigation beyond the area of the scheme, as daily labour is imported and wealth is exported to the surrounding areas.

The health analysis benefited from district annual health indicators which were available in summaries for all Districts in Tanzania, collated by the Ministry of Health and Social Services (Table 7-11).

Table 7-11: Summary data for the Districts used in health analysis

District	No of Districts	Population	District Area (km ²)	Number of Schemes	Irrigated Area (ha)
Non irrigated	12	2,340,680	121,997	12	715
Irrigated	21	6,385,664	134,088	818	239,625

Source: District Reports

Area data obtained from website - <http://www.statoids.com/ytz.html>

² Irrigated area (Irr A) data from the DITS /MoWI (January Kayumbe pers. comm. 2010).

Population data estimated at 2008 from data provided in CCHP reports (if no population data was provided in 2008, the 2008 estimate was interpolated from the population in 2007 and 2009). Districts with population density greater than 300 people per km² were excluded.

7.12.3 Irrigation Case Potential Advantages and Disadvantages

A direct health advantage for families living near irrigation projects may be the access to safer cleaner water and the ease of access to a reliable supply facilitating better hygiene. On the other hand, the increased exposure to agrochemicals is a negative health impact and there are many documented cases of human illness associated with unsafe exposure of both workers and residents to agricultural chemicals used on irrigated farms. These include:

- i. Paralysis from exposure to pesticide spray drift from cotton;
- ii. Sterility - through the use of the pesticide DBCP;
- iii. Chronic dermatitis - farm workers;
- iv. Symptoms of pesticide toxicity such as headaches, dizziness and facial burning – from applying pesticides; and
- v. Birth defects – from past pesticide exposure of the mother.

7.13 Comprehensiveness of the Baseline Data

The level of detail of the baseline data collected ranged from data aggregated at the ministerial, zone, and basin levels to detailed investigation at a sub-set of zones, basins, and schemes. At all levels, the information derived from the data is found to be generic. For all practical purposes at the SESA level, the data is the same from all levels.

This has been verified by a detailed investigative study in Mbeya and Iringa regions. The study findings indicated almost same findings as before.

8 ANALYSIS OF ALTERNATIVES

8.1 The Results of Analysis of Alternatives

The analysis of alternatives was done using two procedural steps. First was the analysis of how well each of the identified six alternatives is expected to achieve the intended irrigation development objectives when implemented. Secondly was a risk analysis, which entailed the assessment of the relative likelihood of occurrence of adverse impacts and the severity of such impacts when they occur. The risk analysis was done based on the understanding that many of the adverse impacts in irrigation development are associated with point and non-point pollution of water sources; loss of habitat and ecological environment due to irrigation activities; water depletion due to increased irrigation abstraction; water use conflicts due to increased irrigation demand; increased land degradation due to forest, bush and grass clearing for establishing new land for irrigation purpose; impediment to movement of livestock and wildlife; creation of habitat for disease vectors; localized soil erosion; soil salinization and changes in soil chemical properties due to improper fertilizer use recommendations without considering soil chemistry, and reduced environmental flows with negative consequences on aquatic and water sensitive species, just to mention few.

The analysis of alternatives considered both positive and negative impacts and it used the yardsticks of environmental, socio-economic and cultural integrity. Using the Multi-Criteria Analysis (MCA) technique, the following alternatives were analysed:

1. Alternative 0: Do not implement the policy measures and plans in the NIP and NIMP respectively;
2. Alternative 1: Promote improvement of traditional irrigation schemes only;
3. Alternative 2: Promote all types of existing irrigation schemes concurrently with new smallholders and commercial irrigation schemes of all scales (i.e. small, medium and large);
4. Alternative 3: Government plays a coordination and policy roles and the private sector manages irrigation;
5. Alternative 4: Promote Public Private Partnership (PPP) in irrigation investment and management; and
6. Alternative 5: Promote sharing of O and M such that IOs manage some structures like secondary canals while government does the rest.

The results of analysis of how well each of the six alternatives is expected to perform in relation to the criteria selected during the SESA study are summarized in Figure 8-1 and a detailed discussion is provided in the following sub-sections.

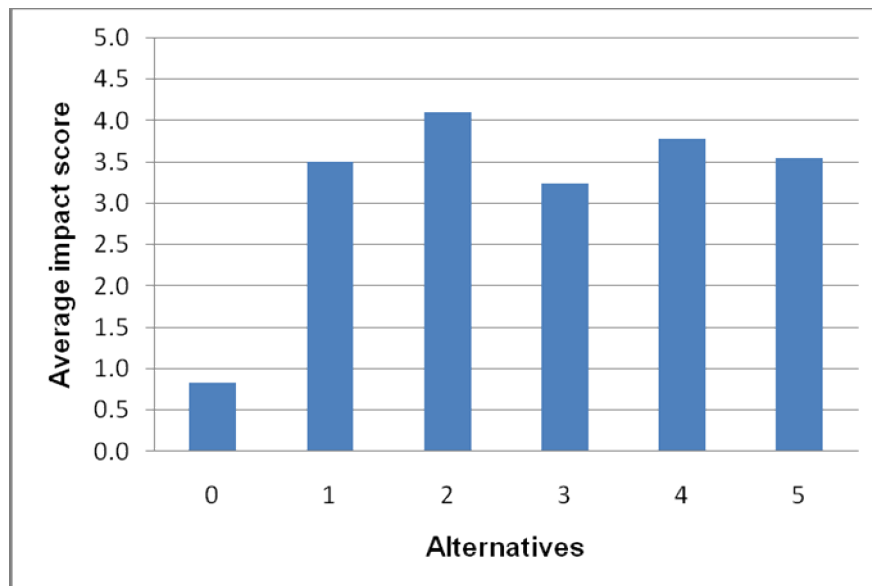


Figure 8-1: Results of alternative rating

Alternative 0: “Doing Nothing”- Do not Implement Policy Measures and Plan in NIP and NIMP

Upon analysis, the “doing nothing” alternative (i.e. not implementing the policy measures and plans in the NIP and NIMP respectively) received a final score of 0.8 implying very low levels of impact in achieving sustainable agricultural/irrigation development. As such, this alternative was given a negligible or very low rating of 1 against many environmental, socio-economic and cultural criteria - including the criteria. Not implementing policy measures and plans in the NIP and NIMP also implies that no training will be done to build capacity of irrigation staff. It also means that the government will not direct her endowed resources towards providing the enabling environment to attract the private sector to participate effectively in irrigation development. As a result many farmers will continue to rely on rain-fed agriculture and undertake unsustainable and poorly managed agricultural operations. Opting to do nothing is therefore less likely to expand economic opportunities for the poor farmers and increase revenue generation for both the local and central government.

Doing nothing also means that the existing irrigation schemes or schemes which are already in operation will continue to operate haphazardly without government support and regulation. This will intensify the weaknesses which are inherently common in the traditional irrigation management approach. As the information gathered during the consultation with stakeholder groups indicates, the traditional approach to irrigation development is characterized by inequality in access to water and overwhelming conflicts over irrigation water use. In addition, very few irrigation organizations have been established with many of the ones which have been established being less effective. Productivity will continue to be low for most crops and schemes.

Alternative 1: Promote Improvement of Traditional Irrigation Schemes Only

Alternative 1 suggests that focus be directed solely towards the improvement of existing traditional schemes. The alternative received a moderate overall rating of 3.5. The main strength of the alternative is centered on its potential to improve productivity of smallholder farmers who are currently abstracting water using traditional intakes and furrows. It is therefore a pro-poor approach to irrigation development expected to benefit smallholder farmers who constitute the majority of poor farmers in the country.

The available empirical evidence suggests that these farmers (i.e. smallholder farmers) may perform well when facilitated. In Usangu plains research findings show that the productivity of water (PW) in smallholder irrigation schemes was higher than that of large scale irrigation schemes. For different paddy irrigation schemes and farming systems, the PW ranged from 0.059 to 0.250 kg/m³ for abstracted water (SMUWC, 2001; Kadigi *et al.*, 2008). For net consumed water the average PW ranged from 0.126 to 0.265 kg/m³ (*ibid*). Overall, the farmers in large scale farms (e.g., the Kapunga and Mbarali irrigation schemes) recorded the lowest PW figures while smallholder farmers had the highest PW (*ibid*). Generally, the PW for rice production in Sub-Saharan Africa ranges from 0.10 to 0.25 kg per m³, with an average yield of 1.4 tonnes per ha and water consumption close to 9,500 m³ per ha (Rosegrant *et al*, 2002). Among developing countries, China and some Southeast Asian countries have recorded higher PW figures for rice, ranging from 0.4 to 0.6 kg per m³. In addition, researchers working with the International Water Management Institute (IWMI) have shown that the PW for water consumed in agriculture ranges from US \$ 0.05 to 0.90 per m³, with the majority of observations in the range of US \$ 0.10 to 0.20 per m³ (Perry, 2001).

There are numerous explanations for high PW in smallholder irrigation schemes in the Usangu plains. Importantly is perhaps the practice that these schemes had normally involved small plots or banded basins (*vijaruba*), enabling greater control of water levels. The entire small banded basins (*vijaruba*) were cropped and the nurseries prepared at special places (often under trees) to minimize evaporation losses. Thus, alternative 1 (improving traditional schemes) may significantly help saving water which is currently wasted in unimproved traditional schemes because of the existing poor irrigation infrastructure in these schemes.

There are however some important major drawbacks of implementing alternative 1. These may spring from its exclusionary effects, that is, the failure to consider the promotion of other types of irrigation schemes. The option seems to benefit only farmers in the traditional irrigation sector. Farmers outside this sector may benefit if and only if they hire and or purchase plots in the improved traditional schemes. Thus, focusing irrigation development only on improvement of traditional irrigation schemes may compromise the objective of ensuring equitable sharing of irrigation benefits. Other bottlenecks relate to the discouragement of the private sector to participate actively in irrigation development; limited privatization and commercialization of irrigation schemes and lack of conformity to market oriented economy.

Alternative 2: Promote all Types of Irrigation Schemes (Existing and New) Concurrently

Alternative 2 requires that all types of irrigation schemes are promoted concurrently, including the existing and newly established irrigation schemes of all types. The alternative is ranked as the most appropriate alternative to pursue. It received the highest final score of 4.1, implying 'moderate to high' performance. The successful implementation of this option is likely to result

in positive economic outcomes for the national agriculture sector, and in particular to the community of farmers who are the main beneficiaries of irrigation development.

One of the direct economic impacts of adopting the alternative is increased crop yield, agricultural production and farm income. If appropriately implemented and suitable mitigation measures undertaken, the alternative is likely to serve as a powerful pathway towards reducing rural poverty. This is not so much through the direct impacts of increased yield and farm returns *per se*, but more through indirect impacts like increased rural employment and the feedback and multiplier effects resulting from the improvement and provision of irrigation structures for all types of irrigation schemes. Irrigation infrastructure will have impacts on inequalities in income distribution and the poverty status.

The indirect positive impacts, such as more stable rural employment and higher rural wage rates will help landless farm labourers to obtain a significant share of improved agricultural production. In addition to yield improvement and intensive production practices, better irrigation infrastructure and reliable water supply will also enhance uses of other inputs like fertilizers and high yield varieties. This intensification of agricultural practices will generate additional employment opportunities in the rural sector and hence reduce rural-urban migration.

Obviously, the irrigation induced positive impacts will not be limited to farming households only but will also affect broader sectors of the economy by providing increased opportunities to growing rural service sectors and other off-farm employment activities. Examples of such opportunities are additional employment creation for landless labourers in agro-industries, rural marketing and other off-farm activities like house construction and basic infrastructural building. In turn, this feedback process will increase demand for employment many-folds and generate additional wealth creation and capital accumulation in the rural sector.

It should however be noted that, for this alternative to perform well, the key challenges and issues identified during the stakeholders' consultation should be appropriately addressed. These include, among others, the need for ensuring a well organized inter-basin water transfer and equitable sharing of the available water resources, between different user groups, including the poor women and other rural farmers. The issues of environmental degradation and loss of biodiversity, which are inherent in most irrigation development efforts, also need special attention. In addition, it is important that all the key mitigation measures suggested under the section of Social Environmental Management and Monitoring Plan are effectively implemented; including the measures which are meant to mitigate impacts of land and water degradation; drying up of rivers and reduced environmental flows.

Just as important, a successful implementation of this alternative requires that adequate funds and proper auditing system for the irrigation funds are put in place and that effective Irrigators Organizations (IOs) and Water Users Associations (WUAs) are established, strengthened and empowered. In addition, it needs not to be over-emphasized that the scope for the implementation of the "Kilimo kwanza" (agriculture first) and reduction of income-inequality and improvement of agricultural productivity and benefits for the vulnerable farming households in the country will critically depend on the accompanying arrangements and institutional mechanisms. Institutional reforms (e.g. establishment and strengthening of IOs and WUAs) are necessary in order to ensure that the vulnerable groups have access to the institutional platform through which water and land resources are sustainably managed. Past experiences suggest that the formation of IOs and WUAs might not happen without some external support in facilitating the formation process. This suggests an important role for the regional and district level institutions, and the Basin Water Offices in supporting the organization of local water users. IOs and WUAs are about ensuring active involvement of irrigators and other water users in making sustainable water management and allocation decisions. This is a reflection of the recognition of water resources management insight of local people's cultures and the determinative power of the local communities to shape their future livelihoods.

Alternative 3: Government Plays Coordination and Policy Roles and the Private Sector Manages Irrigation

Alternative 3 requires that the government transfers its role of managing irrigation to the private sector and remains with the coordination and policy formulation roles. This alternative received an overall rating of 3.2. The option is likely to attract more entrants from the private sector. It is also expected that many irrigation schemes will become commercial and there will be a tendency to move towards increased conformity to market oriented economy. The major drawbacks include the possibility of excluding poor farmers in benefiting from irrigation development because of their inherent problem of lack of capital and risk management options.

The high risk for water-related yield loss in rainfed agriculture will make farmers avert risks, which in turn will continue to influence their perceptions on investments in other production factors, such as labour, improved seed and fertilizers. Because of the risks associated with climate variability, smallholder farmers will consider reducing risk of crop failure due to dry spells and drought before they consider making investments in soil fertility, improved crop varieties and other yield-enhancing inputs. They are usually aware of the effects of shortage and/or variability of soil moisture on the variety, quantity and quality of produce. This, together with the fluctuations in yields, will make it hard for resource-poor men and women, especially in semiarid areas to respond effectively to opportunities made possible by emerging markets, trade and globalization.

Alternative 4: Promote Public Private Partnership in Irrigation Investment and Management

Alternative 4 advocates the promotion and encouragement of Public Private Partnership (PPP) in the development and management of improved and new irrigation schemes. The alternative received an overall rating of 3.8. The alternative is likely to have positive outcomes if the private sector will be willing to participate effectively in irrigation development. This in turn, is likely to accelerate commercialization of irrigation schemes and increase conformity to market oriented economy.

However, there is a danger that the option might result in exclusion of the poor farmers, who have limited access to capital for investment in irrigated agriculture, including the women. The private sector may not consider investing in smallholder irrigation schemes. The option may also weaken the existing IOs and WUAs that involve smallholder farmers as it is likely to benefit only relatively well-off farmers and private companies who have huge capital and access to loans from lending institutions. Most smallholder farmers in Tanzania have troubles accessing loans from banks and other lending institutions; the option may therefore deny them the benefits of irrigation development and may lead to inequitable access to water for irrigation by the poor farmers and hence unreliable and unsustainable crop production, food insecurity and increased incidences of poverty and income inequality.

Alternative 5: Promote Sharing of O and M so that IOs Manage Some Structures like Secondary Canals while the Government Does the Rest

Alternative 5 suggests that Operation and Maintenance costs are shared by IOs and the government, such that the former manages some structures like secondary canals while the latter (government) covers expenses of major components of irrigation infrastructures. The alternative received an overall rating of 3.5. The alternative is likely to have potential livelihood impacts, because members of IOs will develop the ownership feeling that will lead to effective contribution in O&M. This will however require that the IOs and WUAs are well established and

empowered enough to effectively manage the irrigation schemes. During consultations with stakeholders, it was noted that most farmers in smallholder irrigation schemes do not regularly contribute to O&M and the enforcement mechanisms are not well established.

8.2 Results of Risk Analysis

The results of risk analysis are summarized in Table 8-1.

Table 8-1: Results of Risk Analysis

Alternative	Description of the alternative	Aggregated Relative Likelihood of Occurrence	Aggregated Severity of Consequence	Aggregated Risk Factor*
0	Do not implement the policy measures and plans in the NIP and NIMP respectively	0.29	0.31	0.09
1	Promote improvement of traditional irrigation schemes only	0.50	0.49	0.28
2	Promote all types of existing irrigation schemes concurrently with new smallholders and commercial irrigation schemes of all scales (i.e. small, medium and large scales)	0.59	0.59	0.35
3	Government plays a coordination and policy roles and the private sector manages irrigation	0.59	0.60	0.36
4	Promote Public Private Partnership in irrigation investment and management	0.56	0.55	0.34
5	Promote sharing of O and M such that IOs manage some structures like secondary canals while government does the rest	0.49	0.44	0.23

*Risk Factor = Relative Likelihood of Occurrence x Potential Severity of Consequence

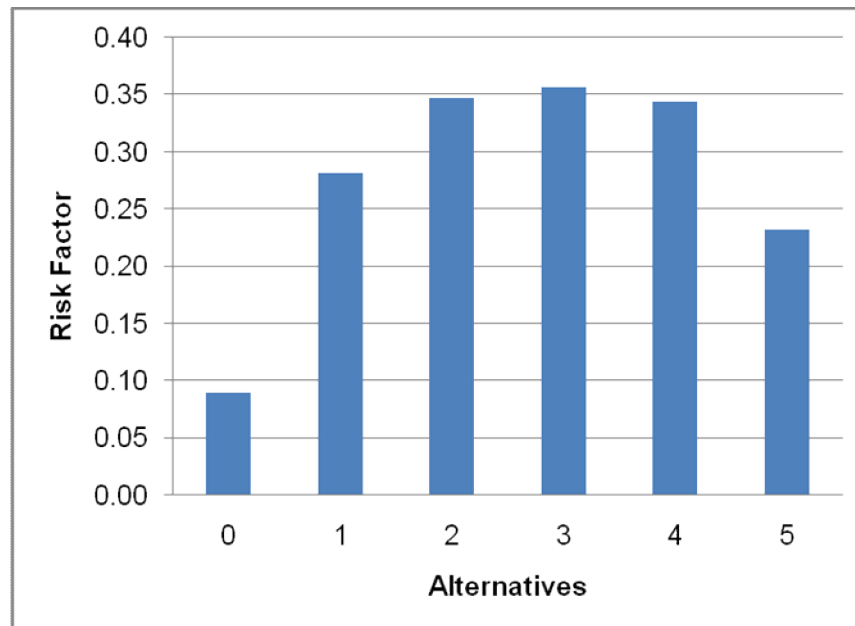


Figure 8-2: Results of risk analysis

8.3 Remarks on Alternatives

As shown in Table 8-1 and Figure 8-2, all alternatives show risk factors of less than 0.4 ranging from negligible to low levels of risks. Comparatively however, alternative 3 is the most risky alternative with a risk factor of 0.36. Alternative 2 is ranked as the second risky alternative with a risk factor 0.34. However, the alternative is also ranked the highest in terms of performance compared to the rest of the alternatives. This may raise another question of whether alternative 2 should be accepted or rejected based on the risk factor or impact/performance yardsticks. It should be noted that, accepting risk is desirable if the risk offers the potential of large pay-offs in performance. Normally, risk buys performance potential and it can be accepted if it is manageable. Thus, risk management plan is critical and must be seriously implemented. Risk can also be accepted if it is accepted by the stakeholders.

The strength of alternative 2 rests on the fact that it advocates that different types and scales of irrigation schemes are promoted simultaneously. The alternative realizes the heterogeneity of farmers (small, large and commercial) and hence the likelihood of achieving equitable sharing of irrigation development pay-offs. The full benefits of implementing this option will not only be captured by farmers, but will also spread to wider sections of society. These effects constitute the un-intended income (also employment) equivalent of welfare changes brought about by the construction of irrigation schemes. The extent of such irrigation induced positive externalities or spillover impacts, is likely to be much wider in scope and may contribute significantly to the national development pace.

However, realizing the most beneficial outcome from the adoption of alternative 2 requires that the key issues identified during stakeholders' consultation are appropriately addressed and the mitigation measures suggested in this report are effectively implemented. With regard to adverse impacts that may occur as a result of irrigation, especially in large schemes, these impacts could be potentially more severe, such as public health, increase in water stress of the renewable water sources, and loss of land. Also water quality of the lakes and rivers may potentially be adversely impacted by irrigation arising mostly from water abstraction and or irrigation drainage water. All these need that effective mitigation measures are put in place and correctly implemented.

9 ANALYSIS OF POTENTIAL DIRECT IMPACTS FROM IMPLEMENTING THE NATIONAL IRRIGATION POLICY AND THE NATIONAL IRRIGATION MASTER PLAN

Potential impacts of a cross-cutting nature are identified and evaluated for the NIP and the NIMP as policy and planning documents. The NIP and the NIMP are treated as one with respect to potential impacts, for the NIMP is a reflection of the NIP.

In addition, the potential impacts of implementing the NIP and the NIMP on the physical, biological, and socio-economic environments are identified for the NIP and NIMP. All potential impacts are preliminary, for they are being updated, categorized, and prioritized.

9.1 NIP and NIMP Impact

This section is organized by the 6 policy themes identified from this study. The impacts are as follows:

Table 9-1: Cross Cutting Potential NIP - NIMP Impacts

S/n	Policy Theme	Potential Positive Impacts	Potential Negative Impacts
1	Institutional strengthening	<ul style="list-style-type: none"> • Staff well trained to manage the irrigation • Private sector supported to manage irrigation • Government to coordinate and finance the development only but not operation & management • Sustainable and well managed irrigation operations • Well researched irrigation activities • Well established and registered Irrigation Organizations 	<ul style="list-style-type: none"> • Lack of staff development funds • Unattended scheme due to leave of absence during training • Movement to greener pasture of the trained personnel
2	Financing mechanisms and funding support for irrigation development	<ul style="list-style-type: none"> • Established irrigation development fund • Access to funds enabled • Expanded economic opportunities • Increased and expanded irrigated areas • Increased opportunities for income generation • Increased revenue 	<ul style="list-style-type: none"> • Mismanagement of government funds • Lack of funds

S/n	Policy Theme	Potential Positive Impacts	Potential Negative Impacts
		<p>generation for local and the government</p> <ul style="list-style-type: none"> Investment fund for Irrigation Development for all Irrigation Scheme types 	
3	Regulatory Framework	<ul style="list-style-type: none"> Working Enforcement and compliance; Good governance; Enhanced Legislative changes in support of irrigation development and creation of enabling environment to attract private investors and financiers in the irrigation sector; Violators punished 	Conflicts with other policies
4	Land tenure and ownership rights	<ul style="list-style-type: none"> Well Demarcated and surveyed and registered irrigated land; Irrigation Land known and fixed and no change of use without permit 	Change to other uses might be difficult
5	Water Resource Development	<ul style="list-style-type: none"> Well documented and analyzed groundwater potentials and advocating its use Developed large scale water storage structures e.g dams etc Well organized inter-basin water transfers 	Some properties being submerged due to large water
6	Promote the development and management of irrigation schemes	<ul style="list-style-type: none"> Reliable and sustainable crop production under irrigation will contribute to food security, employment, poverty reduction and the overall economic growth of the Nation; Aesthetic beauty 	<ul style="list-style-type: none"> Loss of habitat and ecological environment Water depletion Water use conflicts due to increased irrigation demand Increased land degradation Forest/Bush/grass clearing

9.2 Socio-economic Environment Potential Direct Impacts

The following potential economic environment impacts have been identified (Table 9-2).

Table 9-2: Socio-Economic Environment Potential Impacts

S/N	Impacts
Potential Positive Impacts	
1	Successful implementation of the empowerment interventions may help developing the private sector
2	Privatization and commercialization of irrigation schemes may help conforming to market oriented economy
3	Increased crop production (yield improvement) and increased farm income
4	Increased cropping intensity and crop diversification opportunities and the feasibility of year-round crop production activities
	Increased farm employment—more employment opportunities for farming families as well as for hired laborers in the locality
5	Increased farm income (for farmers) and increased farm and off-farm employment opportunities for rural landless laborers will result in better school attendance of children of farm laborers and improved social capital. This is due to the income effects of irrigation
6	Enhanced women empowerment through involvement in irrigation activities
7	Sustainable and successful Irrigation Organizations enhance social cooperation
8	Increased farm consumption and increased permanent wealth (permanent asset accumulation due to irrigation). This has significant implications for reducing intrinsic food insecurity in the country
9	Reduced food (crop) prices allowing access to food for all, which is more beneficial to landless and subsistence families and provides better nutrition intake. This is also equally beneficial to urban poor and city dwellers, since they spend a large proportion of their daily income on food items
10	Export tax revenue accruing to government coffers; this is important particularly for Tanzania being largely an agricultural-based country.
11	Reduced friction in the rural economy and reduced transaction costs including reduced farm marketing costs
12	Irrigation development may also bring about some benefits such as less maintenance, low conveyance loss, less land acquisition area, and protection against water-borne diseases (e.g. irrigation schemes with lined canals)
13	Aesthetic and recreational benefits accruing out of irrigation facilities.

S/N	Impacts
14	Easy access to groundwater and less drudgery in fetching water for daily household needs in addition to irrigation water
15	Mechanisms for ensuring that water fees reflect the economic value of water instituted
Potential Negative Impacts	
1	Privatization and commercialization of irrigation schemes may compromise the goal of poverty reduction and equity in welfare distribution
2	The rate of growth of the private sector may not cater for the anticipated upsurge of management and development in irrigation schemes
3	Irrigation funds may not be used in an efficient and economical way and exclusively for purposes intended
4	Irrigation expansion targets may not be well aligned to capacity and available financing
5	Slow implementation of cross-cutting reforms (e.g. infrastructure, finance, and lands) may limit the rate of irrigation development
6	Water utilization and provision of water permit may not be subjected to economic criteria in consideration of water for the poor and the environment
7	Increased child labor, prostitution, and social strife during planting and harvesting;
8	HIV from migrants and construction workers;
9	Poor health and sanitation due to water borne disease;
10	Conflicts due to water misuse and destruction of irrigation infrastructure;
11	Conflicts among farmers due to lack of water;

9.3 Public Health Potential Direct Impacts

The availability and quality of data on the incidence of potential positive and negative health impacts from the scheme level through the district level to the Ministry of Health and Social Welfare has been determined. The data sources include district profiles, Ministry of Health and Social Services documents, as well as documented and anecdotal data that were collected from irrigation schemes, district medical facilities and offices.

The influx of people in irrigation projects causes potential incidence of diseases. Therefore a significant incidence of STD should be anticipated in irrigation schemes.

9.3.1 Toxigenic Cyanobacteria (blue green algae)

Tropical reservoirs provide suitable habitat for seasonal blooms of toxigenic cyanobacteria (Anabaena and Microcystis), which can make reservoir water unsuitable for stock or human use and also affect downstream communities traditionally reliant on river water as a source of potable supply.

9.3.2 Waterborne diseases

Waterborne diseases like malaria, dysentery, schistosomiasis and a variety of intestinal worms are endemic in Tanzania. The construction and operation of irrigation systems and large dams can increase the likelihood of infection amongst people living in proximity to the schemes by expanding the habitats suitable for the animal vectors of the human diseases listed in Table 9-5. The evidence from the comparative district study reported here, supports the expectation that incidence of schistosomiasis can be expected to rise in new irrigation development. Waterborne in this assignment means all diseases related or associated with water

Table 9-3: Human diseases with intermediate host potentially increased by new dams or irrigation schemes

S/N	Disease	Intermediate host	Infection	Control
1	Guinea worm (<i>Dracunculus medinensis</i>)	<i>Cyclops</i> (in river and lake zooplankton)	Drinking unfiltered water containing the copepod	Provision of filtered potable water Improved Sanitation
2	Urinary schistosomiasis <i>Schistosoma haematobium</i>	Bulinid snails (e.g. <i>Bulinus truncates</i>)	By direct (primary) contact with the infective larvae. Shallow standing water near lake shores is especially dangerous	Avoidance of primary contact. Dry vegetation in littoral zone by reservoir drawdown Improved Sanitation
3	Intestinal schistosomiasis <i>Schistosoma mansoni</i>	<i>Biomphalaria species</i> e.g. <i>B. pfeifferi</i>	By direct contact with infective (cercariae) larvae in water. Shallow standing waters are especially dangerous	Avoidance of primary contact. Dry vegetation in littoral zone by reservoir drawdown Improved Sanitation
4	Malaria (<i>Plasmodium falciparum</i>)	<i>Anopheles</i> mosquito species	Transmitted through bite from adult mosquito	Proper channel design to keep water flowing Avoid reservoirs, Weeding, Canal Lining, Mosquito nets, Awareness
5	River Blindness (Onchocerciasis)	Black fly breeds in fast moving water		provide piped water supply Stop downstream flow intermittently
6	Rift Valley fever (Virus)	Mosquito	Virus transmitted from livestock to humans via mosquitoes in reservoir filling phases	Vaccinate or remove livestock Quarantine livestock Awareness Control mosquito habitat

9.4 Analysis of Cumulative Potential Impacts

An assessment of the cumulative impacts of the options proposed has been made based on a consideration of the strategic elements with impacts that are not confined to a single event or location. These are:

i. Carrying Capacity

- ii. Climate Change
- iii. Proliferation of Pests
- iv. Shrinkage of Wetlands
- v. Degradation of Ecologically Sensitive Habitats
- vi. Drying of water sources

9.4.1 Carrying Capacity

The basic assumption of the Carrying Capacity Framework is that an area can support a fixed number of people given the quality of the natural environment and the level of technology. FAO studies (2010) indicate that.

The minimum amount of agricultural land necessary for sustainable food security, with a diversified diet similar to those of North America and Western Europe (hence including meat), is 0.5 of a hectare per person. This does not allow for any land degradation such as soil erosion, and it assumes adequate water supplies. Very few populous countries have more than an average of 0.25 of a hectare. It is realistic to suppose that the absolute minimum of arable land to support one person is a mere 0.07 of a hectare, and this assumes a largely vegetarian diet, no land degradation or water shortages, virtually no post-harvest waste, and farmers who know precisely when and how to plant, fertilize, irrigate, etc.

These estimates could be wildly off given the apparent effects of climate change since the early 1990's. As it stands now, historic climate data is no longer reliable for farm planning. Planting dates, performance of particular seed varieties, and pest cycles are all erratic. Therefore, "farmers who know precisely when and how to plant, fertilize, irrigate, etc" is no longer a reasonable consideration. Planting frequently is the simplest countermeasure to erratic weather, but this requires a lot more land, as the farmers is overplanting to account for potentially poor performance (Postel, 2000).

9.4.2 Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC), climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.

- i. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.
- ii. The spatial and temporal variation caused by climate change will all take place at the margin. This has a number of significant ramifications for water resource management. These include:
 - iii. Planning for greater uncertainty;
 - iv. Impacts on water quality;
 - v. Operational and structural considerations in infrastructure design;
 - vi. The inevitability of water supply dislocations; and
 - vii. Institutional adaptations.

Based on the information in the IPCC's Fourth Assessment Report (IPCC, 2007) it is likely that Tanzania will experience more rainfall in the future. The average projected increase in the period 2010 – 2039, as compared to the base year 2000, is 51 mm/year, or about 5%. The areas predicted to have increase in rainfall include the central and central-northern part of the country. Based on the relationship between average annual rainfall and actual evapotranspiration in the various drainage basins, the average annual increase in runoff is estimated at 12%. The predicted increase in runoff is expected to have impact on the infrastructure (e.g. road networks and the irrigation structures) and consequently affect the NIMP and NIP implementation.

IPCC (2001) predicts the rise in the mean temperatures in the range from 0.2°C per decade (low scenario) to more than 0.5°C per decade (high scenario). The rise in temperature will generally lead to increased evapo-transpiration and consequently an overall increased demand for water for crops, livestock and human use, although there will be shifting patterns of demand as people adjust to temperature, precipitation, extreme events and water availability. The coastal aquifers are predicted to become increasingly saline with sea-level rise and increased storm events.

The NIMP potential irrigated areas considered among others the availability of water for irrigation and accessible infrastructures. Given the predicted increase in evapo-transpiration and rainfall, it is imperative that NIMP focuses on flood control to enable smooth transfer of the flood water and ensure enough water storage to mitigate the drought effects in areas that are predicted to be affected by the increase in temperature. Furthermore, NIMP should focus on public awareness to the effects of climate change especially to coastal communities and enhance disaster preparedness. Climate change is expected to further affect the vulnerability of poor farmers in the rain-fed agriculture. Increased occurrence of floods and droughts will increase the uncertainty in agricultural production and make the variations in yield more severe. The aim of the Government to substantially increase the farmers' income and the national food security through development of irrigated agriculture seems therefore a logical one.

The adverse effects of climate change on the freshwater systems will aggravate the impacts of other stresses, such as population growth, changing economic activity, land-use change and urbanization. Water demand will grow in the coming decades, due to population growth, increased public water supply, and development of irrigation areas to ensure a degree of food security.

Current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability, flood risk, health, agriculture, energy and aquatic ecosystems. In many locations, water management cannot satisfactorily cope even with current climate variability, so that large flood and drought damages occur (IPCC, 2008 TR VI).

Climate change will have impact on the operation of existing water infrastructure, including drainage and irrigation systems, as well as on the design of future systems. Water management practices will have to be adjusted to cope with the changed water resources conditions. One of the coping mechanisms is dam construction for different uses (e.g. livestock, domestic, irrigation et cetera). The construction of these dams should be properly coordinated to avoid cumulative environmental and social impacts.

The Drilling and Dam Construction Agency (DDCA) which is a Government Executive Agency under the Ministry of Water; is charged with the role of coordinating of dams and boreholes. The agency was established under the Executive Agencies Act No. 30 of 1997. DDCA is the leading and most efficient organization in the country in the business of water well drilling and dam construction, including the construction of earth-fill dams and charcos for different uses; carrying-out soil investigations for various purposes; providing consultancy services on drilling and dam construction; and conducting Environmental Impact Assessments (EIA).

9.4.3 Proliferation of Pests

Increased proliferation of pests and incidence of pest attacks are attributable to the impact of changes in climate. Recent study by (IFPRI, 2009) has indicated that proliferation of pest will reduce yields leading to consequences on food security, which will also be more affected by climate change related price increases. With the increased pests, pastures may become scarce, which may also cause disease and pressure on both livestock and crops. Such incidences will affect the vulnerability of poor farmers in the rain-fed agriculture including the pastoralist making them more exposed to poverty.

9.4.4 Shrinkage of Wetlands

Wetland shrinkage will affect the spatial extent and the ecological components of wetlands ecosystems. Given the connectivity of wetland ecosystems it will as well affect the chain of products and services (ecosystem services) provided by wetland ecosystems. This will have multiplier effects that may boil down to effects on wetland dependent livelihoods and ecological process that influence wetland productivity. Wetlands are important for water storage and conservation. Shrinkage of wetlands will reduce their capacity to store water resulting into reduced water storage and availability which in turn will affect water supply downstream and consequently sanitation and health. Wetlands are also known as important ecosystems for water purification and hence water quality. Decreasing areas of wetlands as they are annexed to irrigation development will lead into reduced capacity for water purification and hence reduced water quality. Wetlands are known to be good refuge for biological diversity and especially wildlife resources. The decrease in wetland areas will reduce the available habitat especially for wetland dependent wildlife. This will consequently affect the functioning of wetlands as repositories of biological diversity especially during the dry season. Fisheries are a key development sector both locally and in and other areas outside the vicinity of the wetlands. Changes in spatial extent of the wetlands will affect negatively the fisheries sector. Further reduced capacity to store and regulate water flow will affect future hydropower development and subsequently the national economy

9.4.5 Degradation of Ecologically Sensitive Habitats

Some of the irrigation schemes are established in ecologically sensitive areas such as wildlife corridors, protected areas and catchment forests. Irrigation activities in such areas will affect negatively the ecological integrity of these habitats including habitat fragmentation with a resultant loss of gene flow among populations and possibly driving some wildlife populations to below minimum viable levels and local extinction and may as well result into conflicts among stakeholders. Conservation is therefore a key issue since there are several areas in the potential irrigation sites that are classified as having very high biodiversity value in Tanzania. Among the most important impacts will be increased pressure on wildlife and the resultant decrease in wildlife populations impacting further on tourism sector as well as local and the national economy dependent on tourism. Influx of people and improved access to the irrigation areas will create higher pressure on biodiversity in terms of hunting as a result will lead into decrease biodiversity of these areas. Encroachment into wildlife corridors will result into human wildlife conflicts as wildlife damage to crops increases.

9.4.6 Drying up of Water Sources

The drying-up of water sources is a consequence of either increased water abstractions or rainfall variability and increased evaporative loss resulting from climate change. The recent flow assessments in the Tanzanian water basins have indicated decreasing trends in river flows; consequently, there has been escalating conflicts over water usage and distortion of ecological integrity. For example, a study by Kashaigili *et al.*, (2005), Kashaigili (2008), revealed changes in flow regimes of most rivers in the Upper Great Ruaha River catchment (UGRRC) in the Rufiji

Basin as a result of increased agricultural production and changes in land use. The Great Ruaha River that used to be a perennial river dried-up since 1993 up-till now downstream of the Usangu Wetlands through the Ruaha National Park. The dry-up has resulted into serious environmental concerns following disruption of ecosystem balance, mortality of fish and hippopotami. Not only that but also other rivers like Mkoji and Ipatagwa that used to be perennial have dried-up in the downstream as a result of increased agricultural production especially in the dry season due to high value crop farming. In the past years, these used to be dependable rivers by the people living in the downstream. Considerations are being thought to ensuring environmental flows to safeguard the environment and the riparian ecosystems.

Despite that, expansion of the area irrigated has the potential to impact the environmental flows in the respective river basins. The potential impacts include the reduction in the quantity and quality of water flowing in the rivers and the physical conditions of the riparian ecosystems. The intensification of irrigated agriculture can lead to surface and groundwater pollution linked to the increased use of pesticides and fertilizers.

As a water use permit is specific to a location in the river, the expansion in irrigated area while only abstracting the permitted amount can only be done if the system efficiency is increased. Increased efficiency should result in less surface water return flows to the river. The resulting decrease in downstream flow has the potential to impact downstream users, including aquatic biota. Therefore, the following are the potential impacts of irrigation area expansion on environmental flow requirements:

- i. Changed runoff pattern due to daily fluctuations in discharge as a result of increased irrigation abstractions;
- ii. Deteriorated quality of the river flow from return flows polluted with agrichemicals;
- iii. Increased sedimentation from erosion in the irrigated areas; and
- iv. Damage to downstream ecosystems due to reduced water quantity and quality.

10 PROPOSED MITIGATION MEASURES

Potential impacts have been identified and evaluated for the NIP and the NIMP as policy and planning documents. The specific potential mitigation measures on the physical, biological, socio-economic and environmental impacts are presented under the six strategic themes and the detailed discussion is provided in Chapter 11 under the strategic planning. The six strategic themes as identified in the analysis of NIP and NIMP are:

- i. Regulatory framework and institutional strengthening
- ii. Land tenure and ownership rights
- iii. Development and management of irrigation schemes
- iv. Financing mechanism and funding support to irrigation development
- v. Water resources development
- vi. Cross-cutting issues

The details of mitigation measures are presented in Table 10-1.

Table 10-1: Proposed mitigation measures for potential impacts of NIMP and NIP implementation

S/N	Issues and concerns	Potential Negative Impacts	Potential Mitigation Measures	Priority
Regulatory Framework and Institutional Strengthening				
1	Unclear institutional setup and line of command in irrigation services provision	<ul style="list-style-type: none"> • Unproductive and marginalized irrigation development 	Create and develop and institutional set up for irrigation development	HIGH
2	Insufficient human resources at all levels and low capacity in managing irrigation development	<ul style="list-style-type: none"> • Increase in substandard and inefficient irrigation schemes • Moral erosion and overstressing the existing staff • Delayed implementation 	Recruit and institute capacity building programmes for irrigation and environmental related human resources	HIGH
3	NIMP and NIP are not well understood at the Zonal and District levels	Low implementation of NIP and NIMP	<ul style="list-style-type: none"> • Conduct awareness campaigns on the significance of NIMP and NIP in relation to irrigation development in Tanzania • Training of Trainers on NIMP and NIP 	MEDIUM
4	Insufficient local qualified contractors to construct irrigation infrastructures	<ul style="list-style-type: none"> • Delayed production and hence impacting the local livelihoods • Increase in substandard and inefficient irrigation schemes 	Established long term capacity building to local contractors constructing Irrigation schemes	LOW

S/N	Issues and concerns	Potential Negative Impacts	Potential Mitigation Measures	Priority
5	Inadequacy of well established Irrigator Organizations (IOs)	<ul style="list-style-type: none"> Poor O&M Loss of livelihood, water productivity and increase in water use conflicts 	<ul style="list-style-type: none"> Facilitate the establishment and strengthening of IOs Promote and ensure use of O&M guidelines by farmers and extension workers 	HIGH
6	Inadequate incentives for the private sector to participate in irrigation	<ul style="list-style-type: none"> Few private investor in irrigation sector Increased burden to the government 	Promote, build confidence and provide incentives for engagement of the potential private sector to participate in irrigation	HIGH
7	Inefficient marketing systems for agricultural products	Deterioration of livelihood of small farmers	Strengthen and empower smallholder marketing associations and build their capacity to manage the entire production and marketing chain	HIGH
Financing Mechanism and funding support for Irrigation Development				
8	Inadequate funding and delays in disbursement	Retarded growth in irrigation development	<ul style="list-style-type: none"> Strengthen financial accounting, accountability and proper budgeting Funds to be disbursed according to agreed critical path 	HIGH
9	Inadequate access to micro-credits by farmers	Deterioration in livelihoods of small farmers and poverty reduction efforts are undermined.	Strengthen farmers' access to Micro Credit and Finance Mechanism by establishing schemes specific	MEDIUM
Land tenure and ownership rights				
10	Non compliance to the resettlement plans	Deterioration of livelihoods of resettled households	Promote voluntary resettlement and institute mechanisms for laws and by-law enforcement	LOW
11	Inadequate land use planning	<ul style="list-style-type: none"> Degradation, misuse, and waste of productive land resources Loss of opportunities for economic and social development. 	Undertake land use planning and enforce the plans accordingly	MEDIUM
12	Imbalance in allocation of irrigation land between different scales of irrigation categories	Conflict of access and usage	Reallocate irrigation land equitably between the different scales of irrigation categories	MEDIUM

S/N	Issues and concerns	Potential Negative Impacts	Potential Mitigation Measures	Priority
13	Default and land grabbing	Poor land compensation	Discourage direct purchase of land by investors from customary or statutory landowners; instead encourage them to go into joint ventures using their land as their contribution to the investment	MEDIUM
14	Limited understanding of land governing policies, laws and regulations	<ul style="list-style-type: none"> • Conflict among users • Land degradation 	Provide training to Land Committees	HIGH
Water Resources Development				
15	Inadequacy of reliable and sustainable surface water resources for irrigation	Low farm productivity, low income and retarded economic growth	Develop other sources of water for irrigation such as ground water, rainwater harvesting and dams	HIGH
16	Loss of farms, habitat for flora and fauna as a result of clearing and inundation for damming	Low agricultural production, low income and retardation in economic growth and Biodiversity decline	Conduct EIA for all developments and adhere to the EIA recommendations	MEDIUM
17	Reduction in environmental Flows and its Implications on aquatic and water sensitive biodiversity and wildlife Habitats	Loss of wildlife habitats and biodiversity	<ul style="list-style-type: none"> • Promote and ensure Integrated Water Resources Management • Conduct Environmental Flows Assessment and allocation • Conduct stream flow monitoring 	HIGH
18	Uncertainty of water supplies due to Climate change	<ul style="list-style-type: none"> • Crop failure and Increased food insecurity • Loss of livelihood • Deprived ecosystem services • Increase in maintenance cost 	<ul style="list-style-type: none"> • Enhance early warning and disaster preparedness • Promoting water saving technologies • Promote drought resistance crops 	HIGH
Development and Management of Irrigation Schemes				
19	Uncoordinated water uses within irrigation schemes and between upstream and downstream users	Conflicts over water uses	Apply IWRM principles	MEDIUM

S/N	Issues and concerns	Potential Negative Impacts	Potential Mitigation Measures	Priority
20	Inadequate research and development in irrigation sector including linkage and coordination among stakeholders	Low farm productivity, low income and retarded economic growth	<ul style="list-style-type: none"> Promote and ensure adequate research and development (R&D) in irrigation Ensure technology transfer to farmers Establish mechanism for linkage and coordination of all types of irrigation research by various stakeholders 	MEDIUM
21	Deficient criteria for establishment of irrigation potential areas in the NIMP	<ul style="list-style-type: none"> Wrongly quoted irrigation potential areas Loss of investment planning 	Review NIMP, map and demarcate identified irrigation potentials area by considering water resources potentials for reliable water supply and land ownership status in addition to the former criteria	HIGH
22	Issuance of water use permits which does not conform to available water	<ul style="list-style-type: none"> Reduced environmental flows Degradation of aquatic biodiversity Conflict over water use 	<ul style="list-style-type: none"> Conduct water demand assessment and inventory of water users and permits Assess the response of aquatic biodiversity to flow regimes 	HIGH
23	Immigration of people into irrigation schemes	<ul style="list-style-type: none"> changes in local traditional and cultural behaviour spread of sexually transmitted 	Undertake awareness campaigns	LOW
24	Inadequate farm management, Operation and Maintenance (O&M) skills	Low agricultural productivity, low income and retardation in economic growth	Provide extension services and training on O&M guidelines	HIGH
25	Ineffective monitoring and evaluation system of irrigation schemes	Poor performance of irrigation schemes	Provide effective mechanism to monitor both financial and physical performance of the irrigation schemes	MEDIUM
26	Inadequate compliance to irrigation scheme development guidelines	Unsustainable irrigation development	Strengthen the District capacity to use the irrigation development guidelines and set a monitoring mechanism to assure compliance	MEDIUM
27	Exploitation of child labour in the irrigation schemes	Decline in and primary school enrolment and hence increase in illiteracy	Ensure that Child Labour Regulations and local by-laws are adhered to	LOW
28	Human-Wildlife conflicts	Low production and reduced revenues	Provide movement corridors for wild game and control wild animal straying and destroying crops	LOW
29	Vandalism of irrigation infrastructures, border raids	Social instability and	Empower IOs and conduct sensitization campaign to	MEDIUM

S/N	Issues and concerns	Potential Negative Impacts	Potential Mitigation Measures	Priority
	and boundary disputes	retarded economic growth	create a sense of ownerships of irrigation infrastructure	
30	Non compliance to design and construction standards of irrigation schemes (inadequate farm roads and crossing structures)	Loss of crops, injury to people/animals, and destruction of irrigation infrastructure	Enforce adherence to design and construction standards of irrigation schemes	MEDIUM
31	Sedimentation from catchment and within irrigation schemes	<ul style="list-style-type: none"> • Increased sedimentation in canals and rivers • Loss of arable land and low crop productivity • Reduced storage capacity of reservoirs 	Promote soil and water conservation measures	HIGH
32	Increased soil salinity and water pollution	<ul style="list-style-type: none"> • Loss of arable land and low crop productivity • Deteriorated quality of the river flow from return flows 	<ul style="list-style-type: none"> • Adhere to irrigation water quality standards and guidelines for irrigation water management • Regulate fertilizer and agrochemical application 	LOW
33	Flood damages resulting from inadequate drainage in irrigation systems	<ul style="list-style-type: none"> • Increased maintenance costs • Loss of crops, • Injury to people and animals 	<ul style="list-style-type: none"> • Adherence to design, construction and management standards of irrigation schemes • Ensure safety measures for flood control and other natural disasters 	MEDIUM
34	Poor on-farm water management	<ul style="list-style-type: none"> • Water flow reduction downstream • Adverse effects on the ecosystem • water use conflicts among the users 	Promote and ensure use of irrigation water management guidelines by farmers and extension workers	MEDIUM
35	Pollution of land and water bodies due to fertilizers, pesticides and agrochemical utilization	<ul style="list-style-type: none"> • Human and natural ecosystem health impairment • Mortality or morbidity of flora and fauna, • Bioaccumulation of toxic substances 	<ul style="list-style-type: none"> • Proper use of fertilizers (type, amount, and frequency of application) to avoid excessive use • Proper application (type and amount) of other agrochemicals to avoid excessive use • Prepare guidelines for use by farmers in the management of pesticides 	MEDIUM
36	Degradation of River Catchments and Riparian Ecosystems including ecologically sensitive areas	<ul style="list-style-type: none"> • Loss of water sensitive species dependent on the riparian ecosystems • Habitats fragmentation, • Loss of gene flow among populations 	• Adherence to Regulations and Standards for Management of Riparian Buffers and ecologically sensitive areas	HIGH

S/N	Issues and concerns	Potential Negative Impacts	Potential Mitigation Measures	Priority
		<ul style="list-style-type: none"> • Decline of wildlife populations to below minimum viable levels • Local extinction of sensitive flora and fauna 		
37	Blockage of fish movement and consequent interference with Fish Migration and Breeding	Physical barriers to fish and other aquatic organisms movement affecting fish migratory behavior	Plan and Construction of fish bridges after assessing fish species composition, abundance, patterns of movement and breeding behavior	LOW
38	Single resource management approach on irrigation scheme planning	<ul style="list-style-type: none"> • Conflicts in resource uses • Unbalanced resources utilization/ exploitation 	Promote and ensure Integrated Resource Planning and Management	MEDIUM
Cross-cutting				
39	Increase in HIV/Aids incidences in the irrigation schemes	<ul style="list-style-type: none"> • Reduction of labour force in agriculture production. • Increase in orphans and street children 	<ul style="list-style-type: none"> • Awareness campaigns on behaviour change • Provision of ARV for affected 	MEDIUM
40	Expansion of irrigation schemes does not match to the health and sanitation infrastructure	<ul style="list-style-type: none"> • Deterioration of community health 	Expansion of irrigation schemes to go hand in hand with the construction of health and sanitation facilities	MEDIUM
41	Inequitable sharing of irrigation benefits (gender inequality)	Increased gender inequality in-terms of decision making, income and empowerment	Promote gender mainstreaming programme in the irrigation sector	MEDIUM

11 STRATEGIC ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

11.1 Background

During the implementation of NIP and NIMP, for projects and sub-projects levels, funded through ASDP, an Environmental and Social Management Framework (ESMF) was prepared by MAFS which establishes a mechanism to determine and assess future potential environmental and social impacts of all program activities to be financed under ASDP, and then to set out mitigation, monitoring and institutional measures to be taken during implementation and operation of the program activities to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels, while at Policy (NIP) and Plan (NIMP) level a SEMMP is required based on the anticipated environmental and social impacts that might occur.

The development of SEMMP is based on the strategic elements of the six themes that include regulatory framework and institutional strengthening; financing mechanisms and funding support for irrigation development; land tenure and ownership rights; water resources development; development and management of irrigation schemes, and cross-cutting issues. The analysis of the legislative and institutional environments provided information on the institutional capacity of the DITS and the relevant GoT entities to undertake the proposed mitigation measures and entities legal mandate. A proposed Strategic Environmental Management and Monitoring Plan and estimated budget are presented in Tables 11-1.

11.2 Regulatory Framework and Institutional Strengthening for Irrigation Development

11.2.1 Key Institutions Involved in Planning and Approval of Irrigation Development

Effective development planning management and monitoring is essential for sustainable growth to be realized in any society. This is important in the context of all LGAs in Tanzania Mainland facing a limited natural resource base, inadequate capacity, and sensitive or fragile ecosystems. The implementation of NIP and NIMP must be managed in such a way that it ensures benefits to the local community for a long-term period. The existing problem of inadequate manpower, lack of a District Environmental Coordination Officer, and lack of a mechanism for effective coordination and management of the development of the irrigation services calls for institutional capacity-building for proper management of the impact associated with the implementation of NIP and NIMP and the subsequent activities associated with the implementation. Despite these weaknesses, several stakeholders are committed to making sure that negative impacts are minimized so that the benefits of the implementation are realized over a long period of time.

Amongst the broad categories of issues that have been identified as arising out of the NIP and NIMP, have a bearing on the legal aspects of this SESA are as follows;

- i. The regulatory framework: its scope, enforcement and compliance issues and the necessary legislative changes in support of irrigation development;
- ii. Land tenure issues: the nature of rights in land, demarcation of irrigated land, improvement of the institutional organization of irrigation schemes and legislative changes in support of irrigation development; and
- iii. Water resource management: the development of large scale water storage structures; inter-basin water transfers and regulation of use of groundwater

11.2.2 Planning Process

DITS is currently housed in the MAFC and is mandated by the parent Ministry to plan, involve local people or target groups and different stakeholders, approve plans, and undertake development activities under their jurisdiction. They are also entitled to outsource for technical support from the Central Government Ministries and from any other source provided they can pay for it. Undertaking certain activities that are not under their jurisdiction requires approval from the parent Ministry.

DTIS supports the LGAs through ZIUs. The role of the central government has changed from direct involvement in production and service delivery to that of policy formulation, coordination, and advice, strengthening the capacity of LGAs. Following this change, a system called Decentralization by Devolution of powers (D- by- D) was implemented from 1996 to 2000 as an enabling environment for LGAs to perform efficiently and effectively, including approving new projects. The central government reform program (1992–2002) created grant funds and planning guidelines, and criteria for LGA to qualify for funds. The guidelines that are issued by the central government emphasize a bottom-up approach, involving stakeholders in how they can forecast and plan for the coming years, while also facilitating the Government decision on Decentralization by Devolution Policy. The D- by- D approach is focusing on enabling LGA implement projects and activities that have been transferred to the districts from government Ministries, Departments, and Agencies (MDAs), for which funds are also transferred to LGAs.

11.2.3 Central Government Release of Irrigation Funds

The release of funds to LGAs is in quarterly instalments against quarterly reporting on costs and outputs. Fifty percent of funds allocated are aimed at facilitating participatory planning (PP) at the grassroots level using the O&OD methodology. The National Framework Guidelines on Participatory Planning poses important questions for directing the focus in planning, and encompasses ways for identification and involvement of vulnerable groups (marginalized members of the community). It raises questions that assess past efforts including an assessment of what has been done to empower vulnerable groups while considering geographical disparities and resource endowment. The guideline includes criteria for allocation of funds, where, for example, 80 percent of a Capital Development Grant (CDG) goes to poverty reduction areas (health, education, water supply and sanitation, roads and agriculture). Other funds earmarked from CDG are for capacity development.

The problem is that the central government does not lease funds in time and in any case funds allocated are not enough to complete the irrigation projects planned. Some funds are being misused by LGAs.

Recommendations for Planning Guidance

Sustained growth, poverty reduction, and improved social service provision are unlikely to occur in the absence of improvements in governance, including at the DITs and LGA levels. Although the Government of Tanzania is committed to allowing private sector and NGO/CBO involvement in economic development, many communities expect the government to provide effective economic and welfare support even the O and M. Thus, there is much scope for reflection of the facilitation role of the state vis-à-vis other players. There must be special programs to support capacity-building to DITS and LGAs development planning and management processes to ensure that any development meets the sustainability criteria.

11.2.4 Governance

Management of natural resources for sustainable development is also a governance issue. Policies that integrate nature (i.e., environmental management), wealth (i.e., economic

concerns) and power (i.e., good governance) tend to generate positive outcomes in all three areas. The power-wealth and environment nexus may resonate well in Tanzania if factors around environmental governance are addressed. Traditional concepts of governance meant a process of governing associated with government steering by regulations and sanctions. This concept has evolved over time to include the totality of mechanisms and instruments available for influencing change towards a desired direction. The mechanisms and instruments may include:

- i. Appropriate institutional set up for irrigation development
- ii. Information policies and instruments
- iii. Democratic opportunities to local resources users and managers to participate in decisions about the resources they use
- iv. Access, rights, and responsibilities over the resources.

Therefore, environmental governance that must be developed and practiced in all LGAs should ensure the following:

- i. Influencing achievement of environmental and natural resource management objectives (as set out in district, national, and international policies and laws);
- ii. Sharing of responsibilities, rights, costs, and benefits (i.e., equity issues) between local resource users, developers, managers, and the nation;
- iii. Generating and sustaining community, political, and financial support for wise use of natural resources (i.e., sustainability issues);
- iv. Promoting and enhancing transparency in decision-making;
- v. Stakeholders participating in environment and natural resource management;
- vi. Enforce accountability to the public;
- vii. Providing access to environment and natural resources and security of tenure.

Environmental governance is indeed an issue that revolves around how power relationships and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have a say in the management of natural resources and biodiversity. The NIP and NIMP implementation may stimulate agribusiness and other sectors of the economy in the LGAs. Improved environmental governance will ensure that the natural resource base is not impaired to the detriment of the intended growth and social development. Thus, apart from ensuring overall good governance, three key governance areas of concern in development planning identified among others during consultations that need to be addressed include:

Benefits to local communities: Large-scale developments, such as commercial irrigation, and other commercial activities, must ensure benefits to local people and effectively contribute to the overall socio-economic development of the LGA;

Capacity development: Both central and local government must strengthen the role of the people of LGAs in development planning and decision-making to redress the perception that any development, especially government projects and private investments, are being imposed from above through top-down approaches;

Strengthened Coordination: The Parent Ministries must strengthen the role of the LGAs and DITS in coordinating development planning and decisions and in mobilizing people and resources for long-term sustainable growth of the irrigation sector. Coordination between Districts, national-level plans and support program from NGOs and donors must be strengthened.

In order to address the above concerns and prepare the communities to cope with the anticipated accelerated irrigation growth, the following recommendations should form part of the broader district planning process.

Strengthen District Environmental Management Coordination Mechanism

The current situation of the LGAs needs improvement by establishing a coordinating mechanism for environmental management in the LGAs. The Environmental Management Act (Cap. 191) provides directives for coordination mechanism at the LGA level.

It is important to appoint a District Environmental Coordination Officer (DEC) who will be responsible for coordinating other departments and establishing a team in handling environmental matters in a cross-sectoral and multi-professional way.

The DEC is responsible for the following:

- i. Establishing a mechanism for implementation of the Environmental Management Act (Cap. 191) and associated guidelines;
- ii. Ensuring effective application of Environmental Impact Assessments, Environmental Audits and implementation of mitigation measures for all projects that qualify for such assessments;
- iii. Linking the District Council with the National Environment Management Council (NEMC), professional bodies, and village statutory committees responsible for environmental matters.

This should enable development of district specific environmental and socio-economic guidelines for development of the LGA resources. Guidelines needing immediate attention are those for land use development including tenure, and irrigation practices.

Develop LGA By-laws

Under the local Government reform, LGAs in Tanzania are required to develop their own by-laws to provide a legal framework in guiding development in the district. The process should be able to help in addressing key issues that are pertinent to the LGA in place. District by-laws are important in supporting and localizing national laws at the district level.

Strengthen the DITS and LGAs Finance Committees and Finance Department through Re-tooling and capacity building programmes

Decentralization by Devolution (D&D) essentially implies LGAs will have more resources from the Central Government and a greater mandate to mobilize and use financial resources to meet their needs. Councils could also make own choices when budgeting and levying

taxes. However, experience shows that D&D has not actually culminated in that level of decentralization. A financial audit study (CAG, Report 2007:95) by the National Controller and Auditor General in 124 Districts and Municipal Councils in Tanzania covering the financial year 2005/2006 has shown some financial defiance's in the LGAs.

Training needs assessment should be conducted and determine which personnel in the DITS and LGAs require what sort of training.

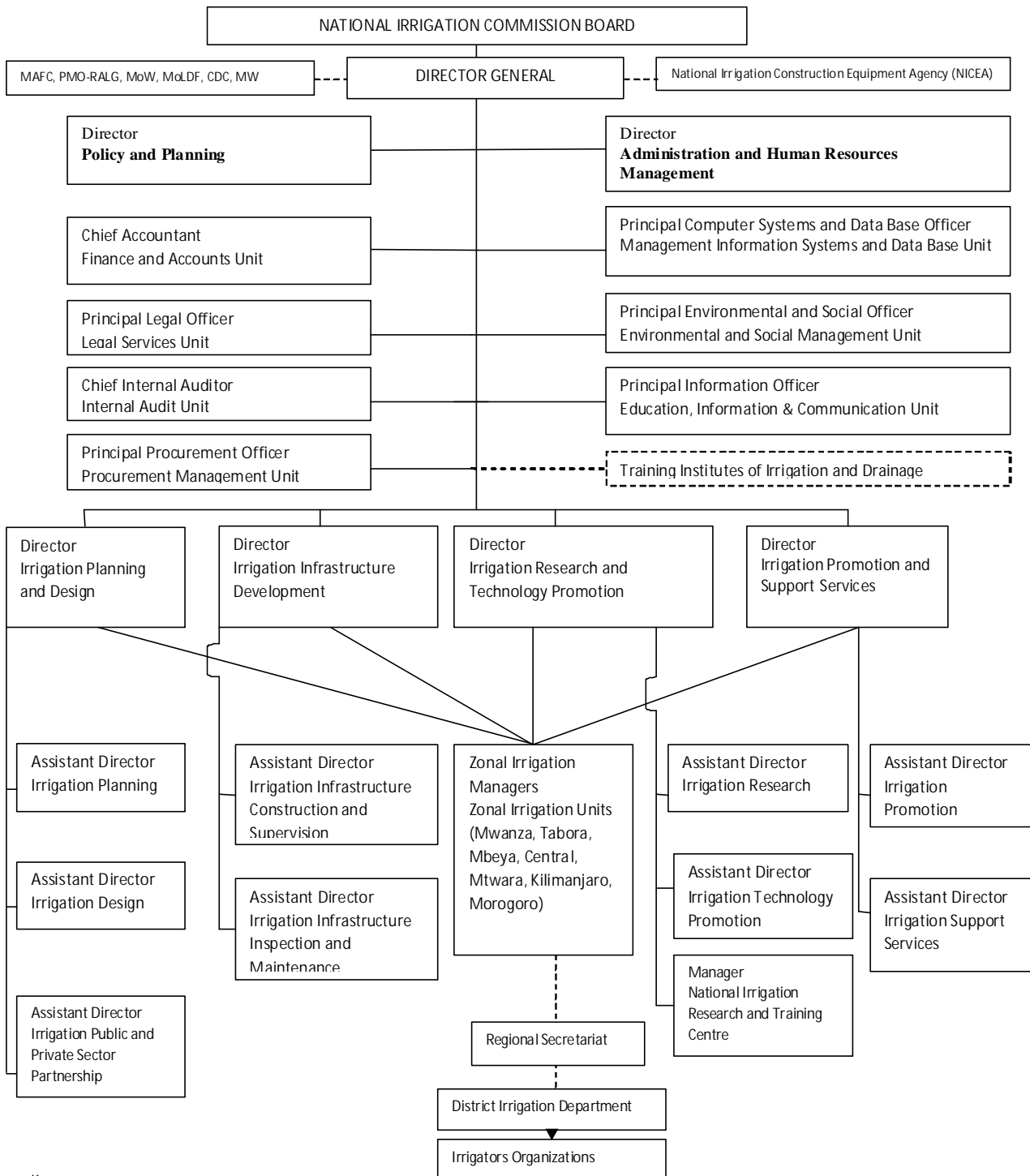
Strengthen DITS Institutional Arrangements

For irrigation issues to be tackled effectively, a semi-autonomous institution has to be in place. Ever since the irrigation unit was institutionalized, it had been moving from one Ministry to another, and of recent, in November 2011, it was moved back to the Ministry of Agriculture Food Security and Cooperatives from the Ministry of Water and Irrigation where it stayed for only 33 months. If the irrigation institution becomes autonomous it can perform its functions effectively and efficiently.

The SESA study looked into different forms (i.e. Commission, Agency or Authority). Of the three setup, a Commission is favorable as it can penetrate anywhere in the government system therefore enforcement of the irrigation laws/ by-laws and mode of operation can be easier. It will be responsible for Irrigation infrastructure, Development and Enforcement.

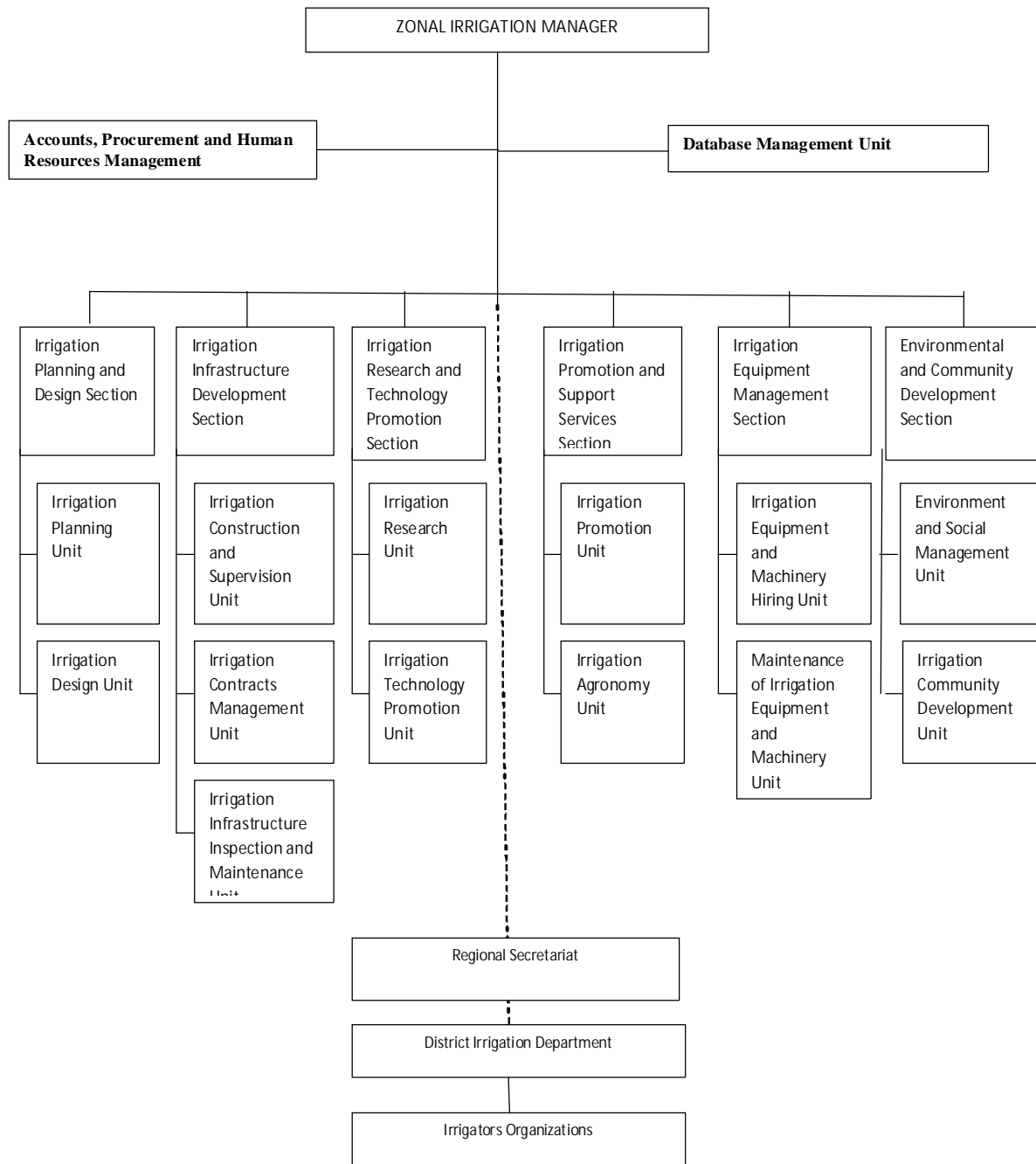
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In many cases, Agencies and Authorities are under the Permanent Secretary (PS) of the responsible Ministry and Ministerial Advisory Boards while a Commission is governed by a Commission Board which can be chaired by a Presidential Appointee and may not be necessarily under any Ministry. Commissions can access and manage funds without necessarily approval of the PS. After stakeholders consultations a more efficient organization structure is proposed as shown in Figure 11.1



- Key:**
- MAFC - Ministry of Agriculture Food Security and Cooperatives
 - PMO-RALG - Prime Minister's Office Region Administration and Local Government
 - MoW - Ministry of Water
 - MoLDF - Ministry of Livestock Development and Fisheries
 - MW - Ministry of Works
 - CDC - Cooperative Development Commission

Figure 11.1: Proposed Organization Structure of the National Irrigation Commission



NB:
Regional and District Irrigation Engineers will work in line with the D by D

Figure 11.1: Proposed Organization Structure of the Zonal Irrigation Units (continued)

11.3 Financing Mechanism and Funding Support for Irrigation Development

The major issues and concerns related to financing mechanism and funding support for irrigation development in Tanzania, as reported during the stakeholder consultations, include; inadequate funding and delays in disbursement of irrigation funds and limited access to micro-credits by farmers. In general, the requirements of funds for irrigation development have not been coinciding with the financing sources in terms of quantity and timeliness as inadequate and untimely disbursement has been a rule of thumb.

11.3.1 Financing Mechanism

Financing mechanisms and funding support for irrigation development should entail, among others, the establishment of an irrigation development fund and the provision of financial support (e.g. facilitating access to micro-credit schemes); and investing for irrigation development for all types of irrigation scheme. Experience has shown that during planning stage for development of irrigation schemes, activities related to studies, designs, preparation of tender documents and supervision of works are not adequately financed and this leads to ineffectiveness during project execution and low quality of work output.

Regarding access to micro finance by smallholders, evidence indicates a large information gap between financial service providers and rural smallholders. Smallholder farmers need a permanent access to financial services to finance investment and production costs in irrigation. Ideally, they would develop durable relationships with their financing institution to better manage the heterogeneity of lending needs. These requirements must be balanced with the overall objective of micro-credit and financial institutions to operate viably. Client orientation and knowledge of the irrigation sub-sector are preconditions for the successful entry into the market. Although smallholder farmers do not require a special product, range delivery channels and lending methodologies must be adopted, especially with regard to collateral requirements and repayment schedules.

A valuable alternative to standard financial products in reaching large numbers of smallholder farmers is the introduction of micro-leasing. Leveraged leasing is especially relevant to smallholder farmers that market their production on a regular and predictable base to capable marketing organizations. Wholesale lending to the private sector and community-based financial intermediaries is another option to reach a large number of smallholder farmers in a cost effective way. Furthermore, risk reducing measures such as tripartite arrangements and/or the use of micro-insurance (e.g. weather indexed micro-insurance in face of unreliable climatic conditions) need to be explored. A value chain approach is an important element of the overall strategy, by linking different actors at all levels.

The challenge is to take into account the special characteristics of financing smallholder irrigation development and to attend to a larger number of smallholder households without impairing the sustainability of rural financial intermediaries. Agricultural potential and the resulting economic activities vary significantly among different areas in the country. Rural outreach of financial institutions can be highly skewed towards the more productive agro-ecological zones. The coverage may strongly decrease with the economic potential of different zones. Agricultural potential, access to water sources, connectivity to road and communication infrastructure, and security of tenure are, in addition to an established market

demand, crucial elements for successful financial intermediation that can be found mainly in areas with higher agricultural potential. In such areas, it is recommended for increasing the outreach of financial services to concentrate on 'upgrading' or 'downscaling' promising institutions but also through 'green-fielding' if no institutions with potential are present.

The aim should be the availability of a range of viable financial institutions that serve smallholder farmers with a variety of financial services on a permanent base. However, sustainable irrigation development is only possible if farmers see economic incentives for intensifying their production. In this context, smallholder irrigation development should offer a wide range of interfaces where the mechanism of public-private-partnerships (PPP) can be usefully applied and can contribute to effective produce marketing, to smallholder irrigation technology development and distribution as well as to value chain development. In such a conducive environment the sustainable access to financial services will boost the abilities of rural smallholder farmers to invest into promising irrigation technologies, to increase incomes - and overall to escape poverty.

11.3.2 Monitoring and Evaluation of Outcomes

It is proposed in this report that the overall monitoring and evaluation of financing mechanism and funding support for irrigation be done using indicators of; the amount of funds allocated to irrigation development, number of farmers and Irrigation Organizations (IOs) accessing micro-credits, and number of accountants trained. These indicators should be monitored as part of the NIP and NIMP implementation process through quarterly and annual auditors' reports, internal reports, human resource development reports, and micro-credit and financial institution reports. These indicators may also be monitored through periodic Household Budget Surveys, Annual National Accounts, and National Sample Survey of Agriculture.

In addition, a rapid agricultural financing survey is proposed to be undertaken in 2011 and every second-year thereafter on a panel of farming/irrigating households to measure access, use and satisfaction of agricultural credits. Impact evaluation surveys should also be undertaken to determine impacts on productivity and farm income.

The monitoring system for LGAs should be built into the mechanism for accessing the irrigation funds. The LGAs should be externally and internally assessed annually against minimum access conditions, which include measures of transparency, accountability, and financial management; and subsequent performance measures of district agricultural planning, agricultural services and quality of investment.

For farmers to benefit from irrigation development, it is imperative to strengthen financial accounting, accountability and proper budgeting. All irrigation development projects should be subjected to joint regular implementation reviews and annual external financial and procurement audit reviews aimed at closely monitoring both financial and physical performance of the plans and irrigation activities. In addition, internal verification of irrigation development activities at each implementing unit should be carried out by their internal audit units. The linkage between physical output and financial outcomes should be strengthened including the Monitoring and Evaluation (M&E) functions in the Ministry of Agriculture Food Security and Cooperatives and LGAs. The motive should be to ensure that an effective mechanism for M&E is put in place, which will play an oversight role in ensuring that

irrigation funds are used for intended purposes and accountability and value of money is achieved. The financial performance of irrigation development activities should be reviewed periodically and follow up on the implementation of the recommendations arising from the audit reports should be made. There should be strong supervision and quality assurance, and a better follow-up of internal and external audit reports. Purposeful internal audit manuals should be developed for irrigation audit staff in LGAs and training on their application be done.

Furthermore, there is a need to strengthen farmers' access to Micro Credit and Finance Mechanism by establishing pro-poor schemes: The large information gap between financial service providers and rural smallholders can be reduced through a number of measures that will ultimately result in better financing options for smallholder farmers. First, financial institutions should be convinced that financing small scale farmers is an interesting business venture. Therefore, commercial banks, rural financial intermediaries, equipment or input suppliers as well as marketing organizations and processors may significantly increase their business activities if the high potential of irrigation are understood and a strategic choice is made to engage into smallholder lending. Second, rural smallholders should be better informed about the available financial services. This will ultimately lead to more informed choices and better use of financial resources in general. The information status of farmers can be improved by agricultural extension staff and should also be supported by financial institutions that find their entry point through better marketing and simple, customer-friendly procedures and financial products. A key strategy to address this is to support rural financial intermediaries in product development and marketing.

11.4 Land Tenure and Ownership Rights

In order for irrigation development to proceed at an accelerated rate envisaged under the NIP and NIMP, rights in land and their transfer must be given to individuals intending to invest in agriculture and agro-industries. There are concerns that lack of secured tenure to land; the complicated and long procedures involved when seeking to transfer rights of occupancy and centralized power to the few top government officials are not conducive to efficient development in the irrigation sector. To some extent, such arrangements hinder the availability of commercial loans for investments in agricultural production from financial institutions due to complications in processing of loans. Proper land tenure system will play an important role in establishing self-reliant and sustainable irrigation development.

Most of the cultivated areas in Tanzania belong to small-scale smallholder farmers who hold land through customary right of occupancy as compared to granted rights. Also ownership of land is determined by both pre-existing rights and the perceived capacity of the landowner to develop the land in question (URT, 1999). The status of customary rights is highly dependant on how the law will be administered. However, land administration procedures are not streamlined to the extent that the granting of title deeds is painstakingly slow. According to the Land Acquisition Act (LAA) of 1967 and its subsequent amendments of 1999, land required for any public purpose such as development of agricultural land or for use by any persons should be granted land for agricultural development (section 4 of the LAA). This Act outlines the procedures for the acquisition of land and the determination and payment of compensation for the land and any improvements on the land. Where alternative

land has been given in exchange for the acquired land, or where the land is land referred to in the Rural Farmlands (Acquisition and Re-grant) Act, Chapter 22 (which is essentially public land leased from or held on a grant based on contract), no compensation is payable for the land. Significant under this Act is the short period of notice (six weeks) within which persons occupying land that is acquired for a public purpose are required to vacate the land. Further, vacation of the land will be required whether compensation has or has not been paid. Promptness in the determination and payment of the compensation is not a requirement under this Act quite unlike the situation under the Land Act and the Village Land Act.

In agro-finances just as in any other lending situation, security is a necessity, therefore this situation discourages potential investors from investing into medium and large scale irrigated agriculture but also there is a chance of unfaithful investors to grab land from villagers without justifiable compensation. On the other hand, land earmarked or developed under irrigation has no protection against conversion into other uses.

During NIMP formulation, issues of land ownership were not considered as a criterion for delineation of potential irrigation area. It is likely that most of the identified irrigation potential areas are presently under individual or group ownership that may not be willing to resettle voluntarily. Therefore impacts due to resettlement from implementation of irrigation projects especially at large scale, may lead into social-economic and environmental risks due to impoverishment of people when they lose their productive assets or income sources. Furthermore people may be relocated to environments where their productive skills may be less applicable and the competition for resources increases; community institutions and social networks being weakened, kin groups being dispersed; and cultural identity, traditional authority, and the potential for mutual help being diminished. Therefore people should be appropriately compensated for their loss (of land, property or access) either in kind or in cash in accordance with the Land Act No.4 and Village Land Act No.5 of 1999 and regulations (S.179 of Land Act No. 4 of 1999. GN 78 published on 4/5/2001) procedures to ensure full, fair and prompt compensation while acquiring land from citizens.

Before allocating land to any use, the Land Use Planning Act (LUPA) of 2007 requires that land use plans that are prepared by the land use planning authorities at the national, district and village levels be adhered to in order to ensure national co-ordination and physical development within zonal land use frameworks. In any project investment, it is advisable to ensure inter and intra district and inter-sectoral co-ordination among lead agencies to enable coordinated physical development and systematic land use in each zone, region, district and village. To overcome the anticipated challenges during implementation of NIP and NIMP, proper strategic planning is vital. It is therefore recommended to:

- i. Promote voluntary resettlement and institute mechanisms for law and by-law enforcement;
- ii. Undertake land use planning in accordance to the Land Use Planning Act of 2007 and implement accordingly;

- iii. Ensure necessary and adequate compensation where necessary to avoid marginalization of people especially when it comes to large scale and/or private irrigation schemes;
- iv. Ensure well defined and equitable land ownership and rights to avoid land use conflicts;
- v. Ensure a balanced allocation of irrigation land between the different scales of irrigation categories (small-scale smallholder, medium scale and large scale) in order to ensure fair and equitable contribution to irrigation potential at all levels;
- vi. Provide training to Land Committees (already formed as per Land Act and Village Land Act) to take care of Land issues;
- vii. Discourage direct purchase of land by investors from customary or statutory landowners; instead encourage them to go into joint ventures using their land as their contribution to the investment or consult Tanzania Investment Center (TIC). This approach will be implementing MKURABITA strategy in Tanzania;
- viii. Ensure land plans are prepared a land use plan based on land capabilities and carrying capacity analyses indicating areas suitable for specific development as well as scales of such development and ensure compliance of the plans.

11.5 Water Resources Development

Water resources development is critical for the NIP and NIMP implementation and for determining limits of acceptable irrigation development. Nevertheless, water is becoming increasingly scarce locally with respect to the demands placed upon it, with no reliable and sustainable water resources for irrigation. The opportunity cost of Tanzania's raw water is increasing, especially in many of the areas considered to have irrigation development potential. According to URT (2002e), the current per capita renewable water resource is 89 cubic meters, or 2,700 cubic meters of water per person per year, however projections indicate that the annual average available water per capita will be reduced by 45 percent to about 1,500 cubic meters per person per year within the next few years making the country a water scarce. Therefore reliable and sustainable water resources development is imperative. The use of water for productive purposes which include irrigation is an essential requirement for poverty alleviation and food security. However, irrigation practices in Tanzania are characterised by low water use efficiency, low water productivity and absence of a mechanism for exercising socio-economic mobility of water and over dependency on surface water as a major source for irrigation development.

The National Water Policy (URT, 2002e) and the Water Resources Management Act (WRMA) (URT, 2009e) provide a framework for water management, development and allocation in the country. The policy aims at ensuring that beneficiaries participate fully in all stages of water resource development and calls for an Integrated Water Resource Management in Tanzania so that there is equitable and sustainable use and management of water resources for socio-economic development, and for maintenance of the environment. The policy recognizes the fundamental but intricate linkages between water and socio-economic development, including environmental requirements (environmental reserve). It expounds on the importance of water for domestic use, agriculture, livestock, mining, energy, fisheries, environment, human health, wildlife and tourism, forestry, navigation, and transboundary requirements. Although Tanzania has the largest water bodies in East Africa, the water supply in many parts of the country faces major problems. Allocation problems and

degradation of water resources through competing uses is hurting the economy and the environment and in many cases resulting into water use conflicts.

Irrigation being one of the water users has been in the centre of most water use conflicts amongst themselves and/or with other users. It is imperative that all water users which include farmers need to understand their obligations with regard to the use of water as stipulated under the National Water Policy and the Water Resources Management Act. Different water uses viz a viz irrigation, mining, livestock, fisheries, hydropower production, wildlife, domestic and industrial uses from a common source of water, if not well organised under a Water Users Organisation can easily be subjected to water use conflicts as a result of inequitable water allocations. Therefore, every developer needs to secure water abstraction rights before any utilization is undertaken and this is provided in the WRMA of 2009 and it is crucial in guiding irrigation development activities.

Climate change is evident and the adverse effects of climate change on the freshwater systems will aggravate the impacts of other stresses, such as population growth, changing economic activity, land-use change and urbanization. Water demand will grow in the coming decades, due to population growth, increased public water supply, and development of irrigation areas to ensure a degree of food security. Increased occurrence of floods and droughts will increase the uncertainty in agricultural production and make the variations in yield more severe.

The current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability, flood risk, health, agriculture, energy and aquatic ecosystems. In many locations, water management cannot satisfactorily cope even with current climate variability, so that large flood and drought damages occur. Climate change will have impact on the operation of existing water infrastructure, including drainage and irrigation systems, as well as on the design of future systems. Water management practices will have to be adjusted to cope with the changed water resources conditions. In the case of drought, water efficiency measures, including rainwater harvesting techniques will be imperative to reduce pressure on the resource while ensuring domestic and environmental flows. In the event of flood control, it is likely that large areas may get inundated by damming leading to the loss of farms, habitat for flora and fauna.

Water resources development is vital for successful implementation of NIP and NIMP. Such development should take into considerations the change in climate, the existing inefficient water use, environmental flow requirements and ecosystem sustainability. Considering the above, the following recommendations are provided:

- i. Develop other sources of water for irrigation such as ground water, rainwater harvesting and dams;
- ii. Conduct EIA for all developments and adhere to the EIA recommendations;
- iii. Promote and ensure Integrated Water Resources Management;
- iv. Conduct Environmental Flows Assessment and allocation;
- v. Improve stream flow monitoring;
- vi. Enhance early warning and disaster preparedness;
- vii. Promote water saving technologies; and
- viii. Promote drought resistance crops.

11.6 Development and Management of Irrigation Schemes

11.6.1 Development of Irrigation Schemes

Development of irrigation and drainage infrastructure is crucial for ensuring reliable availability of water in a sustainable way for higher crop production in a bid to enhance food security and poverty reduction. The irrigation potential as stipulated in the National Irrigation Master Plan (URT, 2002a) is 29.4 million hectares whereby 2.3 million hectares is of high potential, 4.8 million hectares is of medium potential and 22.3million hectares is of low potential. It has been observed that the identified irrigation potential has not been accurately and exhaustively mapped and demarcated. The development of infrastructure include improvement of Traditional Irrigation schemes, improvement of Rainwater Harvesting Irrigation Schemes, development of new Smallholder (small scale, medium and large) Irrigation Schemes, and development of new Commercial (small scale, medium and large) Irrigation Schemes.

The pace of developing irrigation and drainage infrastructure in Tanzania has been so low that only 331,490 hectares have been developed as of June 2010 which is only about 1% of the total potential. In the period from 2010 to 2025 a total of 450,000 hectares are expected to be developed for irrigation in line with the NIMP targets of developing 30,000 hectares per annum. This could bring up the cumulative developed area for irrigation in the country to 760,700 hectares by 2025 but the ability to do this is questionable due to the past experience. The NIMP therefore needs a review in order to take into account progress challenges and experiences during the first nine years of implementation and come out with new targets.

Although smallholder farmers may demand development of their irrigation schemes, they lack irrigation skills, and therefore, require substantial training in the overall development, operation and management techniques on irrigation interventions. The demand-driven based process for identification of new irrigation schemes therefore requires to be aligned with the identified irrigation potential with a target of crop diversification. Despite of good work for improving smallholder irrigation scheme, most of the Improved Rain Water Harvesting Irrigation Schemes are characterised by poor location of intake sites, ineffective abstraction structures, poorly constructed earthworks and serious catchment degradation. There is a need therefore to take conservation measures in the catchments (for both irrigation and rain water harvesting schemes) and to provide storage dams to ensure reliable water supply.

Some of existing commercial irrigation schemes including those established for the purpose of seed production are constrained with inadequate water supply, poor access roads and marketing facilities. Most of them face problems in accessing credit facilities for rehabilitation, remodelling or expansion. In most of the existing large scale commercial irrigation farms, the inhabitants in the vicinity are not provided with the existing opportunity of the neighbourhood as out-growers to benefit from the available facilities for irrigation technologies and other related services from those irrigation farms. Therefore, strategic measures should be undertaken through:

- i. Review NIMP, map and demarcate identified irrigation potentials area by considering water resources potentials for reliable water supply and land ownership status in addition to the former criteria;

- ii. Establish/ strengthen irrigation funding mechanism/ sources to support irrigation development in consideration of cost sharing and establish a mechanism that will attract the private sector investors and/ or progressive farmers;
- iii. Prepare a participatory rehabilitation, remodeling and upgrading plans which will ensure operation of the schemes at full capacity;
- iv. Undertake studies, designs, partial and/ or full development of the irrigation infrastructure for private sector participation through public private partnership (PPP) approach where appropriate;
- v. Carryout Environmental Impact Assessment/ Audit and review/ monitor the implementation of the Management Plans;
- vi. Apply IWRM principles during planning and Implementation of irrigation schemes; and
- vii. Establish appropriate out - growers models.

11.6.2 Management of Irrigation Schemes

Tangible benefits from irrigation development can be accrued if improvements in irrigation infrastructure go hand in hand with improvement in on farm irrigation and drainage water management, production practices and adoption of new technologies for irrigation. Most of the developed smallholder irrigation schemes have management problems characterized by weak and inefficient irrigators' organizations, inadequate adoptability by irrigators to appropriate technologies with higher water use efficiency, and inadequate skills on operation and maintenance, all these resulting into low water use efficiency as well as inadequate environmental consideration when planning and implementing the irrigation projects. It has also been observed during the study that appropriate technologies such as drip and sprinkler irrigation methods; ground water for irrigation and use of appropriate sources of energy (non conventional) such as wind mills, solar power and draught-animal power are not widely used in Tanzania.

Unclear ownership of irrigation infrastructure is prevailing in some irrigation schemes at different levels and has led to low irrigation efficiencies and poorly maintained irrigation infrastructure. Sense of ownership, commitment and responsibility levels in most of farmer managed smallholder irrigation schemes are very low and participatory approach techniques have to be applied in order to inculcate farmers' sense of ownership, commitment and responsibility for their irrigation schemes.

Despite the well elaborated importance of high crop production, productivity and profitability to the farmers in irrigated agriculture there is a little research undertaking in irrigation for ensuring proper planning, design, development, management and operation and maintenance of irrigation schemes. Consequently there are scanty appropriate recommendations that integrate water and other resources relevant to irrigated agriculture.

The available opportunity for crop diversification and intensification to maximize farm benefits is not adequately utilized in the development of new irrigation schemes. Most of the new potential areas are characterized by remoteness and difficulty in accessibility and

marketing facilities. Lack of primary infrastructure subject the area to require high initial capital investment costs. These being new areas for irrigation development, they lack land title deeds and water use permits and thus there is need for making arrangement for their acquisition by the targeted beneficiaries. The financial institutions available have difficult conditions and terms to facilitate credit to potential investors in irrigated agriculture.

The main environmental problems caused by poor management of irrigation schemes include inappropriate water use practices, soil degradation and inappropriate land use practices. Inappropriate water use practices and the resulting degradation threaten the sustainability of ecosystem, human health, food security and productivity and constrain investment in various social and economic sectors. Another fundamental problem is that inappropriate land use practices can result into accelerated run-off, reduced groundwater recharge, soil erosion and increased sediment transported by rivers and silt accumulation in reservoirs and irrigation systems. Therefore, for effective NIMP implementation and sustainable irrigation development, the following strategic measures are recommended:

- i. Provide training to both farmers and technical staff in the operation, maintenance and management of improved irrigation schemes;
- ii. Strengthen the capacity of irrigators' organizations for effective management of irrigation schemes e.g. in preparing constitutions and bylaws and their effective enforcement;
- iii. Institute a mechanism that will enable IOs to perform mandatory formal transactions on transfer of land from one farmer to another in an irrigation scheme whether on temporary or permanent basis for openness and transparency pertaining to the responsibility for operation and maintenance of the irrigation infrastructure;
- iv. Establish a mechanism for service providers in the private sector to provide services for management of irrigation infrastructure where farmers have demonstrated inadequate capacity; and
- v. Establish mechanism for linkage and coordination of all types of irrigation research by various stakeholders nationally and internationally and strengthen collaboration and networking with national and international irrigation based institutions such as UDSM, SUA, ATC, ICID, ARU, UDOM, IRRI, IWMI, IPTRID and INPIM for promoting irrigation technologies.

11.6.3 Implications of Irrigation Development on Environment

Irrigation if well implemented can lead to degradation of river catchments and riparian ecosystems including ecologically sensitive areas. Other negative environmental impacts include among others the loss of water sensitive species dependent on the riparian ecosystems, habitats fragmentation, loss of gene flow among populations, decline of wildlife populations to below minimum viable levels and local extinction of sensitive flora and fauna. As accentuated in the NIP (2010a), the impacts may result right from the initial stage of construction, rehabilitation activities or from crop cultivation and irrigation practices. They can affect water quality, water quantity, sanitation and erosion and thus create water use conflicts through reduction in downstream water flows which sometimes neglect consideration of environmental flows. Furthermore little consideration which has been given

to water sources conservation and catchment management has negative impacts on water availability to downstream users.

Inappropriate water use practices and the resulting degradation threaten the sustainability of ecosystem, human health, food security and productivity; and constrain investment in various social and economic sectors. Another fundamental problem is that inappropriate land use practices can result into accelerated run-off, reduced groundwater recharge, soil erosion and increased sediment transported by rivers and silt accumulation in reservoirs and irrigation systems. On the other hand, environmental issues can cause negative impacts on irrigation interventions. These include global warming and climate change which disturb the trend of hydrological cycle resulting into either heavy rainfalls or less or no rains which leads to floods or drought respectively. The consequences of these events are destruction of irrigation infrastructure due to floods or reduction of river flows for irrigation purposes due to drought. More seriously, there is no compensation provision in cases where natural disasters occur and affect irrigation infrastructures and crops. It is therefore imperative that laws governing the environment (EMA, 2004b) and many other regulations and standards for management of riparian buffers and ecologically sensitive areas are adhered to so as to mitigate the possible environmental effects.

11.7 Cross-cutting Issues

11.7.1 Gender Equity and Irrigation Development

Women play major roles in rural economic development especially in developing and practicing irrigated agriculture but are hampered by low level of social status in the community, illiteracy, low entrepreneur skills, inadequate access to productive resources and services. Gender inequality is one of the underlying causes of low productivity, low human resource utilization, and deprivation of human rights, and these might have implications on the implementation of NIP and NIMP. The National Strategy for Gender Development (URT, 2005b), the country's Constitution, and the poverty reduction strategy promote gender equality and equity. The National Strategy for Gender Development on the other hand provides mechanisms for gender mainstreaming from the national to grassroots level in line with national and international gender policies and programs. Tanzania has formulated several gender-related policies and is also implementing several international gender-related policies and programs. Some of these include the Women and Gender Policy (2000), Vision 2025, National Strategy for Growth and Reduction of Poverty (NSGRP) (URT, 2005a), and the National Plan for Action for the Prevention and Eradication of Violence against Women and Children for 2001-2015 (2001).

Furthermore, the Millennium Declaration and Millennium Development Goals (2000) and the Beijing Declaration and the Platform for Action (1995), the SADC Declaration on Gender and Development aimed at elimination of Gender Based Violence (GBV) against women and children and the East African Community (EAC) Treaty (1998) all address gender inequities. Despite these many efforts, gender imbalances still exist in the country (TGNP, 2007; URT MKUKUTA Monitoring, 2007d). The concept of equity access to water or irrigated lands and decision making is a challenge which has to be addressed. Therefore there is a need to promote gender mainstreaming programme in the irrigation sector.

11.7.2 Public Health and Safety

Public health and safety considerations are vital in the implementation of NIP and NIMP and are to be addressed when planning for irrigation investments. Economic opportunities that may emerge because of the expansion in irrigation schemes will stimulate increased numbers of employees in the irrigated areas and influx of seasonal workers and crop traders. HIV/AIDS, water associated diseases are likely to increase because of expanded human interactions. There is also a danger of increased flood risk especially where drainage provisions are inadequate. Proper planning is instrumental to overcome the expected impacts. It therefore recommended that irrigation projects should have programs to prevent HIV/AIDS at workplaces during project implementation. Such programmes should be implemented in collaboration with District Health Office and TACAIDS. It is also recommended to implement water and sanitation measures to prevent the spread of water associated diseases as well as improvement in safety measures during irrigation operations.

Table 11-1: Strategic Environmental Management and Monitoring Plan for NIMP and NIP

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
Regulatory Framework and Institutional Strengthening										
1	Unclear institutional setup and line of command in irrigation services provision	<ul style="list-style-type: none"> Unproductive and marginalized irrigation development 	Create and develop and institutional set up for irrigation development	A well functioning institutional setup established and working	<ul style="list-style-type: none"> Established Bill Government Gazette 	Once	GoT MAFC	GoT, ASDP, development partners	2012 to 2017	30,000
2	Insufficient human resources at all levels and low capacity in managing irrigation development	<ul style="list-style-type: none"> Increase in substandard and inefficient irrigation schemes Moral erosion and overstressing the existing staff Delayed implementation 	Recruit and institute capacity building programmes for irrigation and environmental related human resources	<ul style="list-style-type: none"> No. of staff recruited and trained, & with furnished office No. of vehicles procured No. of inservice staff trained No. of retooling training and outreach conducted 	Human resources development report	Annually	Ministry responsible for irrigation	GoT	2012 to 2022	26,123
3	NIMP and NIP are not well understood at the Zonal and District levels	Low implementation of NIP and NIMP	<ul style="list-style-type: none"> Conduct awareness campaigns on the significance of NIMP and NIP in relation to irrigation 	<ul style="list-style-type: none"> No. of campaigns conducted No. of ToT conducted 	DITS reports	Annually	DITS	GoT	2012	100

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
			development in Tanzania • Training of Trainers on NIMP and NIP							
4	Insufficient local qualified contractors to construct irrigation infrastructures	<ul style="list-style-type: none"> • Delayed production and hence impacting the local livelihoods • Increase in substandard and inefficient irrigation schemes 	Established long term capacity building to local contractors constructing Irrigation schemes	<ul style="list-style-type: none"> • Tailor made capacity building programme for contractors developed and implemented • No. of trained local contractors 	DITS annual reports	Annually	DITS Universities	GoT Development partners	2012 to 2017	
5	Inadequacy of well established Irrigator Organizations (IOs)	<ul style="list-style-type: none"> • Poor O&M • Loss of livelihood, water productivity and increase in water use conflicts 	<ul style="list-style-type: none"> • Facilitate the establishment and strengthening of IOs • Promote and ensure use of O&M guidelines by farmers and extension workers 	<ul style="list-style-type: none"> • No. of registered IOs • Amount set aside for O&M • No. of operational schemes 	ZIU report LGA report IOs register	Annually	DITS LGA	GoT	2012 to 2017	150
6	Inadequate incentives for the private sector to participate in irrigation	<ul style="list-style-type: none"> • Few private investor in irrigation sector • Increased burden to the government 	Promote, build confidence and provide incentives for engagement of the potential private sector to participate in irrigation	No. of investors in irrigation	TIC Report DITS report	Annually	DITS TIC	GoT	2012 to 2017	275

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
7	Inefficient marketing systems for agricultural products	Deterioration of livelihood of small farmers	Strengthen and empower smallholder marketing associations and build their capacity to manage the entire production and marketing chain	<ul style="list-style-type: none"> No. of small holder marketing associations established and trained No. of training conducted 	Association registration Reports	Annually	MAFC	GOT	2012 to 2017	300
Financing Mechanism and funding support for Irrigation Development										
8	Inadequate funding and delays in disbursement	Retarded growth in irrigation development	<ul style="list-style-type: none"> Strengthen financial accounting, accountability and proper budgeting Funds to be disbursed according to agreed critical path 	<ul style="list-style-type: none"> No. of trained accountants Amount of funds allocated 	Auditors reports Internal reports Human resources dev reports	Quarterly	LGAs Responsible Ministry	GOT Development Partners	2012 to 2017	
9	Inadequate access to micro-credits by farmers	Deterioration in livelihoods of small farmers and poverty reduction efforts are undermined.	Strengthen farmers' access to Micro Credit and Finance Mechanism by establishing schemes specific	No. of farmers /IOs with access to credits	Reports of microcredit and financial Institution report	Annually	Responsible ministry	GOT	2012 to 2017	
Land tenure and ownership rights										

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
10	Non compliance to the resettlement plans	Deterioration of livelihoods of resettled households	Promote voluntary resettlement and institute mechanisms for laws and by-law enforcement	<ul style="list-style-type: none"> No. of people voluntarily resettled No. of registered victims 	LGA reports	Annually	LGAs	Development partners	2012 to 2017	
11	Inadequate land use planning	<ul style="list-style-type: none"> Degradation, misuse, and waste of productive land resources Loss of opportunities for economic and social development. 	Undertake land use planning and enforce the plans accordingly	Prepared and approved land-use plans according to carrying capacity	Land use planning reports	Annually	GoT	Responsible Ministry National Land-use planning commission	2012 to 2017	35,000
12	Imbalance in allocation of irrigation land between different scales of irrigation categories	Conflict of access and usage	Reallocate irrigation land equitably between the different scales of irrigation categories	Reallocation plans developed and agreed upon	Annual Reports	Annually	DITS, LGAs	GoT	2012 to 2017	
13	Default and land grabbing	Poor land compensation	Discourage direct purchase of land by investors from customary or statutory landowners; instead encourage	No. of reported cases	Annual reports	Annually	DITS, LGAs	GoT	2012 to 2017	

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
			them to go into joint ventures using their land as their contribution to the investment							
14	Limited understanding of land governing policies, laws and regulations	<ul style="list-style-type: none"> Conflict among users Land degradation 	Provide training to Land Committees	No. of training conducted	LGAs reports	Annually	LGAs	GoT	2012 to 2017	150
Water Resources Development										
15	Inadequacy of reliable and sustainable surface water resources for irrigation	Low farm productivity, low income and retarded economic growth	Develop other sources of water for irrigation such as ground water, rainwater harvesting and dams	No. of developed water sources	Engineers reports	Annually	ZIU, DITs	GoT Development partners	2012 to 2022	500,000
16	Loss of farms, habitat for flora and fauna as a result of clearing and inundation for damming	Low agricultural production, low income and retardation in economic growth and Biodiversity decline	Conduct EIA for all developments and adhere to the EIA recommendations	No. of flora and fauna species lost	Field report	Annually	LGAs Universities	GoT	2012 to 2022	
17	Reduction in environmental Flows and its Implications on	Loss of wildlife habitats and biodiversity	<ul style="list-style-type: none"> Promote and ensure Integrated Water Resources Management 	<ul style="list-style-type: none"> Percent change in the number observed bio-indicators 	BWO reports	Seasonal	BWOs	GoT Development	2012 to 2022	4,500

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
	aquatic and water sensitive biodiversity and wildlife Habitats		<ul style="list-style-type: none"> Conduct Environmental Flows Assessment and allocation Conduct stream flow monitoring 	<ul style="list-style-type: none"> Percentage change in area of vegetated riparian zones that receive periodic inundation Quantity of discharge in the river 		Seasonal Daily		partners		
18	Uncertainty of water supplies due to Climate change	<ul style="list-style-type: none"> Crop failure and Increased food insecurity Loss of livelihood Deprived ecosystem services Increase in maintenance cost 	<ul style="list-style-type: none"> Enhance early warning and disaster preparedness Promoting water saving technologies Promote drought resistance crops 	<ul style="list-style-type: none"> No. of established weather monitoring stations % of farmers using weather forecast information % of farmers adopting water saving technologies % of farmers adopting drought resistance crops 	TMA reports LGAs reports	Daily/ Monthly/ Annually	TMA Ministry responsible for Agriculture LGAs	GoT	2012 to 2017	2,000
Development and Management of Irrigation Schemes										
19	Uncoordinated water uses within	Conflicts over water	Apply IWRM	• No. of recorded	• WUA reports	Annually	WUA	WBO	2012 to	

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
	irrigation schemes and between upstream and downstream users	uses	principles	conflicts <ul style="list-style-type: none"> No. of Basins with IWRM Plans 	<ul style="list-style-type: none"> MoW Reports 		BWO GOT		2017	
20	Inadequate research and development in irrigation sector including linkage and coordination among stakeholders	Low farm productivity, low income and retarded economic growth	<ul style="list-style-type: none"> Promote and ensure adequate research and development (R&D) in irrigation Ensure technology transfer to farmers Establish mechanism for linkage and coordination of all types of irrigation research by various stakeholders 	<ul style="list-style-type: none"> No. of applied research and technology developed in irrigation and transferred to farmers % of farmers adopting the technology Established coordination unit 	<ul style="list-style-type: none"> DITS report Published research report 	Annually	DITS Research Institutions	GoT	2012 to 2022	14,883
21	Defficient criteria for establishment of irrigation potential areas in the NIMP	<ul style="list-style-type: none"> Wrongly quoted irrigation potential areas Loss of investment planning 	Review NIMP, map and demarcate identified irrigation potentials area by considering water resources potentials for reliable water supply and land ownership status in addition to the	Updated NIMP	NIMP report	Once	DITS	GoT	2012 to 2013	4,000

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
			former criteria							
22	Issuance of water use permits which does not conform to available water	<ul style="list-style-type: none"> Reduced environmental flows Degradation of aquatic biodiversity Conflict over water use 	<ul style="list-style-type: none"> Conduct water demand assessment and inventory of water users and permits Assess the response of aquatic biodiversity to flow regimes 	Established quantities of water demand per sector	BWO report	Annually	Ministry responsible for water Research Institutions	GoT	2012 to 2017	
23	Immigration of people into irrigation schemes	<ul style="list-style-type: none"> changes in local traditional and cultural behaviour spread of sexually transmitted 	undertake awareness campaigns	<ul style="list-style-type: none"> No. of conducted awareness campaigns No. of incidences 	LGAs DFT reports	Annually	LGAs	GoT	2012 to 2017	150
24	Inadequate farm management, Operation and Maintenance (O&M) skills	Low agricultural productivity, low income and retardation in economic growth	Provide extension services and training on O&M guidelines	<ul style="list-style-type: none"> Farm productivity No. of IOs trained in O&M 	<ul style="list-style-type: none"> LGAs training reports LGA agricultural reports 	Annually	LGAs Responsible Ministry	GoT	2012 to 2017	500
25	Ineffective monitoring and evaluation system of irrigation	Poor performance of irrigation schemes	Provide effective mechanism to monitor both financial and physical	<ul style="list-style-type: none"> No. of irrigation schemes performing well complying to 	Monitoring and evaluation reports	Quarterly and annual reports	LGAs Responsible Ministry	GoT	2012 to 2017	

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
	schemes		performance of the irrigation schemes	designs • Economic rate of return						
26	Inadequate compliance to irrigation scheme development guidelines	Unsustainable irrigation development	Strengthen the District capacity to use the irrigation development guidelines and set a monitoring mechanism to assure compliance	No. of developed schemes complying to guidelines	DIT/Zonal Irrigation Units Reports	Quarterly and annual reports	DITS	GoT	2012 to 2017	
27	Exploitation of child labour in the irrigation schemes	Decline in and primary school enrolment and hence increase in illiteracy	Ensure that Child Labour Regulations and local by-laws are adhered to	• No. of children working in schemes • Scholl Enroll rates	LGA education report Attendance registers	Annually	LGAs	GoT	2012 to 2017	
28	Human-Wildlife conflicts	Low production and reduced revenues	Provide movement corridors for wild game and control wild animal straying and destroying crops	No. of movement corridor established			LGA Game officers	GoT	2012 to 2017	
29	Vandalism of irrigation infrastructures, border raids and boundary disputes	Social instability and retarded economic growth	Empower IOs and conduct sensitization campaign to create a sense of ownerships of irrigation	• No of sensitization campaigns • No. of vandalized schemes	LGAs and ZIU reports	Annually	LGAs DITS	GoT	2012 to 2017	

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
			infrastructure							
30	Non compliance to design and construction standards of irrigation schemes (inadequate farm roads and crossing structures)	Loss of crops, injury to people/animals, and destruction of irrigation infrastructure	Enforce adherence to design and construction standards of irrigation schemes	No. of irrigation schemes adhering to standards	As built drawing Project Completion report	Annually	LGAs DITS	GoT Development partner	2012 to 2017	
31	Sedimentation from catchment and within irrigation schemes	<ul style="list-style-type: none"> Increased sedimentation in canals and rivers Loss of arable land and low crop productivity Reduced storage capacity of reservoirs 	Promote soil and water conservation measures	<ul style="list-style-type: none"> Sediment load in canal, rivers and reservoirs Presence of stable river banks Intact riparian zones Absence of large-scale erosion denuding landscapes Absence of excessive fine-scale sediment deposition in river channel 	Laboratory reports Field reports	Quarterly	BWO	GoT	2012 to 2022	500

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
32	Increased soil salinity and water pollution	<ul style="list-style-type: none"> Loss of arable land and low crop productivity Deteriorated quality of the river flow from return flows 	<ul style="list-style-type: none"> Adhere to irrigation water quality standards and guidelines for irrigation water management Regulate fertilizer and agrochemical application 	<ul style="list-style-type: none"> Salinity levels in irrigation water Water quality parameters complying to Tanzania and WHO water quality standards 	<p>Laboratory reports</p> <p>Field report</p>	Quarterly	BWO	GoT	2012 to 2017	
33	Flood damages resulting from inadequate drainage in irrigation systems	<ul style="list-style-type: none"> Increased maintenance costs Loss of crops, Injury to people and animals 	<ul style="list-style-type: none"> Adherence to design, construction and management standards of irrigation schemes Ensure safety measures for flood control and other natural disasters 	No. of inundated structures, damaged farms and displaced people	LGA reports	Annually	LGA PMO	GoT Development partners	2012 to 2017	
34	Poor on-farm water management	<ul style="list-style-type: none"> Water flow reduction downstream Adverse effects on the ecosystem water use conflicts among the users 	Promote and ensure use of irrigation water management guidelines by farmers and extension workers	<ul style="list-style-type: none"> Water use efficiency Crop water productivity 	<p>DIT& ZIU reports</p> <p>LGA irrigation report</p>	Quarterly	DIT& ZIU LGAs	GoT	2012 to 2017	
35	Pollution of land and water bodies	<ul style="list-style-type: none"> Human and natural 	<ul style="list-style-type: none"> Proper use of fertilizers (type, 	<ul style="list-style-type: none"> Measured levels of applied 	Laboratory and	Twice a year	ZIU	GoT	2012 to	150

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
	due to fertilizers, pesticides and agrochemical utilization	ecosystem health impairment <ul style="list-style-type: none"> • Mortality or morbidity of flora and fauna, • Bioaccumulation of toxic substances 	amount, and frequency of application) to avoid excessive use <ul style="list-style-type: none"> • Proper application (type and amount) of other agrochemicals to avoid excessive use • Prepare guidelines for use by farmers in the management of pesticides 	fertilizers, pesticides and agrochemicals <ul style="list-style-type: none"> • Guidelines prepared and used by farmers 	field reports Research reports	Annually	LGAs, Research Institutions		2017	
36	Degradation of River Catchments and Riparian Ecosystems including ecologically sensitive areas	<ul style="list-style-type: none"> • Loss of water sensitive species dependent on the riparian ecosystems • Habitats fragmentation, • Loss of gene flow among populations • Decline of wildlife populations to below minimum viable levels • Local extinction of sensitive flora and 	<ul style="list-style-type: none"> • Adherence to Regulations and Standards for Management of Riparian Buffers and ecologically sensitive areas 	<ul style="list-style-type: none"> • Species composition • No. of rivers with clearly demarcated buffer zones • No. of protected areas 	LGA reports	Annually	LGA Ministry responsible for environment	GoT	2012 to 2017	

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
		fauna								
37	Blockage of fish movement and consequent interference with Fish Migration and Breeding	Physical barriers to fish and other aquatic organisms movement affecting fish migratory behavior	Plan and Construction of fish bridges after assessing fish species composition, abundance, patterns of movement and breeding behavior	No. of irrigation schemes with fish ladders	As built drawing Project Completion report	Once during construction	DIT, ZIU	GoT	2012 to 2017	
38	Single resource management approach on irrigation scheme planning	<ul style="list-style-type: none"> Conflicts in resource uses Unbalanced resources utilization/ exploitation 	Promote and ensure Integrated Resource Planning and Management	<ul style="list-style-type: none"> No. of water basins implementing Integrated Resource Planning and Management 	Basin Integrated Water resources management plans	Annually	BWO	GoT	2012 to 2017	
Cross-cutting										
39	Increase in HIV/Aids incidences in the irrigation schemes	<ul style="list-style-type: none"> Reduction of labour force in agriculture production. Increase in orphans and street children 	<ul style="list-style-type: none"> Awareness campaigns on behaviour change Provision of ARV for affected 	<ul style="list-style-type: none"> No. of campaigns conducted Regional preference indices 	LGAs / TACAIDS reports	Annually	LGA TACAIDS	GoT Development partners	2012 to 2022	400
40	Expansion of irrigation schemes does not match to the health and	<ul style="list-style-type: none"> Deterioration of community health 	Expansion of irrigation schemes to go hand in hand with the construction of	<ul style="list-style-type: none"> No. of schemes with sanitation facilities Reported 	LGA reports	Annually	Ministry responsible for health	GoT	2012 to 2017	

S/N	Issues and concerns	Impact	Mitigation Measures	Monitoring indicators	Means of verification	Monitoring Frequency	Responsible Institution	Possible Source of Funding	Time Frame	Estimated monitoring Costs (Tshs mill.)
	sanitation infrastructure		health and sanitation facilities	diseases outbreak						
41	Inequitable sharing of irrigation benefits (gender inequality)	Increased gender inequality in-terms of decision making, income and empowerment	Promote gender mainstreaming programme in the irrigation sector	<ul style="list-style-type: none"> No. of established gender mainstreaming programme No. of women owning land 	National sample survey of agriculture Village reports	5 years	NHBS Village Government LGA	GoT	2012 to 2017	

12 CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

This SESA work concludes that implementing the NIP and NIMP on the Tanzanian mainland will have both potential positive and potential negative impacts. Tanzanian agriculture mainly relies on rain, and suffers from the inadequacy, seasonality, and unreliability of rainfall. Thus, crop yields are generally low, and although irrigation is considered necessary to mitigate climate constraints and to stabilize agricultural production and ensure local food security, its systems have not been extensively developed.

Although the local Governments (District Council) and Zonal Irrigation Units are the main custodian of all irrigation development plans within the district, it has been noted that most Districts and Zones have inadequate capacity to effectively prepare and implement integrated plans. Some of the main limiting factors include inadequate manpower, inadequate capacity to coordinate and mainstream environmental issues into the district plans as directed by Environmental Management Act (Cap. 191). Other limiting factors include poor harmonization of plans between local and central government, poverty, which is putting more pressure on the unsustainable use of natural resources.

In most areas, agriculture has limited production due to poor farming technologies and inadequate sufficient water to practice irrigation farming. Modern small to large scale irrigation is an upcoming economic activity, involving several privately owned schemes, especially in the Moshi, Arusha and Mbeya areas where large irrigation schemes are already found.

Implementation of the NIP's policy statements to encourage and foster private sector development and ownership of irrigation schemes, preferably in partnership with smallholder farmers will stimulate further private investor in irrigation. This increased irrigation development may increase demand for large scale land holdings, increased food production, increased growth of the service sector that will benefit the local people and local economy.

Furthermore, implementation of the NIP strategy statements on developing irrigation within the existing Basin Water Office framework of water use permit regulations will minimize conflicts.

Irrigation development activities may also trigger potential negative impacts such as, increasing pollution (from solid and liquid waste), increasing demand on fixed or declining water supplies, and degradation of land and other natural resources.

Other potential negative impacts may be the introduction of new cultures and behaviors, increased competition for resources, increased social tension and conflict over access to resources and to their unsustainable use. Other possible impacts include increasing exposure to HIV/AIDS, either from emigrants or from increased incomes and the concomitant increased access to prostitutes. With increased populations and incomes, there will increased stresses on social services. Other additional effects could be an increase in the vulnerability of the Project Affected Parties (PAPs) which will be exacerbated by the protected land for irrigation

Livelihood strategies can be improved and diversified if the proposed mitigation measures put in place are implemented effectively. In the long term, such changes could influence positive livelihood outcomes. In light of the insufficient institutional and human resource capacity to provide the necessary coordination and guidance for development, the socio-economic and ecological sustainability of irrigation development is highly questionable without heavy investment by the central government in supporting key planning initiatives and activities. The Central Government therefore must set as a priority for institutional strengthening (transforming

DITS into an autonomous Commission), and provision of technical and financial support to the proposed recommendations.

Overall, the analysis of NIP suggests that the key policy statements that require immediate attention include to:

- i. Establish an effective institutional set up and coordination mechanism for the irrigation sector;
- ii. Ensure accurate assessment on the quantity, quality and location, and advocate the use of ground water potential in all nine river basins for irrigation purposes;
- iii. Ensure that irrigation staff are provided with appropriate training on short and long term basis; and provide capacity building for irrigators organizations;
- iv. Ensure adequate number of qualified staff at all levels are available to oversee irrigation development in Tanzania;
- v. Ensure that awareness is created among irrigators on their roles and responsibilities in initiation, implementation and management of their irrigation schemes; and
- vi. Undertake mapping and demarcation of the potential land for new irrigation schemes development: *the need to review NIMP*.

12.2 Recommendations

The implementation of NIP and NIMP is likely to cause significant changes in the way resources are utilized. It is therefore important to undertake comprehensive planning in order to determine various resource uses and ensure their conservation. Based on the six strategic themes, specific recommendations are made.

Recommendation on Regulatory Framework and Institutional Strengthening

Managing the potential impacts associated with the implementation of NIP and NIMP and their associated economic activities requires improvement in governance – in the administration and management of their responsibilities for administering the natural resources within their local areas.

The institution responsible for irrigation must ensure effective irrigation development and management and enhance accountability, transparency in decision making, and in promoting the rule of law. For effective implementation of NIP and NIMP, the following are recommended:

- i. Create and develop institutional set up for irrigation development;
- ii. Recruit and institute capacity building programmes for irrigation and environmental related human resources;
- iii. Conduct awareness campaigns on the significance of NIMP and NIP in relation to irrigation development in Tanzania;
- iv. Training of Trainers on NIMP and NIP;

- v. Established long term capacity building to local contractors constructing Irrigation schemes;
- vi. Facilitate the establishment and strengthening of IOs and WUAs;
- vii. Promote and ensure use of O&M guidelines by farmers and extension workers;
- viii. Promote, build confidence and provide incentives for engagement of the potential private sector to participate in irrigation;
- ix. Strengthen and empower smallholder marketing associations and build their capacity to manage the entire production and marketing chain;
- x. The DDCA has to ensure effective coordination of the construction of dams and boreholes; carry-out soil investigations for various purposes, and conduct Environmental Impact Assessments (EIA);
- xi. At zonal levels all the Technical personnel has to be in place (Engineer, Sociologist, environmentalist, Land surveyor, Soil scientist, Economist, and Agronomist); and
- xii. DITS in collaboration with relevant NGOs should sensitize communities and prepare them well in advance to take advantage of the opportunities provided by irrigation and the subsequent potential economic activities it provides to the people.

The Local Governments must ensure effective management of the duties and responsibilities in collaboration with DITS. Specific to the issue of governance, the LGAs must undertake the following measures:

- i. Establish and strengthen the District/Municipal/Town Environmental Officer in all LGAs who coordinates all environmental issues in the District plans, and between the Local Government and Central Government;
- ii. Establish and enforce by-laws that protect the environment. By-laws should be developed in collaboration with local communities;
- iii. Enact legislation to establish and fund the office of District Irrigation Engineer;
- iv. Establish mechanisms that will ensure greater participation of local people in planning and decision making on issues that affect their livelihoods;
- v. Social, cultural, institutional and financial barriers must be addressed at all levels.
- vi. Finance Programmes that will enhance farm management skills by farmers (train and sensitize farmers to adopt good agricultural practices via the establishment and strengthening of Farmers Field Schools and other farmers outreach and extension methods);
- vii. Provide extension and training services that are capable of increasing the ability of irrigators to operate and maintain their schemes

For the above issues to be tackled effectively, a semi-autonomous institution has to be in place. Ever since the irrigation unit was institutionalized, it had been moving from one Ministry to another, and of recent, in November 2011, it was moved back to the Ministry of Agriculture Food Security and Cooperatives from the Ministry of Water and Irrigation where it stayed for only 33 months. If the irrigation institution becomes autonomous it can perform its functions effectively and efficiently.

The SESA study looked into different forms: Commission, Agency or Authority. Of the three setup, a Commission is favorable as it can penetrate anywhere in the government system therefore enforcement of the irrigation laws/ by-laws and mode of operation can be easier. It will be responsible for Irrigation infrastructure, Development and Enforcement.

In many cases, Agencies and Authorities are under the Permanent Secretary (PS) of the responsible Ministry and Ministerial Advisory Boards while a Commission is governed by a Commission Board which can be chaired by a Presidential Appointee and may not be necessarily under any Ministry. Commissions can access and manage funds without necessarily approval of the PS. After stakeholders consultations a more efficient organization structure is proposed.

Recommendation on Financing Mechanism and funding support for Irrigation Development

The institution responsible for irrigation, including LGAs has to ensure effective irrigation development and management through enhancement in financial accounting, accountability and budgeting. It is therefore recommended to:

- i. Strengthen financial accounting, accountability and proper budgeting and undertake targeted Capacity Development programme (e.g. to the District Planning Department, Finance Committee and Finance Department) to prepare and manage plans and resources effectively);
- ii. Disburse funds according to the agreed critical path; and
- iii. Strengthen farmers' access to Micro Credit and Finance Mechanism by establishing schemes specific;
- iv. Scaling up of new approaches to commercialize agricultural production (e.g. providing support to smallholder marketing associations, strengthening linkages to external markets, and undertaking capacity building and investment programmes along the entire marketing chain; and empowerment of producer marketing groups at district level).

Recommendation on Land tenure and ownership rights

The institution responsible for Irrigation in collaboration with the Ministry responsible for Lands has to prepare and implement an Integrated Land Use Master Plan for all LGAs, which, apart from demarcating the planned irrigated area, should also:

- i. Be based on the analysis of the established land carrying capacity for traditional small scale and large investors;
- ii. Be established through formulation of an integrated resource management plan;
- iii. Identify land tenure in the planned irrigation areas, ownership of current land and resources around them, community involvement in sharing the benefits and cost of irrigation development;
- iv. Promote voluntary resettlement and institute mechanisms or laws and by-law enforcement which will ensure that resettlement plans and agreements are adhered to by all the stakeholders;
- v. Reallocate irrigation land equitably between the different scales of irrigation categories;
- vi. Discourage direct purchase of land by investors from customary or statutory landowners; instead encourage them to go into joint ventures using their land as their contribution to the investment;
- vii. Provide provision for training to Land Committees (already formed as per Land Act and Village Land Act) to take care of land issues;

- viii. Prepare a land use plan based on land capabilities and carrying capacity analyses indicating areas suitable for specific irrigation development as well as scales of such development and ensure compliance of the plans;
- ix. Enhance the existing tribunal, to investigate and provide recommendations on the present land conflict cases, and to set-up clear guidelines for safe-guarding both community rights and investor's interests and rights in land transactions in the district;
- x. Discourage direct purchase of land by investors from customary or statutory landowners; instead encourage them to go into joint ventures using their land as their contribution to the investment or consult Tanzania Investment Center (TIC). This approach will be implementing MKURABITA strategy in Tanzania; and
- xi. Design and negotiate benefit-sharing structures that allow the community to receive, as a right, adequate benefits from irrigation. Also, design as part of benefit sharing, a system of profitable partnership between local residents, customary, landowners and private investors.

Recommendation on Water Resources Development

Water resources development is vital for successful implementation of NIP and NIMP. Such development should take into considerations the change in climate, the existing inefficient water use, environmental flow requirements and ecosystem sustainability. It is therefore recommended that DITS and the Ministry responsible for irrigation:

- i. Develop other sources of water for irrigation such as ground water, rainwater harvesting and dams;
- ii. Conduct EIA for all developments and adhere to the EIA recommendations;
- iii. Promote and ensure Integrated Water Resources Management;
- iv. Conduct Environmental Flows Assessment and allocation;
- v. Conduct stream flow monitoring;
- vi. Enhance early warning and disaster preparedness;
- vii. Promote water saving technologies; and
- viii. Promote drought resistance crops.

Recommendation on Development and Management of Irrigation Schemes

Development of irrigation and drainage infrastructure is crucial for ensuring reliable availability of water in a sustainable way for higher crop production in a bid to enhance food security and poverty reduction. It is therefore recommended that the institution responsible for irrigation:

- i. Apply IWRM principles to ensure efficient water management;
- ii. Promote and ensure adequate research and development (R&D) in irrigation;
- iii. Ensure technology transfer to farmers;
- iv. Establish mechanism for linkage and coordination of all types of irrigation research by various stakeholders;

- v. Review NIMP, map and demarcate identified irrigation potentials area by considering water resources potentials for reliable water supply and land ownership status in addition to the former criteria;
- vi. Conduct water demand assessment and inventory of water users and permits;
- vii. Conduct environmental flow assessment in all rivers and wetlands;
- viii. Assess the response of aquatic biodiversity to flow regimes;
- ix. Undertake awareness campaigns;
- x. Provide extension services and training on O&M guidelines;
- xi. Provide effective mechanism to monitor both financial and physical performance of the irrigation schemes;
- xii. Strengthen the District capacity to use the irrigation development guidelines and set a monitoring mechanism to assure compliance;
- xiii. Ensure that Child Labour Regulations and local by-laws are adhered to;
- xiv. Provide movement corridors for wild game and control wild animal straying and destroying crops;
- xv. Empower IOs and conduct sensitization campaign to create a sense of ownerships of irrigation infrastructure;
- xvi. Enforce adherence to design and construction standards of irrigation schemes;
- xvii. Promote soil and water conservation measures;
- xviii. Adhere to irrigation water quality standards and guidelines for irrigation water management;
- xix. Regulate fertilizer and agrochemical application;
- xx. Adherence to design, construction and management standards of irrigation schemes;
- xxi. Ensure safety measures for flood control and other natural disasters;
- xxii. Promote and ensure use of irrigation water management guidelines by farmers and extension workers;
- xxiii. Proper use of fertilizers (type, amount, and frequency of application) to avoid excessive use;
- xxiv. Proper application (type and amount) of other agrochemicals to avoid excessive use;
- xxv. Prepare guidelines for use by farmers in the management of pesticides;
- xxvi. Adherence to Regulations and Standards for Management of Riparian Buffers and ecologically sensitive areas;
- xxvii. Undertake detailed ecological surveys to identify ecologically sensitive areas, viable wildlife corridors and prepare biodiversity monitoring plans for each irrigation scheme;
- xxviii. Plan and Construction of fish bridges after assessing fish species composition, abundance, patterns of movement and breeding behavior; and
- xxix. Promote and ensure Integrated Resource Planning and Management.

Recommendation on Cross-cutting issues

Irrigation development and management to be sustainable the following cross-cutting issues are recommended for considerations during implementation:

- i. Promote gender mainstreaming programme in the irrigation sector;
- ii. Awareness campaigns on health and safety including behaviour change;
- iii. Provision of ARV for HIV/AIDS victims; and
- iv. Expansion of irrigation schemes to go hand in hand with the construction of health and sanitation facilities.

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