

NATIONAL ENVIRONMENT MANAGEMENT COUNCIL (NEMC)
DEPARTMENT OF ENVIRONMENTAL PLANNING AND RESEARCH (DEPR)

**RAPID ENVIRONMENTAL ASSESSMENT OF THE WAMI/RUVU BASIN ECOSYSTEM,
TANZANIA**



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Executive Summary

EXECUTIVE SUMMARY

BACKGROUND AND OBJECTIVES

The National Environment Management Council (NEMC) is implementing the directions of the Minister of State for Environment and Union Affairs to conduct a survey following the pressures and degradation that the Wami/Ruvu Basin is currently facing.

The objectives of the survey are to conduct a rapid survey of different ecosystems such as forests, mountains, rivers, rangelands, and collect information on the ecosystems and biodiversity; discuss with LGAs and communities on environmental challenges that are facing the Wami/Ruvu basin ecosystem; identify relevant stakeholders who will be invited to participate in a stakeholders workshop that will be organised by NEMC to chart out a framework for cooperation and collaboration amongst different stakeholders working in the Basin; and identify biodiversity hotspots and/or environmental sensitive areas and assess current conservation pressures within these ecosystems.

The assignment are in line with the National Environmental Research Agenda (2017-2022) which among other things NEMC facilitate the coordination of environmental research in areas of priority especially in integrated water resources management, aquatic ecosystems and biodiversity conservation. The specific objectives of the study are 1) to collect information on ecosystems and biodiversity, 2) to produce a technical report with conservation recommendations and 3) to arrange stakeholders' meeting.

INTRODUCTION TO THE WAMI/RUVU BASIN

The Wami/Ruvu Basin, as defined administratively, consists of the two main rivers of Wami and Ruvu, and the minor coastal rivers (Mpiji, Sinza, Mlalakuwa, Msimbazi, Mzinga, Kizinga and Mbezi) that all drain into the Indian Ocean, encompassing with a total area of 66,820 km² (Wami-43,046 km², Ruvu-18,078 km² and the Coastal-4,796 km²). The basin has 3 catchments of Wami, Ruvu and Coast. The Sub-Catchments of

the Wami catchment are Kinyasungwe, Mkondoa and Wami from the upstream, and the ones for the Ruvu catchment are Upper Ruvu, Ngerengere and Lower Ruvu. Coast catchment is reckoned as a Sub-Catchment in Wami/Ruvu Basin, and then it is divided into 7 Sub-Catchments.

Table 1: Sub-catchments of the Wami/Ruvu Basin

Sub-catchment	Area (km2)
Kinyasungwe	16483
Mkondoa	12787
Wami	12121
Ngerengere	3099
Upper Ruvu	7552
Lower Ruvu	7105
Coast	5097

In regard to the administrative unit, the basin covers 6 regions and 27 districts. (*Note: There have been changes in districts over 2002-2012; for instance, the area formerly under Dodoma Rural has been divided into Bahi, Chamwino and Chemba.*) According to JICA (2012), population in 2011 in Wami/Ruvu basin is estimated at approximately 7.28 million, in which 4.07 million are urban population (56%) and 3.21 million are rural (44%). The basin supplies water for different uses/needs; 1) Ecosystems: vegetation and wildlife are adapted to naturally occurring rainfall and water availability; changes to water availability, such as the over-extraction of water from rivers can harm ecosystems, 2) Agriculture: Agriculture includes both rainfed and irrigated farms and is the largest water user in the Basin, 3) Domestic (rural and urban): Domestic rural consumption includes use of water for drinking, cooking, washing and kitchen gardens, 4) Energy, 5) Industry/Commercial: Industry has various water needs, as well as need effective treatment plants, 6) Livestock: Livestock historically had access to rivers for drinking; however expanding farmland in some cases cuts off access to streams which may lead to pastoralist - farmer conflicts. Vulnerability of water resources in the Wami/Ruvu Basin; 1) increasing water demand (growing population, industrial growth, increase in irrigated agriculture, etc.); 2) increasing pollution of water (soil erosion,

sewage, industries, agrochemicals, etc); 3) decreasing landscape capacity to regulate water quality and availability (Land Cover and Land Use Change – deforestation, wetland loss, desertification in arid areas); and 4) Climate change (increasing uncertainty of rainfall onset duration, distribution and amount; rise in temperature; sea level rise; coastal groundwater salinity).

Preservation of the biodiversity helps maintain healthy ecosystems, which in turn sustain human life by providing natural-resource based livelihoods, water, medicines and flood-control.

ECOSYSTEMS AND BIODIVERSITY

The Wami and Ruvu rivers originate in the biodiversity rich, perpetually cloudy Eastern Arc Mountain ranges of Tanzania, and flow across fertile agricultural plains and grass-land savannahs to the Indian Ocean. The lower Wami river ecosystem and estuary supports abundant and diverse bird life, fish, hippos, crocodiles, and well preserved mangrove forests. The salty marsh estuaries close to the river are home for pelican and flamingo which come to feed on fish and crustaceans of the sea. It is known, however, that the environment in the basin is being degraded and polluted. Agriculture has expanded as a function of population increase leading to deforestation, and water is being extracted from the basin for agricultural irrigation, industry, and household use. In areas with intensive agricultural activities, people cultivate up to the river bank. It is known that this accelerates erosion and sedimentation. The potential consequences of these threats are reduced river flow, changes in seasonal flows (pulsing), nutrient loading and water contamination from agro-chemicals, and water contamination from washing and sewage.

Forests in the Ruvu catchment are important for water, soil and biodiversity conservation as well as maintaining a climate that ensures reliable rainfall that favors continuous agricultural production. Also communities adjacent to the catchment depend on these forests to meet their daily wood and non-wood requirements. Forest reserves

have been subjected to degradation due to agricultural expansion, illegal tree cutting (for timber, firewood and building poles) and forest fires caused by farmers who use fire as a tool for land preparation for agriculture. The situation is worsened by the inability of the government to manage all its forest resources as a result of inadequate human and financial resources and the lack of involvement of the local community to manage and sustainably develop forest resources.

GAPS IN ENVIRONMENTAL CONSERVATION

The social and economic circumstances prevailing today have made particular demands upon the country's water resource base and the environment, and its sustainability is threatened by human induced activities. Inadequate regulations to monitor groundwater resources development has led to underutilization of the resources and in some places over exploitation and interference in the existing water sources. Fragmented planning, implemented following sector, regional or district interests, aggravates this situation even further. Despite the progressive policy environment, sectoral programmes remain narrowly focused, with different sectors still working in 'silos. Currently, there are no an integrated, cross-sectoral plan that would facilitate a strategic, streamlined and cost-effective approach that would make it possible to address land degradation at a catchment scale, and bring stakeholders together around a common vision.

GOVERNMENT INITIATIVES

1 STUDIES CARRIED OUT SHOWING DIFFERENT ISSUES IN THE BASIN

Different studies/assessments related to water resources management were implemented in the basin for the purpose of proposing proper ways of mitigating environmental challenges;

Sediment Fingerprinting; Wami/Ruvu Basin Water Board in collaboration with the iWASH Program piloted an innovative scientific technique to determine the major sources of suspended sediments in the Ruvu Basin. By utilizing **“sediment**

fingerprinting” they were able to positively identify the major sources of sediment in the basin, enabling future soil management interventions to be targeted in those priority areas.

A Rapid Ecohydrological Assessment of the Ruvu River Estuary: Water abstraction, deforestation, afforestation, agricultural and industrial activities in upstream areas of the Ruvu River Basin have the potential to substantially affect the ecology of the estuary as well as the goods and services it provides to local human populations. The specific objective of the study was to begin understanding how the plant and animal communities are related with the salinity and flow regime in the estuary. To do so, baseline data was gathered on estuary channel depth, flow velocity, salinity and water quality, riparian vegetation community structure, marine vegetation and fish species and the presence/absence of large terrestrial and marine predators in the estuary. These baseline data are a subset of the inputs necessary to ultimately determine the minimum freshwater inflows required in the Ruvu river to maintain the estuarine ecosystem and the human communities that have been depending on them for millennia.

Situational Analysis - a Study of Mlalakua River in Kinondoni Municipality, Dar es Salaam: The study aimed at assessing the extent of River pollution and the strategies to improve the quality and condition of the River from further degradation. The two outcomes of the study, the situational analysis and the listing of the remedial actions in the form of proposed projects was used as a discussion tool, in engaging different government and non-government organizations, private companies as well as communities in carrying out river Mlalakua pollution prevention and protection actions.

2 PROJECTS IMPLEMENTED TO ADDRESS ENVIRONMENTAL CHALLENGES

Securing Watershed Services through Sustainable Land Management in the Ruvu and Zigi Catchments (Eastern Arc Region), Tanzania: The Government of Tanzania through the Ministry of Water and Irrigation as an Executing Entity/Implementing Partner, is implementing a five years project on “***Securing Watershed Services Through Sustainable Land Management in the Ruvu and Zigi Catchments***”

(Eastern Arc Region), Tanzania” Sustainable Land Management (SLM) offers a comprehensive approach to management and governance of land and water resources and holds the potential to make significant and lasting differences both in the short and long term. Key areas of project support include working with selected communities and relevant basin management authorities to: (i) reduce human-induced pressures (e.g. illegal harvesting and mining and unwise use of fire) on protected forests; (ii) promote sustainable forest management and forest restoration outside of protected areas; (iii) develop and test sustainable livestock management technologies; and (iv) increase household food production and incomes through uptake of SLM practices and the development of diversified, alternative sustainable livelihoods.

Mlalakuwa River Restoration Project: The project comprises of various implementing partners from the public sector, private sector and third sector (NGO and CBOs) as well as communities. Through collective action, the partners take a stewardship approach in addressing water pollution and environmental degradation of the Mlalakuwa River, located in the North of Dar es Salaam. The overall goal of this project was to restore the Mlalakuwa River to a healthy status and prevent further pollution on a sustainable basis; the project serves as a pilot study.

3 OTHER GOVERNMENT INITIATIVES TO ADDRESS ENVIRONMENTAL CHALLENGES

Establishment of WUAs:

Efforts were made towards the establishment of Water Users Associations in different environmentally affected areas. The WUAs are representing the lowest level of water resources management in the Water Resources Institutional Framework. Through WUA, the Basin managed to implement activities, which helped to reduce the environmental impacts due to unsustainable human activities on water sources and environments as a whole, in which water users, water sources encroachers, illegal

mining and all other unsustainable human activities threat to the environment are regulated.

Demarcation of water sources for protection:

- i. Mindu Dam
- ii. Makutupora Basin

ACKNOWLEDGEMENT

The study team acknowledges with appreciation all the individuals who contributed and provided their time and shared their knowledge. These include the Bagamoyo District Executive Director; the Kibaha District Executive Director; the Mvomero District Executive Director; the Kilosa District Executive Director; all the District Environmental Management Officers for Bagamoyo, Kibaha; Mvomero and Kilosa; and the Ward Executive Officers of Magomeni and Makurunge wards.

The team also acknowledges with appreciation the support from Wami/Ruvu Basin Water Office; staff and management of the Bagamoyo Irrigation Development Project; Sea salt company; and farmers and their water user associations (e.g. Kisangata Water User Association).

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ABBREVIATIONS

WRBWB = Wami/Ruvu Basin Water Board

NEMC = National Environment Management Council

LGAs = Local Government Authorities

km² = Square kilometer

JICA = Japan International Cooperation Agency

GLOWS = Global Water for Sustainability

FIU = Florida International University

USAID = United States Agency for International Development

iWASH = Improved Water Sanitation and Hygiene

SLM = Sustainable Land Management

NGOs = Non - Governmental Organizations

CBOs = Community Based Organizations

WUAs = Water Users Associations

DED = District Executive Director

DEMO = District Environmental Management Officer

WEO = Ward Executive Officer

BIDP = Bagamoyo Irrigation Development Project

EFA = Environmental Flow Assessment

FYDP II = 2nd Five Year Development Plan

IWRM&D Plan = Integrated Water Resources Management and Development Plan

NAWAPO = National Water Policy

WRMA = Water Resources Management Act

NEP = National Environmental Policy

EMA = Environmental Management Act

NLUPC = National Land Use Planning Commission

Tanga-UWASA = Tanga Urban Water and Sanitation Authority

DAWASA = Dar es Salaam Water and Sanitation Authority

PBWB = Pangani Basin Water Board

MAFC = Ministry of Agriculture, Food Security and Cooperatives

ILUMPS = Integrated Land Use Management Plans

STAMICO = State Mining Corporation

TANAPA = Tanzania National Parks Authority

CCRO = Certificate of Customary Right of Occupancy

IGA = Income Generating Activities

IUCN = International Union for Conservation of Nature

URT = United Republic of Tanzania

DC = District Council

CDO = Community Development Officer

Ag = Acting

SN = Serial Number

MoWI = Ministry of Water and Irrigation

TAMISEMI = Tawala za Mikoa na Serikali za Mitaa

UDSM = University of Dar es Salaam

SUA = Sokoine University of Agriculture

WI = Water Institute

ARU = University of Arush

CHALIWASA = Chalinze Urban Water Supply and Sewerage Authority

MORUWASA = Morogoro Urban Water Supply and Sewerage Authority

NP = National Park

GR = Game Reserve

TBL = Tanzania Breweries Limited

WARIDI = Water Resources Integration Development Initiative

TV = Television

e.g. = for example

PHOTOGRAPHS

List of photos (with captions) that were taken during field trips at different locations i.e. Bagamoyo DC (Tandika market, sea salt company, etc), Kibaha DC (Mlandizi wetland, machimbo ya mchanga, etc), Mvomero DC (siltation - banio la maji la mradi wa umwagiliaji, etc), Kilosa DC (any picture taken there) and Morogoro Urban (e.g. dumping site & Kihonda ponds)

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Tanzania is currently suffering from complex environmental challenges caused by climate variability and human activities. Such changes and activities have brought significant negative impacts on ecosystems.

Recently, the Minister of State for Environment and Union Affairs directed National Environment Management Council (NEMC) to conduct a survey following the pressures and degradation that the Wami/Ruvu Basin is currently facing. This assignment is also in line with the National Environmental Research Agenda (2017-2022) which among other things NEMC facilitate the coordination of environmental research in areas of priority especially in integrated water resources management, aquatic ecosystems and biodiversity conservation. The field work was accomplished by undertaking a one time (July, 2018) survey of different ecosystems such as forests, mountains, rivers, rangelands; discuss with LGAs and communities on environmental challenges; identify biodiversity hotspots and/or environmental sensitive areas and assess current conservation pressures within these ecosystems. And finally, identify relevant stakeholders who will be invited to participate in a stakeholder's workshop that will be organised by NEMC to chart out a framework for cooperation and collaboration amongst different stakeholders working in the Basin.

Sites were selected following expert knowledge (insights) from different stakeholders and major socio-economic developments were considered.

This report informs about the findings of a team. The information on ecosystems and biodiversity of the basin will be useful to the Wami - Ruvu Basin Water Board and other stakeholders. The survey also serves to establish a baseline for monitoring and facilitates the identification of areas of concern, whilst providing a base for the development of knowledge for the basin.

1.2 OBJECTIVES OF THE SURVEY

The general objective of the survey was to assess current conditions of different ecosystems such as forests, mountains, rivers, and rangelands following pressures and degradation that the Wami/Ruvu Basin is currently facing.

Specifically the team aimed at:

- 1.2.1 Gathering views from stakeholders (LGAs and communities) and measure the level of awareness and perceptions regarding environmental challenges that are facing the basin ecosystems;
- 1.2.2 Identifying biodiversity hotspots/and or environmental sensitive areas and assess current conservation pressures within these ecosystems;
- 1.2.3 Identifying relevant stakeholders who will be invited to participate in a stakeholders' workshop that will be organized by NEMC to chart out a framework for cooperation and collaboration amongst different stakeholders working in the Basin; and
- 1.2.4 Producing technical report with conservation recommendations.

1.3 STRUCTURE OF THE REPORT

Following the introduction, which has highlighted the importance of undertaking a rapid survey of the Wami/Ruvu Basin ecosystems, this survey gives an overview of the natural resources in the basin that provides some information on the current status of the ecosystems and conservation pressures within these ecosystems. Natural resources that are discussed include forests, water and wetland resources, ground water, environmental flows, water quality, protected areas, biodiversity, fisheries and soils. The second chapter gives an insight on the pressures and degradation that the Wami/Ruvu Basin is currently facing and different interventions and/or initiatives undertaken to protect and develop natural resources within the basin. The third chapter

defines different approaches employed by the team to fulfill the objectives of the survey. The fourth chapter brings all the information gathered by the team including opportunities and constraints in the Wami/Ruvu Basin. Also, socio-economic activities (industry, mining, agriculture and irrigation, and pastoralists) and their impact on the basin ecosystems are identified in this chapter. Priority areas for action are identified. The final chapter provides conclusions and recommendations.

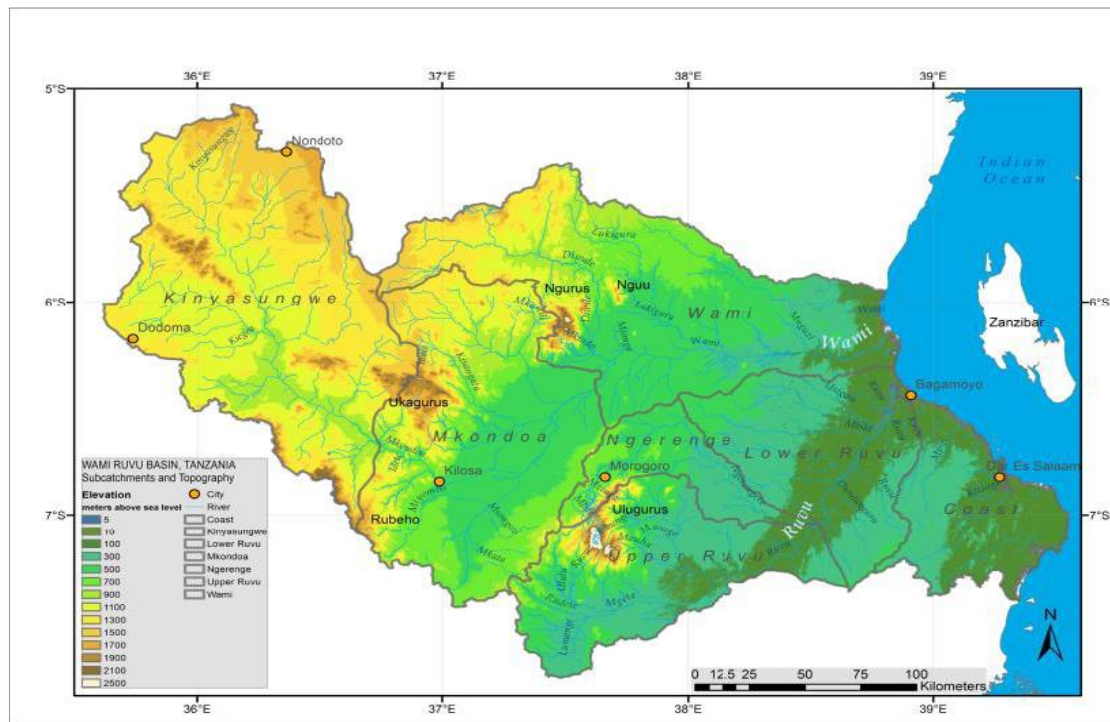
CHAPTER 2 LITERATURE REVIEW

2.1 OUTLINE OF THE WAMI/RUVU BASIN

Wami/Ruvu is one of the nine Rivers and Lakes Basins of Tanzania. The Basin was established in July 2002, with an area of 66,294 km², in which Wami River is the largest catchment covering an area of 43,742 km², followed by Ruvu river catchment of 17,789 km². Wami/Ruvu Basin also encompasses small Coastal Rivers of Mpiji, Msimbazi, Kizinga, Mzinga and Mbezi covering an area of 4,763 km², all discharging its water into the Indian Ocean (FIU - GLOWS, 2014²).

Wami and Ruvu rivers arise in the Eastern Arc mountain range in central Tanzania, and flow eastwards through some of the country's major agricultural, industrial and urban areas before discharging into the Indian Ocean north of the historic port of Bagamoyo. The large urban and commercial cities of Dar es Salaam and Dodoma, all fall in the Wami/Ruvu River catchment area (FIU - GLOWS, 2014a). The Basin supplies water for different uses: Domestic, Commercial, Industrial, fishing, Irrigation, Livestock, National Parks: (Saadani and Mikumi) and Selou and Wami-Mbiki game reserves (FIU – GLOWS, 2014..). The Eastern Arc Mountains with different Biodiversity is also found in the Wami/Ruvu River Catchment

Figure 1: Wami/Ruvu Basin showing its seven Sub catchments



Source: JICA, 2013

A large climatic diversity exists within the basin, from the humid plains along the Indian Ocean coastline, to the Eastern Arcs Mountains with high rainfall, and arid areas around Dodoma further west, that lie in the rain shadow of the mountains. Climate and biogeography history has resulted in a stunningly large variety of biodiversity-rich ecosystems, notably the montane forests, in the Eastern Arc Mountains, the savanna woodlands famous worldwide for wildlife, and coastal mangroves, sea grass beds and coral reefs that form nurseries for marine fish. (FIU - GLOWS, 2014a). A wide range of livelihoods exist in the Wami/Ruvu River Basin encompassing rain-fed and irrigated agriculture, livestock, forest produce and leading industries of Tanzania. Such a diversity of water availability and increasing demands present within the basin poses an ever-widening challenge of sustainable water resources management.



Montane evergreen primary forest in the Headwater catchment of the Mkindo River in the Nguru Mountains



Ecosystems: vegetation and wildlife are adapted to naturally occurring rainfall and water availability



Livestock historically had access to rivers for drinking

Plate..... Variety of biodiversity-rich ecosystems notably the montane forests, the savanna woodlands famous for wildlife and a wide range of livelihoods encompassing livestock (FIU - GLOWS, 2014a)

2.1.1 ADMINISTRATIVE SETTINGS AND POPULATION

The Wami/Ruvu basin covers 6 regions and 27 districts. (*Note: There have been changes in districts over 2002-2018; for instance, the area formerly under Dodoma Rural has been divided into Bahi, Chamwino and Chemba.*) According to JICA (2012), population in 2011 in Wami/Ruvu basin is estimated at approximately 7.28 million, in which 4.07 million are urban population (56%) and 3.21 million are rural (44%). Table below indicates the regions and districts in Wami/Ruvu Basin.

Table 2: City, Regions and Districts in the Wami/Ruvu Basin - Wami/Ruvu Basin Water Board, 2018

Region	District Municipality
Dar es Salaam	Ilala
	Temeke
	Kinondoni
	Ubungo
	Kigamboni
Pwani (Coast)	Bagamoyo
	Kisarawe
	Kibaha (Township)
	Kibaha (District)
	Chalinze
	Mukuranga
	Kilosa

Morogoro	Mvomero
	Morogoro Rural
	Morogoro Urban
	Gairo
Tanga	Handeni
	Kilindi
Manyara	Kiteto
Dodoma	Dodoma Rural
	Dodoma Urban
	Chamwino
	Bahi
	Kondoa
	Mpwapwa
	Kongwa
	Chemba

Source: WRBWB, 2018

2.1.2 SOCIO ECONOMIC ACTIVITIES IN THE BASIN

(a). Agriculture;

Agriculture accounts for nearly 80 percent of the employed population, contributing approximately 50 percent of GDP and 66 percent of the merchandized export. Thus, it is the main socio-economic and subsistence livelihood in Tanzania. Although agriculture is the leading sector in the economy, only 6.3 million ha out of 43 million are under agricultural production due to small-scale farmers with rain-fed agriculture ([source](#)). The two agricultural activities in the Wami Sub-Catchment are rain-fed crops, largely grown in semi-arid areas in Dodoma, Mpwapwa and Kongwa and irrigation schemes that are found in wetter districts such as Kilosa and Mvomero in Morogoro region. In Ruvu Catchment, traditional irrigation is practiced in the Ulugulu highlands where rainfall is adequate. There are a number of irrigation schemes in the lowlands of the Ruvu basin.

(b). Industry;

In the Wami River Catchment, there are no significant industrial developments except Mtibwa Sugar Company located in Turiani, Mvomero district in Morogoro region. In the

Bagamoyo district, salt production is an important economic activity. Previously, it was pointed out that the business resulted into the deforestation of coastal forests including Mangroves for fuel (wood) used for salt production process, but currently, the industry has changed the technology, whereby solar energy is used (IUCN, 2010a). Contrary to Wami Catchment, industries in the Ruvu and Coastal Rivers Catchments, there are varieties of industries, most of them are concentrated in the Coastal Rivers in Dar es Salaam and Pwani Regions and others located in the Morogoro Region. During the implementation of the 2nd Five Year Development Plan – (FYDP II - 2016/2017 – 2020/2021, The Government of Tanzania is emphasizing in the development of sustainable industrialization, which aims at bringing a participatory and sustainable development by using available resources appropriately. Following the current National Motto for Industrial Economy, there are numerous industries being established in the Wami/Ruvu Basin and a plan to develop more industries is underway. Most of the raw materials for the established industries will be obtained in the Basin, which will impose more pressure to the basin environments. Raw materials expected are from agricultural and mining sectors.

(c). Livestock keeping;

Livestock keeping areas in Wami River – Catchment are within villages of Twatwatwa, Parakuyo, Mbwa, Mfisi, Mabwegere, Kwambe and Kambala. Those in Ruvu River Catchment are wide spread ranging from the lowlands of the basin in the Mvaha area, down to Ngerengere Chalinze, Kisarawe and Bagamoyo districts. Over the years a large migration of livestock has taken place into the Ruvu and Wami Rivers Catchments due to the availability of good pasture and water for livestock (WRBWB, 2018).

2.1.3 CURRENT STATUS OF ENVIRONMENTAL CHALLENGES IN THE BASIN

The social and economic circumstances prevailing today have made particular demands upon the country's water resource base and the environment, and its sustainability is threatened by human induced activities. These demands have

intensified with the increase in population and concurrent growth of economic activities requiring water (natural resources) as an input such as irrigated agriculture, industries, tourism, mining, livestock keeping, domestic, fisheries, wildlife, hydropower generation, forestry activities and infrastructures like buildings and transportation (railways and roads). Water scarcity and environmental degradation is perceived at many places due to unreliable rainfall, multiplicity of competing uses of water sources and unsustainable land uses. Water scarcity threatens food security, energy production and environmental integrity and consequently there are water use conflicts between sectors of the economy ([source](#)).

Plate.... Decreasing landscape capacity to regulate water quality and availability: Land Cover and Land Use Change - deforestation



Maize farm to the left and abandoned farm to the right, with eroded gullies visible in the centre



Rivers laden with soil



Clearing and burning of forest for agriculture



Charcoal being taken to the market

Abundant water in the Wami River Catchment often causes conflict between farmers and pastoralists over water access. Increasing pollution of water from soil erosion, sewage, industries, agrochemicals and storm water runoff laden with oil, grease and plastic garbage. Areas with such environmental challenges in the basin are; soil erosion – farming in the steep slopes of the Uluguru, Unguu and Ukaguru Mountains without using soil conservation techniques, Industrial pollution and solid waste dumping sites – Kinyamwezi area in Dar es Salaam City and Kihonda industrial area in Morogoro Municipality. Decreasing landscape capacity to regulate water quality and availability: Land Cover and Land Use Change — deforestation, wetland loss and desertification in arid areas especially in the Wami River Catchment in the upstream in Dodoma City, Chamwino, Mwapwa, Kondoa, Kiteto, Gairo and Kilosa District Councils. In downstream Wami River areas in Chalinze, Mvomero and Bagamoyo District Councils, while in the Ruvu River Sub catchment areas affected are; Mvuha, Morogoro, Mvomero, Kisarawe and Kibaha District Councils (FIU - GLOWS, 2014a). Increasing challenges of strengthening policies and legal and institutional frameworks related to natural resources and fragmented planning implemented following sector, regional or district interests, aggravates this situation even further.

2.2 STUDIES CARRIED OUT SHOWING DIFFERENT ISSUES IN THE BASIN

Different studies/assessments and projects related to water resources management were implemented in the basin for the purpose of proposing proper ways of mitigating environmental challenges;

2.2.1 SEDIMENT FINGERPRINTING: In 2013, the Wami/Ruvu Basin Water Board, working with the iWASH Program, piloted an innovative scientific technique to determine the major sources of suspended sediments in the Ruvu Basin. By utilizing “*sediment fingerprinting*” they were able to positively identify the major sources of sediment in the basin, enabling future soil management interventions to be targeted in those priority areas,

2.2.2 CLIMATE AND LANDSCAPE – RELATED VULNERABILITY OF WATER RESOURCES IN THE MKINDO SUB CATCHMENT OF WAMI CATCHMENT:

The study report provides the background information on present climate, climate change predictions, forest cover change, slope analysis to identify regions with steep slopes, and village water use information. It then discussed the exposure and sensitivity of local water resources to climate and landscape factors. Finally it suggested focal areas for adaptive strategy development by the stakeholder group in the catchment (FIU - GLOWS, 2014d)

2.2.3 ENVIRONMENTAL FLOW ASSESSMENT FOR WAMI RIVER CATCHMENT PHASE I AND II AND RAPID ENVIRONMENTAL FLOW ASSESSMENT FOR THE RUVU RIVER CATCHMENT:

Tanzania's National Water Policy of 2002 and Water Resources Management Act of 2009 establish an order of priority in decision-making as related to allocation of surface water resources. According to these frameworks, basic human needs for water use are afforded first priority, and then water for the long-term sustainability of ecosystems is given second priority in decision-making about water. Implementation of this legislation means that water managers in Tanzania must understand the needs of ecosystems in terms of quantity, quality and timing of freshwater flows.

2.2.4 ENVIRONMENTAL FLOW ASSESSMENT (EFA): This is a process by which these ecosystem needs are identified and quantified to the best degree possible. The general consensus to which many people are arriving is that EFA should be a holistic process that considers the flow needs of ecosystems and the flow linkages to the availability and quality of freshwater ecosystem services upon which humans depend. The goal of the EFA study was to provide scientific information for sound decision making on water resource allocation in the Wami and Ruvu River Basins, and to assist with the implementation of Tanzania's water legislation that establishes ecosystems as second order of priority in the decision making (Kashaigili J.J, 2011).

2.2.5 A RAPID ECOHYDROLOGICAL ASSESSMENT OF THE RUVU RIVER

ESTUARY: Water abstraction, deforestation, afforestation, agricultural and industrial activities in upstream areas of the Ruvu River Basin have the potential to substantially affect the ecology of the estuary as well as the goods and services it provides to local human populations. With respect to the Ruvu Basin as a whole, if maintenance of freshwater flows to the estuary is important to stakeholders, then water management tools such as the Ruvu Environmental Flow Assessment can be applied to balance freshwater needs for humans and nature, and provide guidelines for future water resources development as well as for coastal zone management (FIU – GLOWS, 2014b).

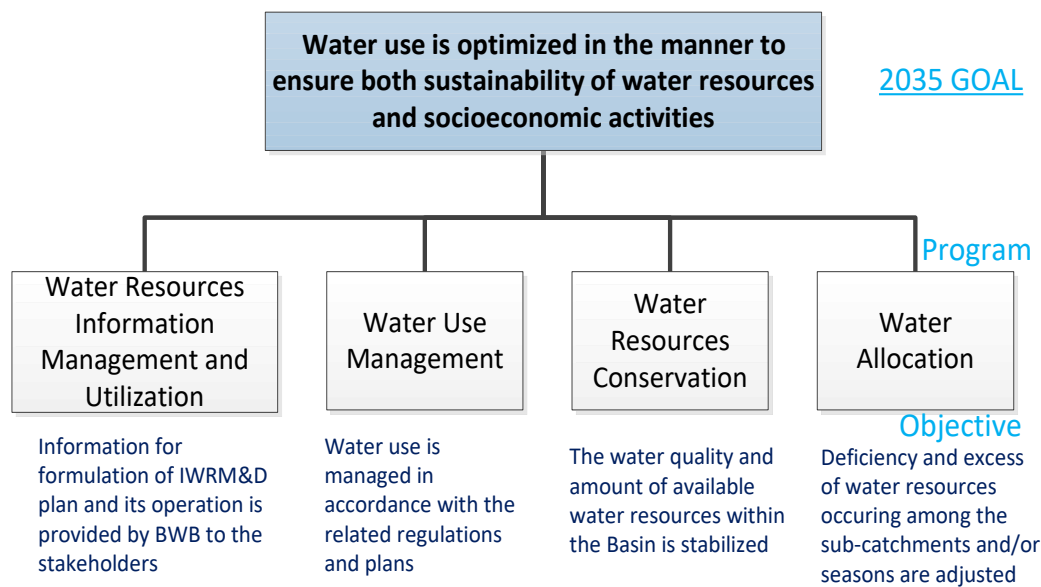
The study report describes the results of the first rapid ecohydrological assessment of the Ruvu River estuary (June 18-28, 2013). The specific objective was to begin understanding how the plant and animal communities are related with the salinity and flow regime in the estuary. To do so, baseline data was gathered on estuary channel depth, flow velocity, salinity and water quality, riparian vegetation community structure, marine vegetation and fish species and the presence/absence of large terrestrial and marine predators in the estuary. These baseline data are a subset of the inputs necessary to ultimately determine the minimum freshwater inflows required in the Ruvu river to maintain the estuarine ecosystem and the human communities that have been depending on them for millennia (FIU – GLOWS, 2014b).

2.2.6 THE STUDY ON WATER RESOURCES MANAGEMENT AND DEVELOPMENT

IN WAMI/RUVU BASIN: The Study supports the formulation of Integrated Water Resources Management and Development Plan (IWRM&D plan) in Wami/Ruvu Basin. The specific objectives of the Study were; to formulate a plan (blueprint) for water resources management and development for Wami/Ruvu Basin, to formulate a strategy and action plan for implementing a plan for water resources management and development, to conduct feasibility study on a priority project of the water supply sector, and to transfer technology and knowledge to counterpart personnel.

The study came out with recommendations in which four programs were proposed to be implemented in an integrated manner. The goals, programs and related objectives are as it is shown in the following figure

Figure 2: The proposed goals, programs and related objectives of the IWRM&D plan



Source: JICA, 2013

2.2.7 SITUATIONAL ANALYSIS, A STUDY OF MLALAKUA RIVER IN KINONDONI MUNICIPALITY, DAR ES SALAAM;

The Water Future Tanzania carried a study with an intention of getting an action plan for control of pollution and brings back the quality and best use of Mlalakua River. The study aimed at assessing the extent of River pollution and the strategies to improve the quality and condition of the River from further degradation. The two outcomes of the study, the situational analysis and the listing of the remedial actions in the form of proposed projects was used as a discussion tool, in engaging different government and non government organizations, private companies as well as communities in carrying out river Mlalakua pollution prevention and protection actions.

2.3 GAPS IN ENVIRONMENTAL CONSERVATION

2.3.1 THE ABSENCE OF AN ENABLING COLLABORATIVE INSTITUTIONAL FRAMEWORK FOR EFFECTIVE PARTICIPATION OF STAKEHOLDERS IN CONTROLLING LAND DEGRADATION AND UPSCALING SUSTAINABLE LAND MANAGEMENT IN THE BASIN

2.3.1.1 LACK OF EFFECTIVE LAND - USE PLANS IN SOME AREAS OF THE BASIN

Land use planning is a powerful tool for ensuring optimal use of land and natural resources and for addressing conflicts over use of these resources (FIU – GLOWS, 2014a).

2.3.1.2 LACK OF MANAGEMENT INTEGRATION

At the national level, the financial and human resources earmarked for baseline programs related to agriculture, livestock, forestry and water are deployed and managed by sectoral departments. Despite the progressive policy environment, sectoral programmes remain narrowly focussed, with different sectors still working in ‘silos.’ For example, forestry activities focus on increasing tree cover or forest management, without addressing the rangeland management issues within their area of jurisdiction, as would be needed under a landscape-wide Sustainable Land Management (SLM) or Integrated Water Resource Management Strategy. This result in duplications and redundancies, and many opportunities for joint implementation are lost. The strongly sectoral approach also limits opportunities for sharing knowledge and experiences between departments and also between ministerial departments and agencies and other role-players (such as NGOs and research institutions) (FIU – GLOWS, 2014d).

2.3.1.3 LACK OF CO-ORDINATION AND WEAK STAKEHOLDER LINKAGES

Currently, there are no an integrated, cross-sectoral plan that would facilitate a strategic, streamlined and cost-effective approach that would make it possible to

address land degradation at a catchment scale, and bring stakeholders together around a common vision (FIU – GLOWS, 2014a).

2.3.1.4 PROBLEMS WITH COMMUNITY- LEVEL ADMINISTRATION

At the local level, there are numerous community structures that have been created to deal with different aspects of land and water resource management, which results in a confusing and administratively inefficient situation. Some of the community institutions are the longer-standing, village governance structures such as Village Councils and Natural Resource (or Environmental) Committees, and others are more newly-introduced, such as Water User Associations (provided for in national policy and law), and various Farmer's Associations and other community groups that have been set up by externally-funded projects and programmes. These institutions exhibit variable administrative capacity, some have overlapping mandates and all suffer from a lack of the resources and capacity they require to work effectively (IUCN, 2010b).

2.3.1.5 INADEQUATE FUNDING

Most of institutions in the basin lack funding as one of the primary factors limiting their ability to implement their mandates on the environmental protection (JICA, 2013).

2.3.2 INADEQUATE DEMONSTRATED EXPERIENCES IN INTEGRATED WATER RESOURCE MANAGEMENT APPROACHES AT THE LANDSCAPE LEVEL

In the past years, there have been numerous environmental projects implemented (mostly by NGOs and development partners) in both the Ruvu and Wami Rivers systems. These have mostly dealt with different aspects of forest management, community based natural resource management, sustainable farming, rural financing and payments for ecosystem services. Whilst some of these projects have achieved notable successes, they have tended to be geographically scattered and localised, of relatively short duration, and implemented at a pilot scale, without subsequent follow-through or scaling up (FIU – GLOWS, 2014d).

2.3.2.1 ENDEMIC POVERTY

Many of the communities living in these catchments are heavily reliant on subsistence agriculture to survive and are dependent on natural resources to meet daily food, fuel and shelter requirements. Declining soil fertility limits the profitability of many farms and this is compounded by structural market weaknesses, poor road infrastructure and lack of transports that makes it difficult for farmers to access markets and realizes better returns from their produce (FIU – GLOWS, 2014d). Farmers in the Ruvu and Wami Rivers catchments need viable alternative livelihoods that provide higher net returns and greater long-term benefits, whilst reducing pressures on natural resources caused by activities such as illegal logging and mining, and indiscriminate use of fire (FIU – GLOWS, 2014a).

2.3.2.2 INSTITUTIONAL CAPACITY DEFICIENCIES

There are institutional capacity deficits in the Wami/Ruvu Basin (staff, resources and technical knowledge and skills) right across the water resources management spectrum, with the greatest deficits being at the Basin, District and community/Village levels. Water Basin Offices lack the equipment they need to gather information on the status of water resources, quantify water demand and usage patterns and develop water use plans. They also need GIS-based decision-support systems to monitor land use and to assess the social, environmental and economic impacts of changed land use practice over time (JICA, 2013).

2.4 GOVERNMENT INITIATIVES

2.4.1 POLICIES AND LAWS

The government of Tanzania has ensured enabling environment in mitigating the environmental challenges by provision of different policies and laws related to natural resources. These Policies and Laws are being used by different law enforcement

entities falling under legally established Natural Resources Management Frameworks such as that of Water and Environment. In these Natural related laws, each entity is given clearly stated mandates (Kashaigili, J.J., 2011).

2.4.1.1 NATIONAL WATER POLICY (NAWAPO, 2002)

The National Water Policy (NAWAPO, 2002) with its subsequent Water Resources Management Act (WRMA) No. 11 of 2009 and its Regulations aims at having a comprehensive framework for sustainable development and management of the Nation's water resources. WRMA No. 11 of 2009 provides for institutional and legal framework for implementation of NAWAPO (2002). Considering this fact, water resources management institutional framework was established, in which the management of water resources is done under five main levels; National, Basin, catchment, District and Community or Water User Association. Under the Basin level, Tanzania was divided into nine river and Lake Basins, that do not follow administrative boundaries and Wami/Ruvu Basin is one of these nine Basins (JICA, 2013).

The Wami/Ruvu Basin Water Board has been implementing water resources management activities to ensure that water resources is used and managed in a sustainable way and safeguarding the environment for social economic development. Efforts were made towards the establishment of Water Users Associations in different environmentally affected areas. The WUAs are representing the lowest level of water resources management in the Water Resources Institutional Framework. Through WUA, the Basin managed to implement activities, which helped to reduce the environmental impacts due to unsustainable human activities on water sources and environments as a whole, in which water users, water sources encroachers, illegal mining and all other unsustainable human activities threat to the environment are regulated (JICA, 2013).

2.4.1.2 NATIONAL ENVIRONMENTAL POLICY (NEP - 1997)

NEP - 1997 aims at ensuring environmental sustainability, security and equitable use of resources for sustaining the livelihoods of the present and future generations; raising public awareness and understanding of essential linkages between environment and development and promoting individual and community participation in environmental actions. It outlines on key environmental issues of concerns as land degradation, deforestation, environmental pollution, loss of wildlife habitat and biodiversity, deterioration of aquatic and terrestrial ecosystems and lack of accessible good quality water. The Environmental Management Act (EMA) of 2004 supports the implementation of NEP - 1997, in which it underscores the need for research information on the state of the environment and actual and future threats to the environment, including any emissions to water, air or land as well as disposal and storage of hazardous waste.

2.4.2 PROJECTS IMPLEMENTED TO ADDRESS ENVIRONMENTAL CHALLENGES

2.4.2.1 Securing Watershed Services Through Sustainable Land Management in the Ruvu and Zigi Catchments (Eastern Arc Region), Tanzania

The Government of Tanzania through the Ministry of Water and Irrigation as an Executing Entity/Implementing Partner, is implementing a five years project on *“Securing Watershed Services Through Sustainable Land Management in the Ruvu and Zigi Catchments (Eastern Arc Region), Tanzania”* Other responsible Partners are; National Land Use Planning Commission (NLUPC), Tanga Urban Water and Sanitation Authority (Tanga-UWASA), Dar es Salaam Water and Sanitation Authority (DAWASA), Pangani and Wami/Ruvu Basin Water Boards (PBWB and WRBWB), Ministry of Agriculture, Food Security and Cooperatives (MAFC) and all other institutions involved in integrated water resource and sustainable land management.

Sustainable Land Management (SLM) offers a comprehensive approach to management and governance of land and water resources and holds the potential to make significant and lasting differences both in the short and long term.

This project is building on the extensive baseline of Sustainable Land Management (SLM) work that has been carried out in Tanzania to date. It has been organized under *two components*, the first focused on *building institutional capacity and strengthening co-ordination* amongst Water Basin Authorities and other relevant stakeholders, and the second on *implementing practical Sustainable Land Management (SLM) interventions* to address land degradation in forests, rangelands and on arable land, with the overall purpose of securing watershed services and improving livelihoods. Two components of the project are;

Component 1: (i) development of Integrated Land Use Management Plans (ILUMPS); (ii) establishing or strengthening multi-sectoral stakeholder committees whose role is to co-ordinate dialogue amongst stakeholders and raise awareness about SLM; (iii) forming and strengthening Water Use Associations and capacitating them to perform their roles effectively; (iv) improving compliance and enforcement; and (v) increasing public funds available for SLM.

Component 2: is targeting to the widespread adoption of SLM practices within agricultural and livestock production systems and the conservation and rehabilitation of forests. Key areas of project support include working with selected communities and relevant basin management authorities to: (i) reduce human-induced pressures (e.g. illegal harvesting and mining and unwise use of fire) on protected forests; (ii) promote sustainable forest management and forest restoration outside of protected areas; (iii) develop and test sustainable livestock management technologies; and (iv) increase household food production and incomes through uptake of SLM practices and the development of diversified, alternative sustainable livelihoods.

2.4.2.2 Mlalakuwa River Restoration Project

The project comprises of various implementing partners from the public sector, private sector and third sector (NGO and CBOs). Through collective action, the partners take a stewardship approach in addressing water pollution and environmental degradation of the Mlalakuwa River, located in the North of Dar es Salaam. The overall goal of this

project is to restore the Mlalakuwa River to a healthy status and prevent further pollution on a sustainable basis; the project serves as a pilot study.

2.5 Other Government Initiatives to Address Environmental Challenges

2.5.1 Establishment of WUAs

Efforts were made towards the establishment of Water Users Associations in different environmentally affected areas. The WUAs are representing the lowest level of water resources management in the Water Resources Institutional Framework. Through WUA, the Basin managed to implement activities, which helped to reduce the environmental impacts due to unsustainable human activities on water sources and environments as a whole, in which water users, water sources encroachers, illegal mining and all other unsustainable human activities threat to the environment are regulated (JICA, 2013).

2.5.2 Demarcation of Water Sources for Protection

(i). Mindu Dam

(ii). Makutupora Basin

CHAPTER 3 METHODOLOGY

In order to fulfill the aforementioned objectives, the following methods were employed:

3.1 DOCUMENTS REVIEW;

Review of published reports, journals, articles and other publications relevant to the study objective was done with the aim of acquiring supplement information. The documents were mostly accessed through the internet and most of these documents were studies conducted by the various international/local organizations and researchers previously.

3.2 PHYSICAL OBSERVATION;

This was conducted by physically visiting the field with the aim of collecting information on ecosystems which was aided by taking pictures and GPS coordinates.

3.3 DISCUSSIONS AND CONSULTATIONS;

The team had managed to gather views/opinions from every person/organization met in regard to environmental issues/challenges and possible solutions.

CHAPTER 4 FINDINGS

4.1 BAGAMOYO DISTRICT COUNCIL

Bagamoyo District is one of the nine district Councils in Pwani Region. The historical Bagamoyo is 65 kilometers north of Dar es Salaam City. The district Council borders Chalinze District Council on the west; Indian Ocean on the East; Kinondoni District on the south East and Kibaha District on the South (Bagamoyo DC, 2017)

4.1.1 BRIEF MEETING WITH DISTRICT EXECUTIVE DIRECTOR (DED) OF BAGAMOYO

The team had short discussion with Mr. Charles Wambura Ag. DED, the discussion was based on the following issues;

4.1.1.1 ENVIRONMENTAL ISSUES/CHALLENGES

(i). Floods; during rainy season, some parts of the Bagamoyo District Council are frequently flooded. It was reported that these rains are occurring in the upper catchment of Ruvu and Wami Rivers in Uluguru, Ukaguru and Rubeho Mountains in Morogoro Region and some parts of Manyara and Dodoma Regions. Good example of affected areas are Tandika market located at Dunda Ward, Bagamoyo Irrigation Development Project, Sea Salt and small scale farmers who practice agricultural activities along lower catchment of both rivers.

(ii). Encroachments; destruction of coastal mangrove ecosystem in some parts to meet social economic needs and plots allocation (for residents and industries) in wetlands in different parts of the district is a threat to the Wami/Ruvu Ecosystems.

4.1.1.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

(i). Construction/increase of drainage systems to channel storm water to the sea to reduce storm water stagnation in different parts of Bagamoyo township.

(ii). The district has managed to form fifty (50) environmental groups responsible in securing coastal mangrove ecosystems.

(iii). Awareness raising; the district continues to raise awareness of environmental protection to different stakeholders and/or community, joint efforts between the district, NEMC and Wami/ Ruvu Basin is needed.

4.1.2 BRIEF MEETING WITH Ag. WARD EXECUTIVE OFFICER (WEO) OF MAGOMENI WARD

We had short discussion (repetition of the previous discussion with DED) with Ms. Hanifa B. Shemzigwa Ag. WEO and making arrangement of site visits at Tandika market and Bagamoyo Irrigation Development Project.

4.1.3 VISITING TANDIKA MARKET LOCATED AT DUNDA WARD

This is among the areas of Bagamoyo township affected by floods, on the day of visit some parts of the market area was still wet which is a sign of existence of storm water stagnation.

4.1.4 VISITING BAGAMOYO IRRIGATION DEVELOPMENT PROJECT (BIDP)

On the visit to BIDP the team met with the BIDP committee, discussion was based on different issues and the team had a chance to visit farms and water intake (where water from the Ruvu River is pumped to the canal).

4.1.4.1 ENVIRONMENTAL ISSUES/CHALLENGES DISCUSSED;

(i). Water abstraction; the scheme depends on water from Ruvu River for irrigation, they abstract water from the river by pumping system (oil is well controlled) and the scheme has water use permit.

(ii). Land use conflicts (ownership & boundaries); there is a conflict of ownership of the land between the scheme and Magereza; also there is a conflict of farm boundaries between the scheme and the investor (the area that was privatized by Magereza).

(iii). Infrastructure (irrigation facilities & Bagamoyo - Msata road); the scheme had well designed canals and drainages but during the Road construction the number of storm water drainage were reduced, which results into flooding to the farms during heavy rains causing destruction of farm infrastructures and shift of farming seasons. About 12 hectares (developed farm area with irrigation infrastructure) were lost as a result of the road construction; this is a great loss to the scheme.

(iv). Encroachment; there is farming activities in the river banks (the sixty meter buffer zone is not observed).

(v). Salt water intrusion; this happens during high tides. It was reported that this process has affected both farming activities and groundwater especially shallow wells.

4.1.4.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

(i). In order to resolve the conflict of ownership (between the scheme and Magereza), following previous efforts to resolve the conflict, the team advised the scheme to address their complains direct to the higher authorities.

(ii). The scheme Management is aware of the environmental conservation, whereby all solid wastes (plastic bags, poly sacks and crop residues), agrochemicals and hydrocarbons are well managed.

4.1.5 BRIEF MEETING WITH WARD EXECUTIVE OFFICER (WEO) OF MAKURUNGE WARD

The team had a short discussion with Ms. Ruth Godson WEO, 90% of the discussion was based on repetition of what was previously discussed with DED - Bagamoyo.

4.1.5.1 ENVIRONMENTAL ISSUES/CHALLENGES DISCUSSED

(i). There are still big undeveloped farms in the ward which pose a threat to security to the community.

(ii). Lack of fresh water, the ward is not connected to piped water from both Lower Ruvu and Chalinze water supply infrastructures as a result majority are forced to use water from shallow wells and/or boreholes some of which is of low quality for human consumption.

4.1.5.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

The WEO suggested that the undeveloped farms should be re-allocated to community members.

4.1.6 VISITING SADANI SEA SALT COMPANY

4.1.6.1 ENVIRONMENTAL ISSUES/CHALLENGES DISCUSSED

(i). Land use conflict (boundaries); there is a conflict of boundaries between the factory and Saadani National Park. According to Sadani Sea Salt Company, the boundaries were well defined (as per former ownership of STAMICO/COASTAL SALT), however conflict has arisen under TANAPA Management.

(ii). Salt production; the factory harvest sea water, store it in pans and use solar power for evaporation. However, there is rampant vandalism of the infrastructure, whereby harvested water is often vandalized at night by encroachers, who enter the salt pans and open the gates to allow water to leave with the intention of catching fish from the pans.

(iii). Existence of illegal residence along the coast, whereby the ecosystems including mangroves and water sources are destructed and polluted.

4.1.6.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

(a). Conduct awareness to the community on environmental management

(b). Address Boundary conflicts

4.2 KIBAHA DISTRICT COUNCIL

Kibaha District Council is among the 9 district councils of Pwani region in Tanzania. Other district councils are Bagamoyo, Kibaha Town, Kisarawe, Chalinze, Mkuranga, Kibiti, Rufiji and Mafia. To north, it is bordered by Bagamoyo District Council, to the east by Kibaha Town Council, to the south by Kisarawe District Council and to the west by Chalinze District Council. It is about 40 kilometers away from Dar es salaam City along the Tanzania – Zambia and Malawi highway with total area 1,251.7 km² (Kibaha DC, 2017).

4.2.1 BRIEF MEETING WITH DISTRICT EXECUTIVE DIRECTOR (DED) OF KIBAHA

The team had a short discussion with Ms. Tatu Selemani - DED; discussion was based on the following issues:-

4.2.1.1 ENVIRONMENTAL ISSUES/CHALLENGES

(i). Floods; during rainy season, some parts of the Kibaha District Council are frequently flooded. It was reported that these rains are occurring in the upper catchment of Ruvu River in Uluguru Mountains in Morogoro Region and some parts of Coast Region. Good examples of affected areas are Ruvu River at Mlandizi and Ruvu Village and small scale farmers who practice agricultural activities along lower Ruvu catchment.

(ii). Encroachments; farming next to river banks is wide spread in areas like Mwanabwito and Mwadima villages (sixty meter is not observed). Plots allocation for residents and industries e.g. Top Choice Industries in wetlands at Mlandizi area.

(iii). Sand mining; there is wide spread of sand mining in different locations such as Wards of Boko, Gwata, Kikongo, Soga and Mpiji River catchment. Soga site was observed to be a recharge area for most of wetlands observed in most of the areas; the water table seemed to be high.

(iv). Conflicts between farmers and pastoralists.

4.2.1.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

- (i). Construction of storm water drainage systems to channel storm water from Mlandizi area to the Ruvu River to reduce storm water stagnation (referred to Mlandizi wetland).
- (ii). The district has given stop order and further actions are taken against illegal sand miners.
- (iii). Awareness raising; the district continues to raise awareness of environmental protection to different stakeholders and/or community, joint efforts between the district, NEMC and Wami/Ruvu Basin is needed.

4.3 WAMI/RUVU BASIN WATER BOARD (WRBWB)

The Wami/Ruvu basin with an area of 66,295km² is located in east-central area of the country. The basin is located on 6 regions and 27 districts. Table below indicates the regions and districts in Wami/Ruvu Basin.

Table 3: City, Regions and Districts in the Wami/Ruvu Basin

Region	District Municipality
Dar es Salaam	Ilala
	Temeke
	Kinondoni
	Ubungo
Dar es Salaam	Kigamboni
Pwani (Coast)	Bagamoyo
	Kisarawe
	Kibaha (Township)
	Kibaha (District)
	Chalinze
	Mukuranga

Morogoro	Kilosa
	Mvomero
	Morogoro Rural
	Morogoro Urban
	Gairo
Tanga	Handeni
	Kilindi
Manyara	Kiteto
Dodoma	Dodoma Rural
	Dodoma Urban
	Chamwino
	Bahi
	Kondoa
	Mpwapwa
	Kongwa
	Chemba

Source: Wami/Ruvu Basin Water Board, 2018

4.3.1 BRIEF MEETING WITH WAMI/RUVU BASIN WATER BOARD STAFFS - HEAD OFFICE

The Ag. Basin Water Officer presented an overview of the Basin and covered the following environmental issues /challenges;

- (i). Farming practices that does not observe environmental conservation,
- (ii). Irrigation that does not observe good water management,
- (iii). Illegal mining (Kibangile, Rudovelo and Kinda Villages)
- (iv). large herds of livestock compared to the carrying capacity of the area
- (v). Industrial and domestic waste water pollution (e.g. 21st Century is discharging its untreated Industrial effluent into Ngerengere River)

- (vi). Change of natural river course (water losses)
- (vii). Settlements in water sources e.g. Uluguru Mountains, Upstream Mindu Dam
- (viii). Brick making along river banks
- (ix). Undesignated dumping of solid wastes (e.g. Kihonda solid waste dumping site in Morogoro Municipal Council)
- (x). Car wash along important water sources (Ngerengere River at Bwawani, Morogoro River at Morogoro Municipal Council).

4.4 MVOMERO DISTRICT COUNCIL

Mvomero District Council is among the 7 district councils of Morogoro region in Tanzania. Other district councils are Gairo, Kilombero, Kilosa, Ulanga, Morogoro rural and Morogoro urban. To north, it is bordered by Tanga Region, to the northeast by Pwani Region, to the east and southern by Morogoro Rural District Council and Morogoro Urban District Council, and to the west by Kilosa District Council. It is about 131 kilometers away from Morogoro Town with total area 7325 km² (Mvomero DC, 2017).

4.4.1 ENVIRONMENTAL ISSUES/CHALLENGES DISCUSSED;

4.4.1.1 IN WAMI RIVER SUB CATCHMENT, ARE AS FOLLOWS:-

- (i). Illegal mining in water sources; Mkingu Nature Reserve where Mkindo River is originating in Makate, Kinda, Semwali and Kisimagulu Villages.
- (ii). Farming practices that does not observe environmental conservation,
- (iii). Irrigation that does not observe good water management,
- (iv). Large herds of livestock compared to the carrying capacity of the area (Kambala and Lukenge Villages)
- (v). Change of natural river course (water losses)

- (vi). Settlements in water sources e.g. Unguu Mountains
- (vii). Brick making along river banks
- (viii). Deforestation
- (ix). Bush fire Diwale and Mkindo Rivers
- (x). River siltation e.g. Mvomero River at Mvomero irrigation scheme
- (xi). Impact of Climate change in Hembeti village and Mvomero River

4.4.1.2 IN NGERENGERE RIVER SUB CATCHMENT ARE AS FOLLOWS:-

- (i). Illegal mining in water sources; Mindu Forest Reserve,
- (ii). Farming practices that does not observe environmental conservation in Mgeta, Tangeni, Tchenzema, Mzinga, Mlali villages,
- (iii). Irrigation that does not observe good water management (illegal abstraction and low water use efficiency),
- (iv). Large herds of livestock compared to the carrying capacity of the area (Mongwe Village)
- (v). Settlements in water sources e.g. Uluguru Mountains
- (vi). Brick making along Ngerengere River banks
- (vii). Deforestation
- (viii). Illegal fishing using **Utupa**
- (ix). Conflicts exists between farmers vs farmers, farmers vs pastoralists and pastoralists vs pastoralists

4.4.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

- (i). There are already Land use plans/Frameworks in the following villages; Melela, Mlali, Bunduki, Vinile, Maguruwe and Tandali.
- (ii). There are villagers who have already issued Certificate of Customary Right of Occupancy (CCRO) in Dihombo, Kigugu, Mgongola and Hembeti villages

- (iii). Collaborating with Non Governmental Organizations (NGOs) to stop Illegal Miners
- (iv). Collaborating with Wami/Ruvu Basin to carryout water use inventory,
- (v). Collaboration with Wami/Ruvu Basin to raise awareness to the communities on overall environmental management issues
- (vi). Initiate alternative Income generating activities (IGA)

4.5 KILOSA DISTRICT COUNCIL

Kilosa District Council is among the 7 district councils of Morogoro region in Tanzania. Other district councils are Gairo, Kilombero, Mvomero, Ulanga, Morogoro rural and Morogoro urban. To north, it is bordered by Gairo District Council, to the east by Mvomero District Council, to the south by Kilombero and Kilolo (in Iringa region) District Councils, to the west by Mpwapwa District Council (in Dodoma region), and to the southwest by Kongwa District council (in Dodoma region). It is about 100 kilometers away from Morogoro Town and 300 kilometers west of Dar es Salaam with total area 12,394 km². (Kilosa DC, 2016)

4.5.1 ENVIRONMENTAL ISSUES/CHALLENGES DISCUSSED;

Kisangata River at Mvumi (issues raised by Kisangata Water Users Association)

- (i). Change of natural river course (water losses) - Kisangata River
- (ii). Illegal mining in water sources; Mtega village in Ibondo Hamlet
- (iii). Farming practices that do not observe environmental conservation in Mvumi, Mvumi – Gongwe and Mambegwa Villages.
- (iv). Irrigation that does not observe good water management (illegal abstraction and low water use efficiency),
- (v). Large herds of livestock compared to the carrying capacity of the area (Muutumi, Bomba Kumi and Mandela)
- (vi). Settlements in water sources e.g. Ukaguru Mountains

4.5.1.1 DED KILOSA DISTRICT COUNCIL

DED Kilosa identified the following challenges;

- (a). Floods; during rainy season, some parts of the Kilosa District Council are frequently flooded. It was reported that these rains are occurring in the upper catchment of Kinyasungwe River Sub catchment in Ukaguru Mountains, Mpwapwa, Gairo and Chamwino Districts. Good example of affected areas are Kivungu, Magomeni, Kidete, Mkadage, Munisagala and Msaganza villages and small scale farmers who practice agricultural activities along Mkondoa River sub catchment.
- (b). Farming practices that does not observe environmental conservation,
- (c). Irrigation that does not observe good water management (e.g. Lumuma Village)
- (d). Illegal mining
- (e). large herds of livestock compared to the carrying capacity of the area
- (f). Change of natural river course (water losses)
- (g). Settlements in water sources e.g. Ukaguru Mountains, Upstream Mkondoa River
- (h). Deforestation
- (i). Conflicts exists between farmers vs farmers, farmers vs pastoralists and pastoralists vs pastoralists
- (j). Poachers/bush fire
- (k). Investors not being able to revamp the defunct farms that existed in the district has led to unemployment as a results most of former employee opts to encroach and carryout farming activities in river banks and water sources

4.5.2 POSSIBLE SOLUTIONS/EFFORTS ACHIEVED

- (a). Awareness raising to the pastoralists on reducing the Number of herds according to the available land carrying capacity, complying with relevant Regulations and bylaws
- (b). Livestock Branding

- (c). Reduction of conflicts between farmers and pastoralists by 83%
- (d). Alternative income generating activities
- (e). Construction of 4 km flood protection dike along Mkondoa River at Magomeni in Kilosa Township
- (f). Sustainable fishing at Miyombo Dam

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Based on the above observation and consultation made by the team, the team realized that, there is a threat of destruction of the basin ecosystems. The major concerns with regard to the destruction of basin ecosystems are:

- i. Encroachments; destruction of coastal mangrove ecosystem in some parts to meet social economic needs and plots allocation (for residents and industries) in wetlands;
- ii. Sand mining; there is wide spread of sand mining in different locations such as Wards of Boko, Gwata, Kikongo, and Soga in Bagamoyo district and Mpiji River catchment;
- iii. Undesignated dumping of solid wastes (e.g. Kihonda solid waste dumping site in Morogoro Municipal Council);
- iv. Illegal mining in water sources; Mkingu Nature Reserve where Mkindo River is originating (in Makate, Kinda, Semwali and Kisimagulu Villages), Mindu Forest Reserve and (in Kibangile, Rudovelo and Kinda Villages)
- v. Floods; during rainy season, some parts of the basin are frequently flooded (e.g. Ruvu River at Mlandizi and Ruvu Village, Tandika market located at Dunda Ward, Bagamoyo Irrigation Development Project, Sea Salt and small scale farmers who practice agricultural activities along lower catchment of both rivers);
- vi. Farming practices that does not observe environmental conservation (e.g. in Mgeta, Tangeni, Tchenzema, Mzingu, and Mlali villages).

5.2 RECOMMENDATIONS

From the observations and stakeholders' consultations, the team recommends the following:

i). Consider the Strategy for Urgent Action on Land Degradation and Protection of Water Catchment (2006), which has provided measures and directions that have to be taken to combat land degradation and protection of water sources in the country. Key areas that have been highlighted include:

- a. Prevention of environmental degradation due to illegal human activities;
- b. River bank encroachment (EMA, 2004; WRMA, 2009);
- c. Limited public awareness on environmental management issues;
- d. Land use conflicts (agriculture, mining, establishment of protected areas); and
- e. Pollution emanating from indiscriminate use of plastics.

ii). Different Stakeholder Ministries and Institutions should be involved in the implementation of short,, medium and long-term measures to address these issues.

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Kibaha District Council, 2017. District Investment Profile

Wami/Ruvu Basin Water Board, P. O. Box 826, Morogoro, Tanzania

Mvomero District Council, 2017. District Socio - Economic Profile

Kilosa District Council, 2016. District Socio - Economic Profile

APPENDICES

Appendix 1: List of People Met

S/N	Name	Institution	District
01	Mr. Charles Wambura – Ag. DED	Bagamoyo District Council	Bagamoyo
02	Mr. xxxxxxxx zzzzzzzzz – DEMO		
03	Ms. Hanifa B. Shemzigwa – Ag. WEO	Magomeni Ward, Bagamoyo DC	
04	Emmanuel Kiwasira – Chairperson	Bagamoyo Irrigation Development Project (BIDP)	
05	Hassan Chamzira – Deputy Chairperson		
06	Jabir Mdoe – Advisor (irrigation expert)		
07	Tabu Nassoro – Member		
08	Wilfred Nazari – Member		
	Hanifa Rajab – Member		
	Jabir Mdoe – Secretary		
09	Zuberi Gembe – Member		
10	Rajabu Chejo – Member		
11	Ms. Ruth Godson Mhezi – WEO	Makurunge Ward – Bagamoyo DC	
12	Mr. Chapa xxxxxxxxxxx – Chairperson	Number 4 Village, Makurunge Ward – Bagamoyo DC	
13	Mr. (jina la yule bwana wa kihindi) – cheo		

14	Mr. Chaula xxxxxxxxxxxxxx – cheo	Sadani Sea Salt Company	
15	Ms. Tatu Selemani – DED		
16	Ms. Xxxxxxxxxx zzzzzzzzzzz – DEMO	Kibaha District Council	Kibaha
17	Mr. xxxxxxxxxxxx zzzzzzzzzzz – resident	Mlandizi wetland	
18	Tumaini Lukanazya – Ag WO		
19	Nickbar Mwanana – CDO		
20	Joyce Mkwiche – Water Lab		
21	Rehema Omindo – CDO	Wami/Ruvu Basin Water Board (WRBWB)	Morogoro Urban
22	Jamila Tuwa – Hydrogeologist		
23	Joseph Daud – Water Engineer		
24	Mr. Florent Kyombo – DED		
25	Abdallah Lusewa – DEMO	Mvomero District Council	Mvomero
26	Seif Ramadhani Msangi – DEMO		
27			
28			
29			
30		Kisangata Water Users Association	
31			
32			
33	Mr. Mkambala Kessy Juma – DED		
34	Aloyce O. Semiono – DEMO	Kilosa District Council	Kilosa
35	Joseph Sudi Bunyelele – resident	Kihonda oxidation ponds	Morogoro Urban
36		Msamvu fish farms	

37		Msamvu Car wash	
38			

Appendix 2: Stakeholders` Identification

Districts in the Wami/Ruvu Basin, its importance and Environmental Challenges

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
1	Dar es Sala am	Ilala	Economic importance – Industrialized Municipal area Groundwater potential areas	☐ Msimbazi River encroachment Msimbazi River pollution from Industrial and domestic effluent - Highly populated Groundwater pollution from unsustainable borehole development Unplanned settlements – Buguruni kwa Mnyamani	2	V

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
				Dumping site (Kinyamwezi) within Kizinga River sub catchment Sand mining in the Mzinga/Kizinga River Sub catchments Salt water intrusion in groundwater		
		Temek e	Economic importance – Industrialized Municipal area, business centers Groundwater potential areas	Sand mining for construction and industrial inputs Mzinga and Kizinga River encroachment Mzinga and Kizinga Rivers Pollution from Domestic and Industrial effluents Groundwater pollution from unsustainable borehole development Unplanned settlements - Mbagala	3	V
		Kinond oni	Economic importance – Industrialized Municipal area, business centers Groundwater potential areas	☐ Sand mining along River Banks Encroachment within 60 m along river banks Mlalakuwa, Ubungo, Mbezi Rivers pollution from solid waste disposal, industrial	4	

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
			– Sinza, Mwananyamala, Magomeni,	and domestic effluent discharges Unplanned settlements – Manzese, Kinondoni (Bonde la Mpunga) Groundwater pollution - Manzese, Sinza		
		Ubung o	Economic importance - Industrialized area, business Centers	Sand mining along Mpiji River River bank encroachment Pollution from solid waste and domestic effluent disposal Groundwater pollution	5	
		Kigam boni	Groundwater potential areas; Kimbiji - Future water source for Dar es Salaam City, Economic importance – growing Industrialized Municipal area, business centers	□ Limestone mining for cement production Shore destruction due to settlements development Sand mining Groundwater development – Dar es Salaam future water source Groundwater pollution Wetland destruction due to encroachment and settlements	1	V

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
				Possible salt water intrusion		
2	Coas t	Bagam oyo	Historical town Growing Industry and Business center Saadani National Park Irrigation potential area	☐ Floods Livestock Large and Small scale irrigation activities Ruvu and Wami River encroachment Conflicts over land Estuary destruction – tree cutting – Mangroves Possible industrial pollution Shallow Groundwater pollution – salt water intrusion	1	V
		Kisara we		☐ Sand mining Livestock Ruvu River encroachment Forest reserve encroachment – Kazimzumbwi and Pugu Forest Reserve – Kizinga River water source Kaoline mining	5	

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
		Kibaha (Township)		Sand mining along Mpiji River Mpiji River encroachment	6	
		Kibaha (District)		☐ Sand mining along Mpiji River Wetland encroachment Quarry for road construction Ruvu River encroachment Livestock Flooding along Ruvu River Wetland encroachment - Settlements	3	V
		Mukuranga	Source of materials for industrial input – sands for ceramic industries Groundwater potential area (Mpera) – major water source for the district is groundwater One of the source of	☐ Sand mining for construction and industrial materials – Ceramic industries Wetland encroachment – Lake Manze and Funza area Mbezi River encroachment Wetland encroachment	2	V

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
			recharge for the Kimbiji aquifer – future water source for Dar es Salaam City and other areas around			
		Chalinz e		☐ Livestock – Ruvu and Wami Rivers Ruvu River floods Quarries – mining for aggregates Ruvu and Wami Rivers encroachment	4	
3	Moro goro	Kilosa	Potential land for farming – Potential for irrigated agriculture Source of materials for industrial input Source of pasture for livestock Historical town Mikumi National Park	large herds of livestock Large and Small scale irrigation activities Wami River encroachment Water loss Wetland encroachment – Kivungu, Tindiga, Mvumi etc Quarry for road construction Small scale mining in water sources	1	V

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
			Water source for most of Wami River tributeries – Wami, Kisangata, Tami, Ilonga,	River siltation – as a result flood and water loss in Mkondoa, Miyombo, Kisangata Thami and Mkata Rivers		
		Mvomero	Potential land for farming – Potential for irrigated agriculture Source of materials for industrial input Source of pasture for livestock Mikumi National Park Water source for Wami River tributeries – Divue, Mkindo, Mkundi	☐ Livestock Large and Small scale irrigation activities Wami River encroachment Water loss Wetland encroachment Quarry for road construction Small scale mining in water sources River siltation – as a result flood and water loss in Mkindo and Divue Rivers	2	V
		Morogoro Rural	Potential land for farming –	☐ Livestock Large and Small scale irrigation activities	3	V

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
			Potential for irrigated agriculture Source of materials for industrial input Source of pasture for livestock Selou Game Reserve Forest reserves Water source for Ruvu River tributaries – Mbezi, Mfizigo, Mgeta, Mvuha,	Ruvu River encroachment Water loss - Mvuha Wetland encroachment Quarry for road construction Small scale mining in water sources Kibangile, Ludevero villages Encroachment in Forest reserve – River siltation – as a result flood and water loss in Mvuha and mbezi Rivers downstream		
		Morogoro Urban	Business town Industrial area Uluguru Nature Reserve Mindu Forest reserves Water source for Ruvu River tributary – Ngerengere River	Livestock Large and Small scale irrigation activities Ruvu/Ngerengere River encroachment Wetland encroachment Upstream Mindu Dam Quarry for Aggregates Sand mining around Mindu Dam	4	V

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
			Water source for Morogoro Municipality – Mgoole, Morogoro, Tangeni, Ngerengere, Mlali, Mzinga and Mgera Rivers	Unprotected land fill for solid waste – environmental pollution Industrial Pollution from untreated effluent discharges River siltation – as a result flood and water loss in Ngerengere River at Mgera tributaries Encroachment of water sources from Uluguru Mountains		
		Gairo	Arable land Growing business town	Livestock Large and Small scale irrigation activities Ruvu/Ngerengere River encroachment Quarry for Aggregates Sand mining River siltation – as a result flood and water loss in Ngerengere River at Mgera tributaries Land degradation Illegal mining in water sources	5	

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
4	Tang a	Hande ni		Livestock Small scale irrigation activities Mkundi River encroachment Quarry for Aggregates Sand mining River siltation	2	
		Kilindi		Livestock Small scale irrigation activities Wami River tributaries encroachment River siltation Quarry for Aggregates	1	
5	Many ara	Kiteto	Good land for agriculture	Livestock Small scale irrigation activities Mkundi River encroachment Quarry for Aggregates Sand mining within river course Land degradation	1	

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
				River siltation		
6	Dodo ma	Dodom a (Urban)		Sand and aggregate mining for road and building construction for a new City development Rampant groundwater development for Domestic and irrigation use Siltation of Flood control Dams	1	V
		Cham wino		Kinyasungwe River encroachment Water source encroachment	3	
		Bahi				
		Kondo a				
		Mpwap wa		Kinyasungwe River encroachment Land degradation Kinyasungwe River siltation Small scale irrigation activities	2	
		Kongw a				

S N .	Regi on	District/ Munici pality	Importance	Environmental challenges	Priority / Rank for each District	Select ion
		Chemba				

Appendix 3: Relevant Stakeholders for the Workshop

S N	Stakeholder Name		Professional	No. of People
1	Line Ministries	Mazingira	Environmental Officer	2
		Maji na Umwagiliaji (MoWI)	Irrigation Engineer	2

S N	Stakeholder Name	Professional	No. of People
		Mifugo na Uvuvi	2
		Mali Asili na Utalii	1
		Kilimo	1
		Viwanda	1
		TAMISEMI	1
2	Institutions	NEMC	5
		Higher Learning Institutions - UDSM, SUA, Mzumbe, WRI (Chuo cha Maji), ARU (Chuo cha Ardhi)	5
		Wami/Ruvu Basin Water Board	3
		Water User Associations (Mkindo, Wami, Kisangata, Miyombo, Mfizigo and Ngerengere Juu B)	5
		Water Supply Authorities (CHALIUWASA and MORUWASA)	2
		Vikundi vya Mazingira(Mecca Group Morogoro, Mvumi Environmental Action)	2
		Saadani NP, Mikumi NP, Selou GR and	4
3		Mtibwa Sugar Company	1

S N	Stakeholder Name		Professional	No. of People
	Private Sectors	TBL		1
		Bakhressa		1
		Mkulazi Holdings		1
		21st Century		1
4	NGOs	WARIDI		1
		Water Aid		1
		Shahidi wa Maji		1
5	LGAs			
	Dar es Salaam	Kigamboni		1
		Ilala		1
		Temeke		1
	Pwani	Bagamoyo		1
		Mkuranga		1
		Kibaha DC		1
	Morogoro	Kilosa		1
		Mvomero		1
		Morogoro Municipality		1
		Morogoro DC		1
	Dodoma	Dodoma City		1
		Mpwapwa		1??
5	Vyombo vya Habari	TV, Magazeti, Utamaduni – e.g. Bw. Mpoto		10

Appendix 4: A map showing distribution of (areas visited) ecosystems examined during field study