ASSESSMENT OF ENVIRONMENTAL MANAGEMENT SYSTEMS FOR AGRO INDUSTRIES AND BOTTLING COMPANIES IN WAMI-RUVU AND PANGANI WATER BASINS

SYNTHESIS REPORT

February 2008

Prepared by the
Tanzania Health and Environmental Sanitation Association (THESA)
with support from the Water and Development Alliance (WADA)

The Tanzania Coastal Management Partnership for Sustainable Communities and Ecosystems

The Water and Development Alliance (WADA) is collaboration between the Coca – Cola System (including corporate, foundations, and bottling partners) and USAID to improve water resources management and expand access to improved drinking water and sanitation services for poor and marginalized people in developing countries.

This publication is available electronically on the coastal Resource center's website at http://www.crc.uri.edu. For more information contact: Coastal Resource Center, University of Rhode Island, Narragansett Bay Campus, South Ferry Road, Narragansett, Rhode Island 02882, USA. Tel: (401) 874-6224; Fax: (401) 874-6920.

Citation:

Tanzania Health and Environmental Sanitation Association (THESA) 2008. Assessment of Environmental Management Systems (EMS) for Agro-industries and bottling Companies in Wami-Ruvu and Pangani Water Basins, 24 pp.

Disclaimer:

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the Coastal Resource Center at University of Rhode Island as part of the Tanzania Coastal Management Partnership for Sustainable Coastal Communities and Ecosystems in Tanzania. Cooperative Agreement No. 632-A-00-05-00339-00

On the Cover: Mtibwa Sugar Factory, Tanzania

Cover photo credit: Karoli Njau

Edits and design: Gratian Luhikula, Appa Mandari, Jeremiah Daffa
Don Robadue, James Tobey

ACRONYMS

BBL	Bonite Bottler Limited
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
E&WR	Environmental and Water Resources
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMS	Environmental Management System
FMT	Field Machinery and Transport
g	Gram
h	Hour
ha	Hectare
kg	Kilogram
KSE	Kigombe Sisal Estate
l	Litre
m	Metre
mg	Milligram
MSE	Mtibwa Sugar Estates
NAWAPO	National Water Policy
TDS	Total Dissolved Solid
t	Ton
THESA	Tanzania, Health and Environmental Sanitation Association
TPC	Tanganyika Planting Company
WUA	Water Utilization Act
TCMP	Tanzania Coastal Management Partnership
URI	University of Rhode Island
CRC	Coastal Resource Center
NEMC	National Environmental Management Council

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

FOREWORD

This report of the assessment of environmental management system for agro-based industries and bottling companies in Wami-Ruvu and Pangani basins has been prepared by THESA through TCMP and its landscape- seascape initiative under the Water and Development Alliance project supported by the United States Agency for International Development (USAID). The intention of the report is to disseminate present status of Environmental Management System (EMS) in agro-based industrial operations in the two basins with the goal of improving environment management practices and promoting bio-diversity conservation.

The assessment work started in February 2008. Since then it has conducted EMS assessment of four agro-based industries with recommendations on improvements. The agro-industries assessed include: Mtibwa and Tanganyika Planting Company Sugar factories; Coca Cola bottling Companies and Kigombe sisal estate. The project has 16 month timeframe and a focus on water sanitation and education, strengthening of community organizations, environmental flow assessment and improved agro-industrial environmental practices.

ACKNOWLEDGEMENTS

The Coastal Resource Center (CRC) of the University of Rhode Island (URI) wishes to thank all partners who contributed to this report.

The implementation of the Environmental Management System (EMS) assessment work is a result of the efforts made by the THESA in collaboration with other partners. This task would not have been possible without the support and co-operation of the agro-based industries and many individuals. URI/CRC wishes to express sincere gratitude to all those people and organizations that in various ways contributed to the successful implementation of EMS Assessment work, one of the components in Water and Development Alliance (WADA) Program.

We are gratefully acknowledging that funding was provided by the United States Agency for International Development (USAID), the Coca-Cola Africa Foundation, and the Coca-Cola Atlanta Foundation through the Water and Development Alliance (WADA). Their timely financial support contributed much toward the smooth implementation of this work.

It is a pleasure to acknowledge Ms Appa Mandari, the WADA coordinator, who worked tirelessly to key in this program. Special thanks also should be extended to Tanzania Coastal Management Partnership (TCMP) Manager, Mr. Jeremiah Daffa and to its entire staff for their voluminous assistance and cooperation during all the time of project implementation. We also recognize the efforts of Mr. Don Robadue and Dr. James Tobey URI/CRC for their valuable technical contribution including reviewing and editing the report.

We also feel greatly indebted to other WADA implementing partners including, World Vision Tanzania, Environmental Flow Assessment (EFA) team and Wami-Ruvu Water Basin Office staff for their cooperation which made our work to be successfully completed. Also we would like to express our most sincere gratitude to the management and staff of all four visited industries, Kigombe Sisal Estates (KSE), Mtibwa Sugar Estates (MSE), Tanganyika Planting Company (TPC) and Bonite Bottlers Limited (BBL) for their cooperation and contributions during EMS assessment in their respectively industries.

We acknowledge all people who participated in the two day start-up workshop organized in Dar es Salaam to discuss the implementation and management of WADA program. They spent long hours looking at the appropriate means for the running WADA Program. It is not possible to mention them all. We sincerely thank them all for their collaborative efforts.

Finally we dedicate this auspicious result to the THESA members who allowed their expert team to work tirelessly in order to arrive at the intended achievements of this assignment. Their tolerance, support and working extra hours were of the great value for the team to accomplish the assignment on time.

EXECUTIVE SUMMARY

This report presents the status of Environmental Management System (EMS) in three agro-based industrial operations in the Wami-Ruvu and Pangani River basins. The companies covered were Mtibwa Sugar Estate (MSE) Company Ltd, the Tanganyika Planting Company (TPC) Sugar Estate and Kigombe Sisal Estate (KSE). The report also covers assessment of EMS and documentation of good practices for two bottling companies namely Bonite Bottlers Limited (BBL) and Coca Cola Kwanza which are franchise companies of Coca Cola International, also in the two river basins.

The main environmental impacts of these industries are aquatic, atmospheric and solid waste emissions. In cooperation with MSE, TPC, KSE and BBL the recommendations on effectiveness of current approaches and potential improvements on best-practices; reduction of water consumption and improvement of solid waste and wastewater treatment methods have been proposed.

Of the four companies visited only BBL is implementing an elaborate EMS and that has ensured that environmental issues are integrated in the day to day activities of the company. The MSE, TPC and KSE do not have an elaborate EMS in place. Currently the environment management issues are not integrated in the overall management of these industries. MSE, TPC and KSE have a number of good practices safeguarding the environment although these are done for other reasons than environment concern such as energy recovery. Based on this survey, it has been proposed that MSE, TPC and KSE establish an environmental management system.

If EMS is conceived and implemented at these three industries, it would enable them to manage their environmental risks and set quantifiable targets for achieving environmental gains, reduced costs and increased efficiencies. The EMS works by having common reporting standards, which then would allow the MSE, TPC and KSE to manage trends and new developments and to report publicly.

The four companies have demonstrated “good practices” in the following areas:

(i) Excellent housekeeping in the processing area, stores and waste management at BBL, MSE, TPC
(ii) The wastewater is collected and treated in a wastewater treatment system at MSE and BBL
(iii) Reuse and Recycling of bagasse for energy and floor cleaning, Recycling of filter mud in cane farms at MSE and TPC, Recycling the sisal bole back into the sisal farms as fertilizer KSE.
(iv) Reuse of molasses through a feedlot project and sale to community at MSE and TPC
(v) Proper handling of solid waste, Collection and disposal of scrap metals to the scrap metals dealers at TPC, MSE and BBL
(vi) Fire fighting equipment is in place and well placed, Personal protective gears are in place and used.
(vii) Medical waste incinerator and dump at TPC
(viii) Vetiver grass technology for protection of irrigation canals from soil erosion, drip irrigation system at TPC
(ix) Proper record keeping and management of all materials at TPC, BBL and MSE

The following have been identified as potential areas for improvement:

(i) Establishment of elaborate EMS that will ensure that the environmental issues are well integrated in the management of the companies for TPC, MSE and KSE
(ii) Documentation of “good practices” at MSE, KSE and TPC;
(iii) Insulation of hot pipes and equipment; Control of leaks at MSE;
(iv) Re design waste water treatment ponds and integrate the treated wastewater in the irrigation system of the Estates at MSE;
(v) Improvement of oil trapping system to separate used oil from FMT wastewater at MSE;
(vi) Establishment of wastewater treatment system (Activated Sludge system, Bio digester, in combination with Constructed Wetland etc.) at KSE;
(vii) Establishment of solid waste management system at KSE (solid waste can be directed to produce energy, sold to biomass using companies for energy production).Establishment of biogas plant that would produce electricity and fertilizer at KSE **(**Refer UNIDO project);
(x) Recycle the treated wastewater for watering gardens in factory premise at BBL
(xi) Start up community irrigation projects in the nearby villages to use the treated water at BBL.
(xii) Disposed off the obsolete chemicals at BBL and TPC

1 INTRODUCTION

1.1 WHAT IS WADA?/ ROLE OF WADA

The Water and Development Alliance (WADA) is a program that supports Tanzania's new water governance strategy. The programme is implemented in two river water basins namely Wami-Ruvu and Pangani River Basins within the administrative regions of Dar es Salaam, Pwani, Morogoro, Kilimanjaro and Tanga.

The programme is managed through the USAID/Tanzania's environment and natural resources management strategic objective and implemented by a partnership involving the Kwanza and Bonite Coca-Cola Bottlers, World Vision, the Tanzania Health, Environment and Sanitation Association (THESA), the Coastal Resources Center at the University of Rhode Island/Coastal Resource Centre through its Tanzania Coastal Management Partnership (TCMP) program office located in Dar es Salaam, Florida International University through its GLOWS program site in the Mara River Basin, the Division of Environment in the Vice President's Office, the National Environment Management Council (NEMC), the Ministry of Water, the Ministry for Local Governments, the Wami-Ruvu River Basin Office, the Pangani River Water Basin Office, District Councils, Village Water Committees, Saadani National Park, and agro-industrial sugar and sisal producers including the Tanganyika Planting Company the Mtibwa Sugar Estate and the Kigombe Sisal Estate.

1.2 ABOUT THESA

THESA (Tanzania Health and Environmental Sanitation Association) is a Non-Governmental Organization (NGO), which among others provides multidisciplinary consultancy services to public and private clients in Tanzania. THESA endeavors to provide high standard quality service through application of the most appropriate participatory methodologies and skills that are compatible to local environment. THESA provides services in environmental management system, environmental impact assessment, environmental auditing and promotion of hygiene and sanitation education.

1.3 ENVIRONMENTAL MANAGEMENT SYSTEM

In the Pangani and Wami-Ruvu watersheds, agro-industrial plants are major users of water resources and at the same time, a prime source of environmental pollution. Consultations with five agro-industries including sugar and sisal producers and bottlers assessed the implementation of Environmental Management Systems (EMS) and made recommendations to reduce water consumption and waste generation. The companies covered were Mtibwa Sugar Estate (MSE) Company Ltd, the Tanganyika Planting Company (TPC) Sugar Estate and Kigombe Sisal Estate (KSE). The report also covers assessment of EMS and documentation of good practices for two bottling companies namely Bonite Bottlers Limited (BBL) and Coca Cola Kwanza which are franchise companies of Coca Cola International, also in the two river basins.

The Tanzania Health and Environmental Sanitation Association (THESA) worked with these firms to identify good practices that are both low in cost and that can improve compliance with water and environmental laws.

Sugar industry is one of the most important industries in Tanzania. There are currently four major sugar estates in Tanzania namely Kilombero, Mtibwa, TPC and Kagera Sugar Estates. Mtibwa and Kagera sugar estates are owned by the same company. Compared with other manufacturing industries, the sugar industry sector is a minor contributor to environmental loads, as most of its outputs are not hazardous. However, sugar industry

produces high amounts of biodegradable waste, and the high organic loads of liquid effluents (wastewater) also represent a major problem.

The Sisal industry has been one of the most important industries in Tanzania. This industry produces high amounts of biodegradable solid waste and the high organic loads of liquid effluents (wastewater). Location of sisal processing facilities close to water streams and their need for a lot of process water represent a major problem.

Long sisal fibres and its products is the mainstay of the industry and this is what has kept the industry going. The fibre is however, only 2-4 percent of the sisal plant. The rest is a biomass and short fibres that are thrown away. This is more prevalent in Tanzania where the mode of production has predominantly been estate based and therefore leaves are transported to a central factory for decortications thus disposal of huge amount of biomass becomes a problem. The traditional answer has been to pump in a lot of water to convey this material from the decorticator - at some places directly into a river causing serious oxygen depletion in the water.

Meanwhile water is becoming an increasingly scarce resource and therefore limiting agricultural and industrial development in many regions and countries of the world. Globally, efficient and sustainable management of water resources is increasingly becoming a policy objective. The MSE is one of major agro-industry area in Wami-Ruvu Basin while TPC and KSE are in Pangani Basin. The sugar companies consumes large amount of water for plant and equipment washing, for irrigating sugarcane farms and other industrial and domestic utilization. The resultant wastewater has a high organic content, containing parts of the sugarcane, cleaning agents, salts, chemicals and suspended solids. The KSE consumes large amount of water mainly for sisal processing, plant and equipment washing. The resultant wastewater has a high organic content, containing parts of the sisal (biomass) and suspended solids that is discharged to the Kigombe River without any environmental management consideration. Bottling companies consume large amount of water for beverages production in the plant and for washing activities. Due to hygienic and food safety considerations, most of the utilized water should be of drinking water quality. The BBL is therefore one of major water consumer in Pangani River Basin. The resultant wastewater contains parts of the chemicals, cleaning agents, and suspended solids.

1.4 GOVERNANCE SYSTEM FOR WATER RESOURCES

Water Policy

Water resources, management and the National Water Policy (NAWAPO) is based on the national water policy of Tanzania adopted in July 2002.The main objective of NAWAPO is to develop a comprehensive framework for sustainable development and management of the Nation's water resources, in which an effective legal and institutional framework for its implementation is put in place. This policy seeks to address cross- sectoral interests in water, watershed management and integrated and participatory approaches for water resources planning, development and management. The following extracts from the NAWAPO highlight this.

Present Water Resources Management System

The Water Utilization (Control and Regulation) Act No. 42 of 1974 and its subsequent amendments govern the present water resources management system. Amendment Act No. 10 of 1981 introduced pollution control aspects. However, the Water Utilization Act and other sub-sector water related laws are inadequate to meet the growing water resources management challenges facing the country today.

Water and Social - Economic Development

Water is a basic natural resource for sustenance of life and for socio-economic development. As a source of natural capital, water in adequate quantity and quality is a primary input for a whole array of productive activities. It is fundamental for various social – economic development activities such as industrial production, irrigated agriculture, livestock keeping, mineral processing, hydropower production, navigation, recreation and tourism and the sustenance of ecosystems

Irrigation is a highly consumptive water user and makes greatest impact on net water resources. In the Pangani and Rufiji basins, for example, irrigation systems are located upstream of major hydropower plants thus the two sectors are competing for the same source of water. Agricultural activities also contribute to pollution from the use of agrochemicals, which are washed by rainwater and find their way to water sources.

Industrial performance depends, among other factors, on reliable water supply. This implies that adequate and reliable water supply is required for the growth of this sector. The growth in the industrial sector will have significant impact on the water supply and also in terms of potential pollution and degradation of water resources due to industrial solid wastes and effluents if not properly disposed of but are allowed into water bodies without adequate treatment.

Water Resources Management Challenges

Water is a finite and vulnerable resource, which is under pressure and growing scarce as a result of increasing multi-sectoral demands of the rapidly growing population. Water is also vulnerable due to increasing environmental degradation, which causes unsustainable availability of the resource and hence failure to meet demands. Severe widespread water shortages also occur due to low and highly variable rainfall resulting in inadequate river flows and reservoir levels. Pollution from point and non-point sources of water resources is responsible for the deterioration of the quality of water, makes water unusable and its treatment very costly. Increased human activities including poor land use practices, as well as uncontrolled abstractions and pollution of water bodies impact on the quantity and quality of the available water resources. All these have manifest implications in the overall availability of the water resources for domestic uses, agriculture, industrial, energy production, ecosystem and environmental sanitation, which result in competition and conflicts among the different social and economic sectors.

1.5 REQUIREMENTS FROM ENVIRONMENTAL LAW

The new environmental management law of Tanzania (EMA 2004) clearly requires individuals and companies to ensure that they do not pollute the environment in the course of their activities. The following extracts from the Act highlight this.

General Prohibition of Pollution

Section 106 (1, 3 and 6) state that

(1): “It shall be an offence for any person to pollute or permit any other person to pollute the environment in violation of any standards prescribed under this act or any other written law regulating a segment of the environment”.

(3): “For the purpose of this section, “the best practicable option”, in relation to the discharge of a contaminant or an emission of noise means the best method for preventing or minimizing adverse effects on human health, life or the environment”.

(6): “It shall be an offence for any person to discharge contaminants or to emit noise without taking into account practicable measures prescribed in the regulations that may be made by the Minister”.

Prohibition of Water Pollution

Sections 109(1 and 2) state that

(1): "Any person who knowingly puts or permits to be put or to fall or to be carried into any stream, so as either singly or in combination with other similar acts of the same nature or interfere with its due flow or pollute its waters, or puts solid refuse of any manufactory or manufacturing process, or put any rubbish or any other waste or any putrid solid matter into such stream, commits an offence".

(2): "Any person who causes to fall or flow or knowingly permits to fall or flow or to be carried into any stream any poisonous, noxious or polluting liquid proceeding from any factory or manufacturing process, commits an offence".

Prohibition to Discharge Hazardous Substance, Chemicals, Materials, Oils, etc

Section 110 (1-3) state that

(1) "No person shall discharge any hazardous substance, chemical, oil or mixture containing oil in any water or any other segment of the environment except in accordance with guidelines prescribed under this Act or any other written law".

(2) "A person who discharges any hazardous substance, chemical oil or mixture containing oil in any water or any other segment of the environment, commits an offence".

(3) "Apart from the general punishment provided for under this Act, the person convicted of an offence under this section may be ordered by the court

(a) To pay the cost of removal including any costs which may be incurred by the Government or Government agency in the restoration of the environment damaged or destroyed as a result of the discharge"; and

(b) To pay the cost of third parties in the form of reparation, restoration, restitution or the compensation as may be determined by the court".

Movement of Hazardous Waste

Section 135(2 and 3) state that:

(2) "Any generator of hazardous waste shall take measure to minimize the generation of such waste"

(3) "Any generator of hazardous waste shall be responsible for its disposal and shall be liable for any damage to human health, living beings and the environment".

Environmental Impact Assessment of Hazardous Waste

Section 136 (1, 2) state that:

(1): "Subject to the provisions of subsection (2), disposal of any hazardous waste shall be done in an environmentally sound manner".

(2): "EIA shall be carried out before hazardous waste is disposed off into soil, land, air or body of water".

Compliance with Standards, etc

Section 141 states that: "Every person undertaking any activity shall be required to comply with environmental quality standards and criteria".

Enforcement of Environmental Quality Standard

Section 142(2) states that: "Subject to the provision of any other law, any person who permits or causes to permit pollution or emission in excess of environmental quality standards and criteria stipulated pursuant to this Act commits an offence".

1.6 REQUIREMENT FROM WATER UTILIZATION ACT

The Water Utilization (Control and Regulation) Act No. 42 of the year 1974 clearly defines offences and penalties to individuals and companies fails to comply with this Act in the course of their activities. The following extracts from the Act highlight this.
Section 33 (4), (5) of this Act states that:

> (4) "Any person who pollutes the water in any river, stream or watercourse or in any body of surface water to such extent as to be likely to cause injury directly or indirectly to public health, to livestock or fish, to crops, orchards or gardens which are irrigated by such water or to any products in the processing of which such water is used shall be guilty of an offence".
>
> (5) "Any person who being required to give information under any provision of this Act or under any regulation made under this Act refuses without reasonable excuse to give such information or gives information knowing the same to be false, or having reason to believe the same not to be true, shall be guilty of an offence".

1.7 ENVIRONMENTAL QUALITY STANDARDS

The national effluent standards are prescribed in the Second schedule of the Water Utilization (Control and Regulation) Act No. 10 of the year 1981.

Table 1: Industrial Effluent Standards: Physical Characteristics

Physical Characteristic	Unit	Effluent for Direct discharge to receiving water: maximum permissible limit	Effluent meant via municipal sewage treatment plant to receiving water: maximum permissible limit
Suspended Solids	mg/l	Not to cause formation of sludge or scum in receiving water	No limit
Color	Number (Pt-Co)	Not to cause any change in the natural taste or odor of the receiving water	100
Taste and Color	-	Not to cause any change in the natural taste or odor of the receiving water	-
Temperature	^{o}C	Not to cause any increase of the receiving water by more than 5 ^{o}C	35 ^{o}C or not more than 5 ^{o}C above ambient temperature of the supplies waster whichever is greater
Total dissolved solids	mg/l	3000; no restrictions for discharge into the sea	7500
pH	-	6.5-8.5	
BOD, 5 days, 20 ^{o}C	mg/l	30	-
BOD, 5 days, 25 ^{o}C	mg/l	34	No limit
BOD, 5 days, 30 ^{o}C	mg/l	37	No limit
Permanganate value	mg/l	80	No limit

Table 2: Industrial Effluent Standards: Chemical Characteristics

Chemical Characteristics	Unit	Effluent for Direct discharge to receiving water: maximum permissible limit	Effluent meant via municipal sewage treatment plant to receiving water: maximum permissible limit
Aluminium (Al)	mg/l	2.0	5.0
Arsenic (As)	mg/l	0.1	0.1
Barium (Ba)	mg/l	1.5	3.0
Cadmium (Cd)	mg/l	0.1	0.1
Chromium (Cr^{3+})	mg/l	0.1	2.0
Chromium (Cr^{6+})	mg/l	0.1	0.2
Cobalt (Co)	mg/l	1.0	1.0
Copper (Cu)	mg/l	1.0	1.0
Iron (Fe)	mg/l	3.0	5.0
Lead (Pb)	mg/l	0.2	0.2
Manganese (Mn)	mg/l	3.0	5.0
Mercury (Hg)	mg/l	0.005	0.005
Nickel (Ni)	mg/l	0.2	0.5
Selenium (Se)	mg/l	0.5	1.0
Silver (Ag)	mg/l	0.1	0.1
Tin (Sn)	mg/l	2.0	2.0
Vanadium (V)	mg/l	1.0	1.0
Zinc (Zn)	mg/l	1.0	1.0
Ammonia + Ammonium (NH_3 + NH_4^+)	mg/l	10	No limit
Chloride (Cl^-)	mg/l	800	800
Free Chlorine (Cl_2)	mg/l	1.0	5.0
Nitrate (NO_3^-)	mg/l	50	80
Nitrite (NO_2^-)	mg/l	1.0	10
Phosphate (PO_4^{3-})	mg/l	6.0	45
Sulfate ($SO_4^=$)	mg/l	600	600
Sulfide ($S^=$)	mg/l	0.5	1.0

Table 3: Industrial Effluent Standards: Organic Substances

Organic Substances	Units	Effluent for Direct discharge to receiving water: maximum permissible limit	Effluent meant via municipal sewage treatment plant to receiving water: maximum permissible limit
Alkyl benzyl sulphonate (ABS)	mg/l	2.0	5.0
Aromatic and aliphatic hydrocarbons	mg/l	1.0	5.0
Aromatic nitrogen containing compounds (aromatic amines)	mg/l	0.05	0.05
Chloroform extract (CE)	mg/l	5.0	10
Formaldehyde	mg/l	1.0	1.0
Grease and oil (petroleum ether extract)	mg/l	5	20
Non volatile chlorinated compounds (CIL)	mg/l	0.05	0.05
Organochlorine pesticides (Cl)	mg/l	0.005	0.005
Other pesticides	mg/l	0.01	0.01
Phenols	mg/l	0.2	1.0
Resins, Tar, etc	mg/l	2.0	5.0
Volatile chlorinated hydrocarbon (Cl)	mg/l	0.05	0.05

2 THE TERMS OF REFERENCE

The Terms of Reference relevant to this task is attached in the Appendix.

3 METHODOLOGY

The THESA's Consultation team conducted sites visits to MSE, TPC, KSE and BBL. The purposes of the visits were to carry out interviews and study the overall production processes, identification of waste streams and status of waste management. A checklist was developed to guide the Team. Interviews, group discussion and walk through assessment to observe potential environmental impacts were applied. The EMS assessment findings were shared with the management of the companies and the best practices and options for reduction of waste generated and reduction of water consumption including those related to emerging environmental and water policy and law were communicated. The following Tip Sheet was applied during the walkthrough assessment:

Walk-through Assessment Tip Sheet:

- Does the facility show signs of poor housekeeping, such as cluttered walkways, un-swept floors or uncovered material drums?
- Are there noticeable spills, leaking containers, or water dripping or running?
- Is there discoloration or corrosion on walks, work surfaces, ceiling and walls, or pipes? This may indicate system leaks or poorly maintained equipment.
- Is there smoke, dirt or fumes indicating material losses and air pollution?
- Are there odors, or eye, nose or throat irritation upon entering the workplace? These symptoms might indicate system leaks or other problems.
- Are there open containers, stacked drums, insufficient shelving for inventory, or other indicators of poor storage procedures?
- Are all containers properly labeled as to their contents and hazards?
- Is emergency equipment such as fire extinguishers available and visible to ensure rapid response to a fire, spill or other incident?
- Is waste such as dripping water, steam or evaporation noticeably being generated from processes in the facility?
- Does the inventory include any outdated stock, and are materials that are no longer in use still in storage?
- Do employees have any comments about the sources of waste in the facility?
- Is there a documented history of spills, leaks, accidents or fires in the facility? If so, which processes were involved?

A mass balance was prepared for the process, including the inputs and outputs and the processing steps. A waste audit was necessary to locate major waste sources, and evaluate the best potential points where the waste problem can be controlled with the least effort.

4 WASTE GENERATION AND MANAGEMENT

4.1 TOXIC WASTE STREAMS AND THEIR MANAGEMENT

The following streams have been identified as streams containing toxic waste:

Table 4: List of toxic chemicals found at MSE

Stream	Toxic component	Source of toxic substance	Destination of the Stream	Remarks
Factory Wastewater	Lead acetate	Laboratory	Treatment ponds	Wastewater require special treatment before discharged
	Mercuric Chloride	Laboratory	Treatment Ponds	
	Cupric Sulfate	Laboratory	Treatment Ponds	

Table 5:List of toxic chemicals found at TPC

Stream	Toxic component	Source of toxic substance	Destination of the Stream	Remarks
Factory Wastewater	Lead acetate	Laboratory	Environment	Laboratory Wastewater requires special treatment before discharged
Field Laboratory	Chromium trioxide	Laboratory	Chemical pit with a possibility of polluting ground water sources	
	Potassium dichromate	Laboratory		

Currently no source separation is practiced at the MSE and TPC for the toxic substances. However, precautions are well posted on the relevant areas about handling of these chemicals. Since the factories were not operating at the time of the assessment it was not possible to judge whether proper outfit is used while handling these toxic substances.

4.2 WASTEWATER MANAGEMENT

4.2.1 Wastewater Management at MSE

Factory wastewater is collected into an open channel that drains into the wastewater treatment ponds. The construction of the line from the caustic soda washing is in such a way that in normal operation there is a sluice valve that is shut to direct the water into the wastewater channel. Otherwise the waster water channel is bypassed into a storm water drain.

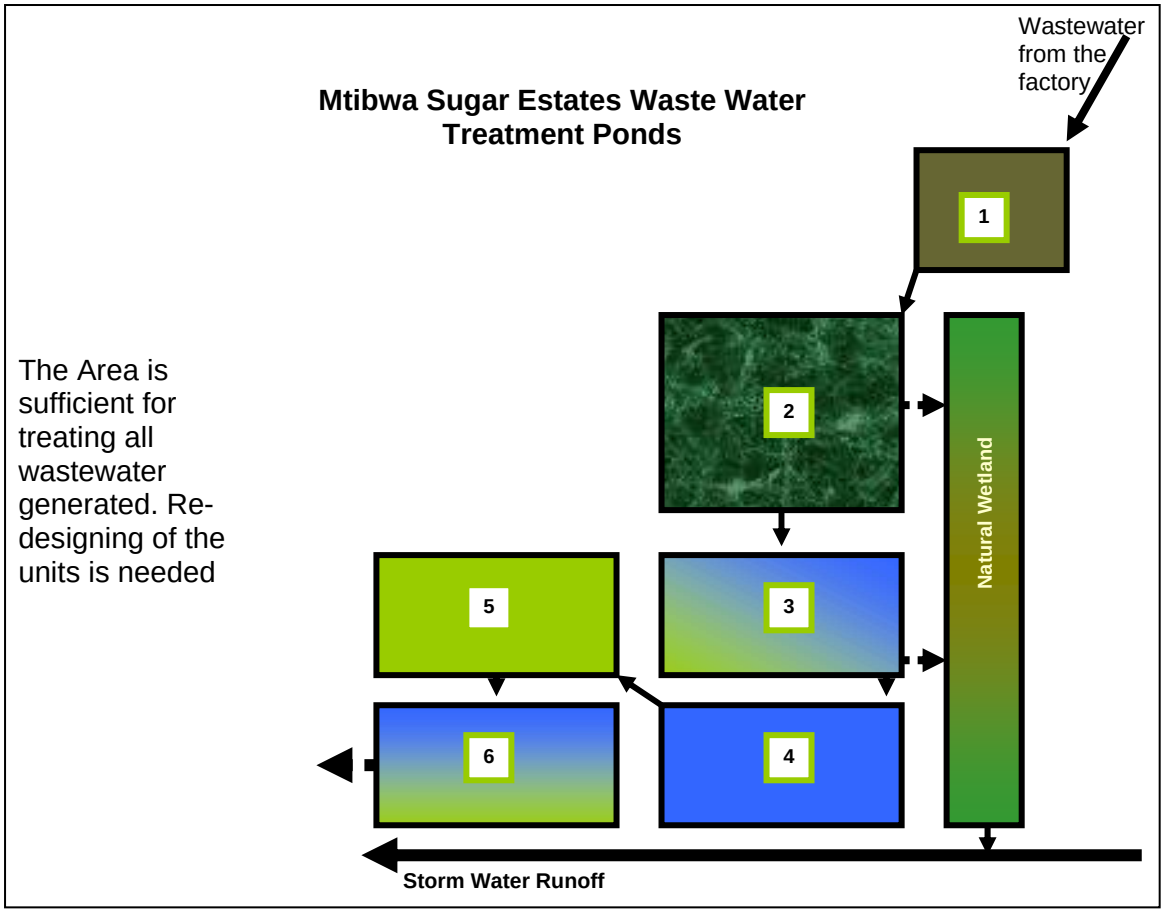

Figure 1: Layout of MSE treatment ponds

The treatment ponds were constructed in year 2000 and have a capacity of 15,000 m^3 following a series of complaints from nearby communities about the wastewater that was dumped and allowed to flow in their areas. The treatment ponds have however, been constructed in an adhoc manner and without following proper engineering design procedures. There are a total of six ponds, which are operating in a series manner. During our visit, it was noted that the inlet-outlets of the different stages of the ponds are poorly located and serious channeling is experienced. Because of this the ponds are not fully utilized. Redesigning of the units is necessary for their optimal utilization. Moreover, these ponds act as water storage facility. The treated water can be reused in the cane farms.

Figure 2: One of the MSE wastewater treatment ponds (4th Stage)

4.2.2 Wastewater Management at TPC

Wastewater from the factory is mainly generated from washing operation (wash water) including wash water from factory laboratory, boiler blow down and cooling water. The wastewater is collected and disposed to the cane fields without any treatment. Currently no water quality parameters are monitored. Wastewater from laboratories is disposed to the wastewater chamber without environmental impact consideration.

4.2.3 Wastewater Management at BBL

Wastewater from the factory is mainly generated from washing operation (wash water) including wastewater from quality control laboratory. The wastewater may contain used chemicals, used lubricants, washing detergents (such as scouring powder, ferrous sulfate, liquid soap, etc) and sugar content is collected and disposed off to the wastewater treatment plant. At BBL a trickling filter plant is used as full on-site wastewater treatment plant. The trickling filter is a wastewater treatment system that biodegrades organic matter and can also be used to achieve nitrification. At the BBL trickling filter, the wastewater trickles through a circular bed of plastic material. A rotating distributor (a rotating pipe with several holes across it) evenly distributes the wastewater from above the bed. The microorganisms in the wastewater attach themselves to the bed that is covered with bacteria. The bacteria break down the organic waste and remove pollutants from the wastewater. At the time of the visit the wastewater treatment plant was still under commissioning. Process, only 180m^3/day out of 1000m^3/day wastewater generated at BBL was being treated. The rest of the wastewater (820m^3/day) was being discharged to the Karanga River just after neutralization.

The average of 266,500 liters of domestic wastewater is generated at BBL and is collected in cesspit tanks within the factory area. The wastewater is removed from cesspit tanks by cesspit emptier trucks and is discharged to the Moshi Municipal wastewater treatment ponds for treatment.

4.2.4 Wastewater Management at KSE

KSE is lacking any form of wastewater management. The amount of wastewater generated is approximated from the water consumption. No clear knowledge whether the current water use is too much or just adequate and water reduction strategies are not evident. The raw wastewater produced from sisal processing contains large amounts of suspended solids and organic matter (chlorophyll). The mixture of solid and liquid waste is released in an open area and the liquid is let to drain water directly into the Kigombe stream without any form of treatment. The river downstream of the processing plant is simply a 'dead river" due to low oxygen thus supporting only anaerobic processes. Smell of sulfide is evident indicating the same. The river is discharging into the Indian Ocean just about less than 1000 m away. The marine ecosystem receiving this discharge is definitely a delicate one thus its function and structure is being threatened. Moreover, there are beaches close by.

4.3 SOLID WASTE GENERATION AND MANAGEMENT

4.3 1 Solid Waste Management at MSE

The Factory produces the following solid wastes: bagasse, filter mud (cake), metallic worn out parts, molasses, fly ash, bagacillo, ash, office trash and garbage. The bagasse is managed through recycled to the boiler for energy (electricity) generation. The filter mud (cake) is sprayed onto farms to improve soil texture. The metallic worn out parts are collected as scrape metals. The molasses is managed by being sold to the outside community and small volume is used for the estate feedlot project. The fly ash and bagacillo are not managed. The ash is collected and used for roads improvement. The office trashes are burnt in the farm area to generate fertilizer. The garbage is usually collected and dumped in the solid waste dump area.

Solid wastes generated at FMT such as lead batteries, metallic parts, packaging materials, used filters and bagasse used to drain spillage oils from working areas are collected and appropriately stored. The metallic parts are collected as scrap metals, the packaging materials, used filters and lead batteries and disposed to solid waste dump.

Domestic solid waste or garbage is collected and disposed off to the estate dump. Since the waste contains mostly organic matters, when decomposed it generate organic fertilizer, which is used in the sugarcane farms. The quantity of waste generated is not known.

4.3.2 Solid waste management at TPC

Bagasse, the expended cane fibers remaining after the juice has been extracted is recycled to the boiler for energy (electricity) generation. Bagasse is also applied as mulch to gardens. The filter mud is used as fertilizer on cane farms and gardens. Molasses is the dark syrup separated from the raw sugar crystals during the milling process. All molasses generated is sold to both domestic and export markets. Molasses is also used in feed for animals such as cattle. Bagacillo is used as filter support. The metallic worn out parts – collected as scrape metals and sold to the scrape dealers. The ash generated as waste is collected by cyclone and recycled to the boiler for energy generation.

Figure 3: TPC Solid Waste dump

The garage/stores solid waste (packaging materials) is normally disposed in the solid waste dump pit. Metallic solid waste is collected as scrap metals and sold to the scrap metal dealers. Used tires are provided to the community for the second uses.

Domestic and office solid waste or garbage is collected, hauled and disposed to the solid waste dump pit.

Medical waste is managed by incineration and dumping in a well constructed enclosed medical waste dump. The dump is concrete lined and has a lid on the opening to close it. This dump was meant for solid medical waste such as sharps and needles. Operation of the dump, however, needs to be improved as the team observed dumping of carton boxes, paper etc which can only shorten the life of the facility. Combustible hospital materials should rather be incinerated in the medical waste incinerator facility.

4.3.3 Solid waste management at BBL

The following have been identified as solid wastes produced and their fate at BBL.

Table 6:Solid waste production at BBL

Waste	Source	Quantity a year	Disposal Method
Package materials	Stores	20,903 tons	Sold to other users
Broken bottlers	Bottling department	139,356 tons	Sent to manufacturer
Plastic containers	Stores	128 tons	Re sold
Broken crates	Beverage packaging	32,267	Re sent to manufacturer
Pet plastics	Stores	4,478	Grinded and re used
Papers	Offices		Shred and dumped as municipal wastes
Wooden pallets	Stores		Sold to villagers for firewood
Metals and scraps	Garage		Sold to the scrap metal dealers
Lead Batteries	Garage		Sold to the scrap metal dealers
Used tires	Garage		Sold to other users

4.3.4 Solid waste management at KSE

During sisal processing (decortications), KSE is producing huge amounts of biomass as waste materials. These solid materials accumulating on the riverbank and areas close to the factory where they are discharged. The practice has been to spread them and let them to dry and then burn them into ashes without any environmental consideration.

4.4 USED OILS MANAGEMENT

Used Oils Management at TPC

Oil trap system is used to trap oils contained in the wastewater. Currently, the oil trap system at TPC is not functioning well. The used oils from garage is stored in the storage tank and sold to the community. The other volume of used oils is burnt in the boiler for energy generation and small amount is used for preventing mosquito life in the drains.

4.5 GOOD PRACTICES/ POSITIVE NOTES

The four companies have demonstrated “good practices” in the following areas:

(i) Excellent housekeeping in the processing area, stores and waste management at BBL, MSE, TPC

(ii) The wastewater is collected and treated in a wastewater treatment system at MSE and BBL

(iii) Reuse and Recycling of bagasse for energy and floor cleaning, Recycling of filter mud in cane farms at MSE and TPC, Recycling the sisal bole back into the sisal farms as fertilizer KSE.

(iv) Reuse of molasses through a feedlot project and sale to community at MSE and TPC

(v) Proper handling of solid waste, Collection and disposal of scrap metals to the scrap metals dealers at TPC, MSE and BBL
(vi) Fire fighting equipment is in place and well placed, Personal protective gears are in place and used.
(vii) Medical waste incinerator and dump at TPC
(viii) Vetiver grass technology for protection of irrigation canals from soil erosion, drip irrigation system at TPC
(ix) Proper record keeping and management of all materials at TPC, BBL and MSE

4.6 DOCUMENTATION

The documentation (record keeping) is essential to implementing environment management system. The process includes identifying, collecting, analyzing and completing information and data. When keeping records, focus should be placed on environmental information that the company needs to manage effectively such as raw materials use, waste generation, waste disposal and controlling environmental aspects. An effective documentation generates sufficient information to enable the company to develop its environment management system. The main objective is not only to locate weaknesses and deficiencies in the implementation of environment management system, but also to highlight achievements and demonstrate compliance with the environmental and water legislation. Of the companies visited only BBL was found to be maintaining good system of documentation for both materials and environmental issues. Other companies visited were found implementing good recording system of materials only.

5 RECOMMENDATIONS

The following have been identified as potential areas for improvement:

5.1 GENERAL RECOMMENDATIONS

(i) Establishment of elaborate EMS that will ensure that the environmental issues are well integrated in the management of the companies for TPC, MSE and KSE;
(ii) Documentation of “good practices” at MSE, KSE and TPC;
(iii) Re design the waste water treatment ponds and integrate the treated waste water in the irrigation system of Estate at MSE;
(iv) Establishment of wastewater treatment system (Activated Sludge system, Bio digester, in combination with Constructed Wetland etc.) at KSE;
(v) Establishment of solid waste management system at KSE (solid waste can be directed to produce energy, sold to biomass using companies for energy production);
(vi) Establishment of biogas plant that would produce electricity and fertilizer at KSE **(**Refer UNIDO project).

5.2 TOXIC CHEMICALS (LEAD ACETATE)

Chemical control and laboratories at MSE and TPC should reduce their consumption of lead acetate, a toxic chemical used in the analysis of sugar content. The frequency of sampling from the factory should also be reduced to the optimum level.

Solutions made of the toxic chemicals should be collected in a separate vessel and kept for treatment before disposal. Precipitation method or activated carbon should be used to immobilize the toxic heavy metals in solution. The dried precipitate or the loaded activated carbon can be incinerated in the boiler.

5.3 DISPOSAL OF CHEMICAL WASTE

Most of the chemical wastes generated from the TPC and MSE operations particularly from the laboratories and the main store are disposed to the environment without environmental impact consideration leading to the environmental pollution. Improvement in the method of disposal of these chemical waste is required so as to protect the environment from pollution, to have a better working environment and more important to comply with the environmental and water legislations.

Obsolete Chemicals

Obsolete chemicals were found at BBL and TPC. It is recommended that these be disposed off immediately in any of the following ways provided they are still useable:

- Identify and sell to customers who may need them,
- Donating them to public institutions such as universities, colleges, schools that may use them.
- The obsolete chemicals should be provided to other potential users such as schools and colleges while the obsolete oils should be burnt in the boiler for energy generation.

5.4 WATER REDUCTION OPTIONS

Wastewater Recycling

Water is a finite and vulnerable resource, which is under pressure and growing scarce as a result of increasing multi-sectoral demands of the rapidly growing population. Globally, efficient and sustainable management of water resources is increasingly becoming a policy objective. At KSE the used water from the processing plant is discharged of to the Kigombe stream without any treatment. We recommend that treated water from constructed wetland should be recycled back to the sisal processing plant for the industrial use provided it is shown that this would not affect the quality of the fibres.

Currently BBL is producing about 1000 m^3/day of wastewater. During this commissioning phase of the wastewater treatment plant about 200m^3/day is being treated. The rest is leaving the plant just after neutralization stage. In six months period all the 1000 m^3/day would be treated. The company has built a small fishpond in the company premise for fish farming. There is a good potential of reusing the treated water. It is recommended that the treated water be used as follows:

- Irrigation of the gardens in the factory compound. Currently gardens and factory grounds are irrigated by water from the boreholes. The treated water can replace all the water used for this purpose.

- The plant is situated in a semi arid area of Moshi. The surrounding communities do not have adequate water for irrigation purposes. The treated wastewater could further be treated to reach river water quality by passing it in a natural polishing stage such as a constructed wetland and then the company could use it for enhancing its image among the surrounding villages by establishing community projects such as tree projects. The water could be used to irrigate farms in the surrounding villages.

6 CONCLUSIONS

Water is a public good of very high value in all its competing uses, and requires that careful conservation and sustainable utilization be ensured. Deliberate efforts are, therefore, needed towards protection and sustaining the resource and to ensure that it is used efficiently and effectively for the benefit of the present and future generation. A company that implements an EMS is able to meet the requirements from the environmental law, maintain good community relations and enhanced public image, as well as fostering development through the sharing of environmental solutions. BBL has set itself as a role model for a company that puts environmental concerns on top of its agenda.

7 THE WAY FORWARD

During this exercise of conducting EMS assessments to the five selected companies in Wami-Ruvu and Pangani basins, it has been found out that only Bonite Bottlers Limited (Coca Cola Franchised Company) has an elaborate EMS system in place. For this reason THESA has opinion that Bonite Bottlers Limited can be taken as a role model and can be effectively used in EMS promotion and sensitization to other companies in the two basins. This may help to expedite the establishment of EMS in the other companies currently not implementing EMS.

THESA also is banking on the positive attitude shown by the management of the visited companies which showed that are ready to establish EMS provided they are properly guided. THESA wishes to disseminate the final output of EMS assessment to the four assessed companies covered in Phase 1, to continue with the tasks at Mtibwa Sugar Estate and Kigombe Sisal Estate to enable them establish an elaborate EMS and finally assist the companies to solve some of the major environmental problems already identified at Mtibwa Sugar Estate and Kigombe Sisal Estate. These tasks are enumerated below:

7.1 DISSEMINATION OF THE FINAL OUTPUT OF EMS ASSESSMENTS

Under this task the following issues will be disseminated:

- Review of Requirement from both environmental and water laws of Tanzania and the link to EMS implementation
- Review of water use reduction and conservation options specific to the company
- Importance and procedures for establishing and implementing EMS, which will ensure that environment issues are integrated in the management of the company;
- Procedures for Implementation of Systematic Environmental Monitoring

7.2 ESTABLISHMENT OF EMS AT MTIBWA SUGAR ESTATE AND KIGOMBE SISAL ESTATE

Mtibwa Sugar Estate and Kigombe Sisal Estate currently have no elaborates EMS in place. Under this task the two companies will be guided to establish elaborate EMS in their operations. Environmental management systems follow a systematic approach of planning, implementing, evaluating and improving. Senior managers will be actively involved in the EMS process from the beginning. All the employee of the companies will also be involved. Environmental matters are joint task requiring the participation of the entire company. Involving staff in the design and implementation of EMS will demonstrate the organization's commitment and help to ensure that the EMS is realistic, practical and adds value.

The process of establishing EMS will cover the following:

- Development of an environmental policy statement of what needs to be achieved by the company in terms of economic benefits as well as compliance with current and pending pollution control regulations;
- Proposing environmental management objectives and targets including the potential benefits in adopting more stringent longer term objectives to encourage the company to improve its performance;
- Prioritization of Actions - After collecting the pertinent information and establishing environmental management objectives and targets, THESA shall assist the company

- Development of an Environmental Management Plan that details the methods and procedures which the operations can use to meet its objectives and targets;
- Documentation of objectives, targets, policies, responsibilities and procedures, including information on environmental performance in terms of impacts on the environment;
- Responsibilities and reporting structure showing how responsibilities need to be allocated to staff and management to ensure the EMS is implemented effectively;
- Identification of training needs for staff, such as environmental awareness and responsibilities for implementing the EMS;
- Review Audits and Monitoring Compliance to ensure the EMS is achieving its objectives and to refine operational procedures to meet its goals including environmental monitoring.

7.3 ASSISTING MSE AND KSE TO SOLVE THE IDENTIFIED ENVIRONMENTAL PROBLEMS

During the EMS assessments in these two companies some environmental problems were identified which do not necessarily need a lot of inputs to solve. The following subtasks are recommended to assist the companies in dealing with these issues:

- Designing of oil trapping system that will trap used oil from Mtibwa Sugar Estate garage and factory wastewater before is discharged off to the main wastewater drain;
- Work with Mtibwa Sugar Estates to redesigning the wastewater system that will treat factory wastewater and put up modalities for reuse of the treated water for Irrigation (Mtibwa Sugar Estates shall be sensitized to incur some costs to realize this);
- Working on cost analysis of the best option for wastewater management at Kigombe Sisal Estate;
- Propose solution to manage solid waste emitted by the sisal processing factory at Kigombe Sisal Estate.

Recommended Deliverables for Follow-up Activities

- Final output of EMS assessment disseminated; Mtibwa sugar Estates and Kigombe Sisal Esates sensitized to establish EMS and adopt water reduction and conservation options;
- EMS established at Mtibwa Sugar Estate and Kigombe Sisal Estates;
- Solution to major environmental problems at Mtibwa Sugar Estate and Kigombe Sisal Estate proposed and adopted.

APPENDIX

The Terms of Reference

THESA will provide assessments of the current status of environmental management systems of selected sugar production facilities and sisal estate by conducting a survey and assessment of current options to reduce water and environmental contamination through examination of solid and liquid waste disposal methods.

Task B 1 Sugar and Sisal Plant Environmental Efficiency

Subtask B1A: Assess the status of environmental management systems at the Tanganyika Planting Company Ltd, Mtibwa Sugar Estate and Kigombe Sisal Estate related to water use, contamination and waste generation through site visits and analysis of production processes. Prepare written reports in the form of an environmental audit for each site.

Task B2 Good practices and policies for sugar and sisal operations

Subtask B2A: Identify and communicate waste reduction options to commercial sugar operations, including those related to emerging environmental policy and law. Draw upon national and other international experience and approaches where relevant and useful. The recommendations will consider the following facets of a small industry environmental management system:

- An environmental policy statement of what needs to be achieved by the facility in terms of economic benefits as well as compliance with current and pending pollution control regulations.
- Proposed objectives and targets including the potential benefits in adopting more stringent longer-term objectives to encourage it to improve its performance.
- Measures to insure commitment of staff and community consultation should be undertaken before, during and after establishment of an EMS, and indications of how implementation can improve public perception of the company, one of the benefits of implementing an EMS.

Recommendations will also cover the following topics:

- An Environmental Management Plan that details the methods and procedures, which the operations can use to meet its objectives and targets.
- Documentation of objectives, targets, policies, responsibilities and procedures, including information on environmental performance in terms of impacts on the river system.
- Responsibilities and reporting structure showing how responsibilities need to be allocated to staff and management to ensure the EMS is implemented effectively.
- Training needed for staff, such as environmental awareness and responsibilities for implementing the EMS.
- Review Audits and Monitoring Compliance to ensure the EMS is achieving its objectives and to refine operational procedures to meet its goals including environmental monitoring.
- Develop strategies for the establishment of EMS (drawn in a participatory manner in order to ensure ownership)

The information should also address procedures required for encouraging continual improvement.

Task B3 Issues and options from environmental management perspective

Subtask B3A Contribute information and insights from the sugar industry environmental management analyses to the environmental flows team (Element C. of the Tanzania Community Watersheds Partnership Program) in the Wami and regional authorities responsible for water management including the Wami River Basin Offices, and to relevant agencies for example the Pangani River Basin Office.

Task B4 Good practices in bottling operations

Subtask B4A Conduct a rapid review and assessment of environmental management systems and practices for water consumption and wastewater management for the Kwanza and Bonite Bottling plants. Prepare materials to communicate the type and effectiveness of current approaches and recommendations for potential improvements.

List of Technical Deliverables Associated with Tasks includes the following:

Element B1Ap1: TPC Sugar EMS Assessment Report
Element B1Ap2: Mtibwa EMS Assessment Report
Element B1Ap3: Kigombe Sisal Estate EMS Assessment Report
Element B2Ap: EMS Options Presentations
Element B3Ap: Written Inputs to Flow Assessment Team, Wami River and other River Basin Authorities
Element B4Ap: Assessment report, Bottling Companies

REFERENCES

1 American Public Health Association, American Water Works Association, Water Environmental Federation, *Standard Methods for the Examination of Water and Wastewater*, 20t Edition, 1998. Lenore S.C, Arnold E.G, Andrew D.E and Mary H.F (ed), American Public Health Association, Washington, DC.

2. United Republic of Tanzania, *National Water Policy*, 2002.

3. United Republic of Tanzania, *Water Utilization Act*, 1974.

4. United Republic of Tanzania, *Environmental Management Act*, 2004.

5. United Republic of Tanzania, *National Environmental Policy*, 1997. Vice President's Office, Dar es Salaam.

6. Salum Shamte, *Paper on Overview of the Sisal and Henequen Industry: A Producers' Perspective*. Tanzania. Internet Version.

7. Donald L. Wise and Debra J. Trantolo (ed), *Process Engineering for Pollution Control and Waste Minimization*, New York, 1994.

8. IPP Media, *Government Commitment to Revival of Sisal Industries*, Tanga, 2006. Internet Version.

10. The Coca-Cola Quality System-Evolution 3, *The Environmental Management System*, 2006. Jeff Seabright, Environment and Water Resources.

11. The Coca-Cola Quality System, *Wastewater Quality Requirement*, 2006.

12. The Coca-Cola Quality System, Quality Procedures Manual, 2005. Plant Environmental Coordinator.

13. EMS assessment reports for Mtibwa Sugar Estates, TPC, Bonite Bottlers Limited, and Kigombe Sisal Estates.

COASTAL RESOURCES CENTER

University of Rhode Island