



**ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED
TANA INTEGRATED SUGAR PROJECT IN TANA RIVER AND LAMU DISTRICTS,
COAST PROVINCE, KENYA (Land Allocation Reference No. 106796 of 17.1.1995)**

26th November 2007

This study was carried out by:

HVA International
P.O. Box 12204, 1100 AE Amsterdam, The Netherlands
Paasheuvelweg 28, 1105 BJ Amsterdam
Tel +31 (0)20 311 6000, Fax +31 (0)20 696 9599
Email: cjmrolink@hvainternational.nl
Internet: www.hvainternational.com

In association with :

M.A. Consulting
12th Floor, Corner House, Mama Ngina Street
P.O. Box 73335 – 00200, Nairobi, Kenya
Tel 254 20 227834
Email: nmwaniki@magricon.com
Website: www.magricon.com

EIA STUDY TEAM

The following consultants participated in this study

1. Mr. Ngure Mwaniki – Economist, Project Manager
2. Prof. David Mungai – EIA Specialist, Team Leader
3. Dr. J. Kibwage – EIA Specialist
4. Prof. P. Mbugua – Livestock Specialist
5. Dr. G. Muchemi – Wildlife Specialist
6. Ms. M. Chiuri – Socio-economist
7. Dr. R. Abila – Fisheries Specialist
8. Dr. W. Ojwang – Fisheries Specialist
9. Ms. Mugure Thande – Environmental Lawyer
10. Dr. T. Thenya – EIA Specialist

Inputs were also received from the HVA Consultants through Cees Hopmans, the Project Director

1 DOCUMENT AUTHENTICATION FORM

I/We...**PROF. DAVID N. MUNGAI and Dr. JACOB K. KIBWAGE**.as Environmental Experts to:

Proponent.....**MUMIAS SUGAR COMPANY LTD. (MSC) and TANA & ATHI RIVERS DEVELOPMENT AUTHORITY (TARDA)**.....on Project: **TANA INTEGRATED SUGAR PROJECT (TISP)**

Do hereby certify that this report was prepared based on the information provided by the **TANA AND ATHI RIVERS DEVELOPMENT AUTHORITY** and **MUMIAS SUGAR COMPANY LTD** as well as that collected from other primary and secondary sources and on the best understanding and interpretation of the facts by the environmental assessors. It is issued without any prejudice.

1. Name...**PROF. DAVID N. MUNGAI**
EIA TEAM LEADER - HVA INTERNATIONAL/M.A. CONSULTING

NEMA Reg. No: ...**0117**.....

License No.: ...**274**.....Expiry Date:.....**31/12/2007**.....

Signature.....

Date:.....

AND

2. Name:.....**Dr. JACOB K. KIBWAGE**
EIA EXPERT - HVA INTERNATIONAL/M.A. CONSULTING

NEMA Reg. No: ...**0126**.....

License No.: ...**086**.....Expiry Date:.....**31/12/2007**.....

Signature.....

Date:.....

PROJECT PROPONENT

Name:**MUMIAS SUGAR COMPANY LTD. (MSC) and TANA & ATHI RIVERS DEVELOPMENT AUTHORITY (TARDA)**.....

Signature.....

DR. EVANS KIDERO, CHAIRMAN, JOINT IMPLEMENTATION PROJECT TEAM (JIPT)

Date.....

1.1

1.2 Estimated cost of the project: USD 332.4 million

TABLE OF CONTENTS

NON -TECHNICAL SUMMARY	xx
LIST OF ABBREVIATIONS AND ACRONYMS	xxviii
1 Introduction	1
2 ENVIRONMENT IMPACT ASSESSMENT METHODOLOGY	3
3. DESCRIPTION OF THE PROJECT	9
3.1 Background to the Project	9
3.2 Purpose and justification of the Project	9
3.3 Project Location	10
3.4 Proposed Project Components and Actions	11
3.4.1 Project components	11
3.4.2 Status of the proposal in context of project cycle	12
3.4.3 Description of the project components	12
3.4.3.1 Irrigated sugar production (estate and outgrower sugar cane production)	12
3.4.3.2 Sugar Processing	19
3.4.3.3 Wastes generated and their use	24
3.4.3.4 Cogeneration of electricity	24
3.4.3.5 Ethanol plant	25
1.5 Other investments associated with the project	25
4. BASELINE INFORMATION	26
4.1 Identification of the project sites	26
4.2 Physical environment	26
4.2.1 Physical features	26
4.2.2 Agro-ecological Zones (AEZ)	27
4.2.3 Climate	27
4.2.4 Hydrology and Water Resources	28
4.2.5 Surface and ground water quality	29
4.2.6 Cumulative impacts of other developments along the Tana River	33
4.2.7 Soils	33
4.2.8 Soil physical and chemical properties	35
4.2.9 Status of soil erosion	37
4.2.10 Nutrient cycles and food chains	37
4.2.11 Potential ecological problems due to increased soil erosion and siltation leading to decrease in stream capacity of the Tana River	38
4.2.12 Presence of project activities that cause pollutants to accumulate in the soil profile, air and water	38
4.2.13 Alteration of the natural capacity of hydraulic regulation in river basins (flood levels, deposits) in the vicinity of the delta	39
4.2.14 Agriculture, Pests and diseases	39
4.3 Social-economic environment	40
4.3.1 Basic Socio-Economic Data	42
4.3.2 Population Characteristics	42
4.3.3 Average Household Size	46
4.3.4 Existing Skills among Pastoralists and Agriculturalists	47
4.3.5 Literacy Level and Existing Skills in Reference to Agriculture	49
4.3.6 Main Economic Activities	49
4.3.7 Monthly Household Incomes	50
4.3.8 Household Expenditure Patterns	52
4.3.10 Wealth Ranking	54
4.3.11 Resource Analysis	57
4.3.12 Institutional Analysis	59
4.3.13 Livelihood Analysis	60
4.3.14 Water Resources Utilization	62
4.3.15 Waste Disposal, Sanitation	63

4.3.16	Energy Uses and Sources.....	64
4.3.167	Housing.....	65
4.3.18	Infrastructure	65
4.3.19	Occurrence of human diseases	65
4.3.20	Health facilities in the Area	69
4.3.21	HIV/AIDS	69
4.3.22	Nutrition	70
4.3.23	Agricultural Production	72
4.3.24	Crops Grown, Yield and Income.....	72
4.3.25	Community Participation and Integration in the Project.....	73
4.3.26	Impact of the sugar project on crop farming	73
4.3.27	Migration from Other Areas	77
4.3.28	Community's Acceptability of the Project	77
4.3.29	Labour Management	78
4.3.30	Mechanisms of Engaging the Community	78
4.3.30	Gender Issues In the Study Area	79
4.3.32	Access and Control of Assets.....	79
4.3.33	Women Participation	83
4.3.34	Involvement at farm level.....	84
4.3.35	Women Participation in Agriculture	87
4.3.36	Community Labour Profiles	89
4.3.37	The Changing Gender Situation (A case for women in the proposed project)	89
4.3.38	Literacy Levels in Reference to Agri-Business and Social Facilities	90
4.3.39	Literacy Levels among Women	90
4.3.40	Community Social Requirements in the Project Area.....	91
4.3.41	Types and sources of Conflicts	92
4.3.42	Conflict Resolution Mechanisms	92
4.3.43	Insecurity	95
4.3.44	Existing Tenure and Allocation Agreements.....	95
4.3.45	Land Use Patterns.....	97
4.3.46	Development of Credit Facilities.....	105
4.3.47	<i>Groups Receiving Credit Facilities</i>	105
4.3.49	Major Recommendations.....	107
4.4	Historical, Archaeological Monuments and Cultural Heritage	110
4.5	Hydrology and Water Resources.....	111
4.5.1	Cumulative impacts of other developments along the Tana River	111
4.6	Terrestrial Habitat and Flora.....	112
4.6.1	Vegetation Distribution and Trends	112
4.6.2	Vegetation Communities	115
4.6.3	Major Habitat Eco-types	115
4.6.3.1	River and Riverine Habitat	116
4.6.4	Tana Delta Wetlands.....	118
4.6.4	Mangroves Ecosystem	128
4.6.5	Wetland and Ecotone Ecosystem and their Utilisation	128
4.6.6	Dryland Ecosystem and bushland/thickets.....	129
4.6.7	Farming complex	129
4.6.8	Forest Patches	129
4.6.8.1	Distribution of Forest Patches.....	129
4.6.9	Forest Patches and Vegetation Management Interventions Plus Restoration.....	130
4.6.10	Species of Major Concern	131
4.6.11	Forest Products and Wood Energy - Utilization and Impacts	131
4.6.12	Demographic Characteristics and Fuelwood Consumption.....	132
4.6.13	Loss of Forest Habitat and Vegetation Cover Change	134
1.5.1	4.6.14 Invasive and Exotic Species.....	134

4.6.14.1	Prosopis Juliflora “Mathenge”	134
4.6.14.2	Exotic trees	135
4.6.15	Important Vegetation and Habitat Consideration.....	135
4.6.15.1	Possible Flood Damage	135
4.6.15.2	High Erosion Potential Areas.....	136
4.6.16	Cane Canopy and Micro-Climate	136
4.6.17	Preliminary Monitoring Programme	137
4.6.17	Preliminary Recommendation for inclusion in Environmental Management plan	137
4.7	Tana River Fisheries	138
4.7.1	Introduction.....	138
4.7.2	Fish species distribution	139
4.7.3	Other aquatic fauna	143
4.7.4	Aquascapes of the lower Tana River systems	143
4.7.5	Oxbow lakes	143
4.7.6	Lake Moa.....	145
4.7.7	Lake Shakababo	145
4.7.8	Swamps.....	145
4.7.9	River channels.....	146
4.7.10	Artificial/construction dams.....	146
4.7.11	Importance of Fisheries	147
4.7.12	Conclusions	148
4.7.12.1	Potential negative impacts of the project on fisheries	148
4.7.13	Recommendations/Mitigation measures	150
4.7.14	<i>Preliminary monitoring program for fish species</i>	151
4.7.15	Annex 1 to Section 4.10: Fishes of the Lower Tana.....	152
4.7.16	Annex 2 to Section 4.10: Fisheries activities in the project area	154
4.7.17	Annex 3 to Section 4.10: Other aquatic fauna in Tana River	156
4.8	<i>Wildlife</i>	157
4.8.1	BACKGROUND INFORMATION ON TANA RIVER WILDLIFE	157
4.8.2	THE CONSERVATION STATUS OF THE TANA RIVER RED COLOBUS IN KENYA (2002, 2004)	158
4.8.4	Assessment of deterioration of the environment regarded as areas for the reproduction of species (including fish and bees) that are important because of their food supply and conservation status, endemism, cultural or tourist interest.....	163
4.8.5	ALTERATION OF ENDEMIC BIOTA AS A RESULT OF THE PROJECT ACTIVITIES EITHER DIRECTLY OR INDIRECTLY.....	163
4.8.6	POTENTIAL FOR OR ESCALATION OF HUMAN-WILDLIFE CONFLICT DUE TO THE PROJECT	164
4.8.7	Recommendations/ Mitigation Measures	167
4.9	Livestock	267
4.9.1	Number and types of livestock in TRD	267
4.9.2	LIVESTOCK NUMBERS, OWNERSHIP, PRODUCTIVITY AND DISEASES	267
4.9.2.1.	Livestock ownership, herd sizes and structure	267
4.9.2.2	Livestock population, type, productivity and distribution	269
4.9.2.3	POTENTIAL FOR ENHANCING LIVESTOCK PRODUCTIVITY.....	283
SWOT analysis for operation of the feedlot		288
4.9.2.4	COMMUNITY PARTICIPATION	289
4.9.2.5	CONCLUSIONS AND RECOMMENDATIONS.....	292
4.10	<i>Environmental Law and Policy</i>	293
4.11	Air Quality Analyses at Proposed Factory Site.....	299
4.11.1	Introduction.....	299
4.11.2	Air Quality Guidelines	300
4.11.3	Background information on measured parameters	301

4.11.4	Volatile compounds measurements (VOC,benzene, and hydrocarbons)	302
4.11.5	Particulate matter measurement	302
4.11.6	Results	303
4.11.7	Discussion of the results.....	304
4.11.8	General Conclusion and Recommendations	304
5.	POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK GOVERNING	305
5.1	Introduction	305
5.2	<i>Environmental Policy, Legal and Institutional Framework governing Environmental Management in Kenya</i>	305
5.3	<i>Institutions under EMCA</i>	306
5.4	<i>The Legislative Framework</i>	309
5.5	<i>Relevant Government Sessional Papers</i>	317
5.6	<i>International Conventions and Treaties</i>	319
5.6.1	The Ramsar Convention on Wetlands of International Importance	319
5.6.2	The World Commission on Environment and Development (The Brundtland Commission of 1987).....	320
6.	CONSULTATION AND PUBLIC PARTICIPATION	321
6.1	<i>Introduction</i>	321
6.2	<i>Objectives of the consultation and public participation</i>	321
6.3	Interested and affected stakeholders consulted	321
6.4	Issues raised by the affected community	322
6.4.1	Loss of grazing land	322
6.4.2	Relationship between TARDA and local communities	322
6.4.3	MAT International Ltd Sugar Project	322
6.4.4	Water and Land Rights/ Conflicts.....	323
6.4.5	Preservation of Forest Resources	323
6.4.6	Preservation of Water and Wetland Resources	323
6.4.7	Preservation of Important Birds Areas (IBAs) and other Wildlife	323
6.4.8	The Delta - A Gift from God.....	324
6.4.9	Floods Control	324
6.4.10	Performance of Previous Projects in the Tana River Basin.....	325
6.4.11	Development of a Master Plan for the Tana River Delta	325
6.4.12	Viability of the Sugar Project in Lower Tana.....	325
6.4.13	Political and Economic Pressure	325
6.4.14	Food Security	326
6.4.15	Procurement of goods and services	326
6.4.16	Corporate Social Responsibility (CSR) Strategy	326
6.4.17	Establishment of Tana River Sugar Company Ltd	326
6.4.18	Employment opportunities	326
6.4.19	Training of Youths for Sugar Cane Production and Processing	327
6.4.20	Gender issues in the project.....	328
6.4.21	National Irrigation Board (NIB) special concerns.....	328
6.4.22	Indirect employment	328
6.4.23	Regional Rural Poverty.....	328
6.4.24	Waste disposal	328
6.4.25	Provision of social amenities and services	328
6.4.26	Infrastructural development.....	329
6.4.27	Increased security	329
6.4.28	Increased crime rate.....	329
6.4.29	Influx of People.....	329
6.4.30	Project sensitisation programme by MSC	329
6.4.31	Land ownership and adjudication.....	330
6.4.32	Human Resettlement.....	330
6.4.33	Formulation of an Environmental Management Plan	330
6.4.34	Formulation of an MOU for partnership	330

7.	ENVIRONMENTAL AND SOCIAL IMPACTS	332
7.1	<i>Introduction</i>	332
7.2	<i>Construction phase</i>	332
7.2.1	Negative Impacts.....	332
7.2.1.1	Loss of vegetation cover and biodiversity	332
7.2.1.2	Alteration or destruction of wildlife and wildlife habitat	332
7.2.1.3	Dislocation of populations and communities.....	332
7.2.1.4	Disposal of excavated soil	332
7.2.1.5	Increased soil erosion.....	333
7.2.1.6	Surface and ground water hydrology and water quality degradation.....	333
7.2.1.7	Ecological imbalances	334
7.2.1.8	Solid waste generation	334
7.2.1.9	Risk of oil spills	334
7.2.1.11	Dust emissions	335
7.2.1.12	Generation of exhaust emissions	335
7.2.1.13	Increased water demand	335
7.2.1.14	Increased energy consumption	335
7.2.1.15	Building materials and energy used	335
7.2.1.16	Workers accidents and hazards during construction.....	335
7.2.1.17	Creation of informal settlement.....	336
7.2.2	Positive Impacts	336
7.2.2.1	Employment opportunities	336
7.2.2.2	Improving growth of the economy.....	337
7.2.2.3	Improved living standards.....	337
7.2.2.4	Provision of market for supply of building materials.....	337
7.3	<i>Operation phase Impacts</i>	337
7.3.1	Negative Impacts.....	337
7.3.1.3	Increased water use and reduced downstream flow.....	337
7.3.1.4	Reduced water quality	337
7.3.1.5	Increased incidence of water borne diseases.....	338
7.3.1.6	Increased soil erosion.....	338
7.3.1.7	Salinization and contamination of soils.....	339
7.3.1.8	Waterlogging and salinization of soils.....	339
7.3.1.9	Algal blooms, weed proliferation and eutrophication	339
7.3.1.10	Hinterland effect	339
7.3.1.11	Ecological change	340
7.3.1.12	Increased runoff from new impervious areas	340
7.3.1.13	Solid waste generation	340
7.3.1.14	Increase in air pollution.....	341
7.3.1.15	Occupational health effects	341
7.3.2	Positive Impacts	341
7.3.2.1	Employment generation	341
7.3.2.2	Increased in sugar and other sugar related products	341
7.3.2.3	Electricity generation	341
7.3.2.4	Alternative use of by products	341
7.3.2.5	Increase in revenue	342
7.3.2.6	Optimal use of land.....	342
7.3.2.7	Increased rural development	342
7.3.2.8	Moderation of flooding downstream.....	342
7.3.2.9	Improved security	342
7.4	<i>Decommissioning Phase Impacts</i>	342
7.4.1	Negative Impacts.....	342
7.4.1.1	Loss of livelihood and economic ruin	342
7.4.1.2	Solid waste generation	343
7.4.1.3	Noise pollution	343
7.4.1.4	Dust and exhaust emissions.....	344

7.4.1.5	Occupational hazards	344
7.4.2	Positive Impacts	344
7.4.2.1	Rehabilitation	344
7.4.2.2	Employment opportunities	344
7.5	<i>Environmental hazard and risk assessment of TISP</i>	344
8.	ANALYSIS ALTERNATIVES TO THE PROPOSED PROJECT	345
8.1	Assessment of Alternatives to Projects	345
8.1.1	Alternative 1: Without Project Scenario	345
8.1.2	Alternative 2: Sugar Cane Production and Enhanced Habitat Conservation 345	
8.1.3	Alternative 3: Creation of Nature Reserve	346
8.2	Analysis of alternative technologies: furrow vis-à-vis sprinkler irrigation .	346
8.2.1	Alternative 1: Sprinkler (spray) irrigation	346
8.2.2	Alternative 2: Furrow Irrigation (recommended also by KESREF)	347
8.3	Analysis of alternative factory sites location	348
8.4	Analysis of alternative construction materials and technology	348
8.5	Waste water management alternatives	349
8.5.1	Alternative 1: Connection sewer system	349
8.5.2	Alternative 2: Use of septic tanks	349
8.5.3	Alternative 3: The anaerobic biomethanation system.....	349
8.6	Solid waste management alternatives.....	349
9.	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP).....	351
9.1	<i>Policy</i>	351
9.2	<i>Aims</i>	351
9.2.1	Health and Safety	352
9.2.2	Environment	352
9.3	<i>Management Principles</i>	352
9.3.1	Prevention and Control.....	352
9.3.2	Performance Indicators	352
9.3.3	Interested and/or affected Parties	352
9.3.4	Management and Training.....	352
9.3.5	Monitoring Requirements	352
9.3.6	Continual improvement.....	353
9.4	The Environmental and Social Management Plan (ESMP).....	353
9.4.1	Impact: Loss of floodplain grazing land	369
9.5	<i>Tana Integrated Sugar Project – Decommissioning and Closure Phase</i>	389
9.6	<i>Environmental and Social Incidents</i>	393
9.7	<i>Conclusions</i>	393
10	INSTITUTIONAL ASPECTS FOR THE IMPLEMENTATION OF THE ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN	395
10.1	Introduction.....	395
10.2	Establishment of the Environment Control (EC) Department	395
10.3	Responsibilities of the role players	397
10.3.1	Developer	397
10.3.2	Site Agent	397
10.3.3	Contractor.....	397
10.3.4	The Environmental Control Manager (ECM)	397
10.3.5	Environmental Liaison Officer (ELO)	399
10.3.6	Community Liaison Officer (CLO).....	399
11.	ENVIRONMENTAL MONITORING PLAN	400
11.1	<i>Habitat and vegetation</i>	401
11.2	<i>Socio-economic and community participation</i>	402
11.3	<i>Demography and Settlement</i>	402
11.4	<i>Historical, archaeological monuments and cultural heritage</i>	402
11.5	<i>Physical environment</i>	403
11.6	<i>Wildlife</i>	404

11.7	<i>Fisheries and other aquatic fauna</i>	404
11.8	<i>Livestock</i>	405
11.9	<i>Agriculture, pests and diseases</i>	405
11.12	<i>Forest products and wood energy – see above under Habitat and Vegetation</i> 405	
11.13	<i>Community environmental health</i>	406
11.14	<i>Summary of Environmental Monitoring Programme</i>	406
11.15	<i>Resources for a monitoring programme</i>	411
11.15.1	Laboratory facilities.....	412
11.15.2	Transport	412
11.15.3	Staffing	412

Table 4.1 Waste water quality parameters for irrigation for various sampling points.....	30
Table 4.2: Analytical results for sources of domestic water at the sampled points.....	32
Table 4.3: Major characteristics of the soils in the project area	34
Table 4.5: Tana River District Profile	43
Table 4.6: Population by sex, No. of Households, Area and Density	43
Table 4.7: Education Levels of the Respondents.....	44
Table 4.8: Education Levels of Males and Females (household heads).....	44
Table 4.9: Number of Household in the Sampled Villages and Population.....	47
Table 4.9: Special Groups	47
Table 4.11: Existing skills in the Project area (Danisa 'B' village).....	47
Table 4.12: Existing skills in the Project area (Onkolde village).....	48
Table 4.13: Existing Skills in the Project (Wema Village)	48
Table 4.14: The Economic Activities of the Communities.....	50
Table 15: Average monthly household expenditures (all Ethnic groups) and percentages	53
Table 4.22: Village Resources for Lazima Village (Pokomo)	58
Table 4.17: Household Expenditure -Wardei	53
Table 4.18: Household Expenditure -Pokomo	54
Table 4.19: Agriculturalists wealth ranking results.....	55
Table 4.20: Pastoralists wealth ranking results	56
Table 4.21: Assets acquired within last three years	57
Table 4.16: Household Expenditure -Orma	53
Table 4.23: Village Resources for Danisa 'B' Village (Wardei).....	59
Table 4.24: Village Resources for Kibarani Village (Orma)	59
Table 4.25: Institutional Analysis	60
Table 4.26: Mnazini Village (Pokomo).....	61
Table 4.27: Danisa 'B' Village (Wardei)	61
Table 4.28: Types of water sources.....	63
Table 4.29: Refuse Disposal Methods	63
Table 4.30: Sanitary Facilities Present.....	64
Table 4.31: Energy uses and sources	64
Table 4.32: Type of Housing	65
Table 4.33: Most common diseases in the project area	65
Table 4.34: Average Health and Sanitation Assessment results for a Pastoralist Village	66
Table 4.35: Average Health and Sanitation Assessment results for an Agriculturalist Village	67
Table 4.36: Health benefits of the Project	69
Table 4.37: Number of meals and Food Value	70
Table 4.38: Types of foods	72
Table 4.39: Agricultural Production	72
Table 4.40: Social Benefits of the Sugar Project.....	73
Table 4.41: Anticipated negative social impacts from the project on education standards on the community	74
Table 4.42: Anticipated negative social impacts from the project on culture of the community	75
Table 4.43: Negative social impacts anticipated from the project on religion	75
Table 4.44: Negative Socio-Economic Impacts and Proposed Solutions	76
Table 4.45: Question: is the sugar farming in Lower a agreeable to you?.....	77
Table 4.46: Access and Control of Assets: Lazima Village.....	81
Table 47: Access and Control of Assets: Mnazini Village	82
Table 4.48: Gender Issues in the area.....	83
Table 4.49: Women Participation	84
Table 4.50: Participation in Agriculture : Sailoni Village	86
Table 4.51 : Participation in Agriculture in Vumbwe Village.....	88
Table 4.52: Gender benefits of the sugar/livestock project	90
Table 4.53: Enrolment Levels	90
Table 4.54: Literacy Levels	91

Table 4.55: Priority Needs for each of the sampled villages	91
Table 4.56: Community Conflict Management and Resolution – Onkolde Village	93
Table 4.57: Community Conflict Management and Resolution – Bandi Village	94
Table 4.58: Community Conflict Management and Resolution – Bura Kofira Village	94
Figure 4.16: Land Use Patterns for Agriculturalists	97
Table 4.59: Priority needs of each village	100
Table 4.61: Banking services in the area	105
Table 4.62: Credit Groups.....	105
Table 4.63: Groups reported within the community	107
Table 4.64: Energy uses and sources	133
Table 4.65: Fish species in the lower Tana River identified in this study and breeding areas (marked with asterisks)	139
Table 4.66 List of fish species from the lower Tana River recorded by Luc De Vos et al, 2002	140
Table 4.67 Fish species in Tana River (fish base 2005)	142
Table 4.68 Landings (Kgs) of fish species of economic importance in Tana River District 1999- 2006	148
Table 4.70 Annual income (Ksh) from fish landings in Tana River (2006)	148
Table 4.69 Fish production by divisions of lower Tana R. District.....	148
Table 4.71: Population estimates and change in large herbivores in Tana River	158
Table 4.72: Lower Tana forests with one or more groups of red colobus and mangabey	159
Table 4.75: Cattle, sheep and goats in sampled villages and households (HH)	268
Table 4.76: Number of cattle, sheep and goats per household in sampled villages by community.....	268
Table 4.77: Types and number of livestock in Tana River District (TRD) and Garsen Division	270
Table 4.78: Total cattle population in some villages in the proposed project area (PPA) or close to PPA	270
<i>Table 4.79: Birth, mortality, slaughter and sales of cattle, sheep and goats in the project area (n=180)</i>	270
Table 4.81: Seasonal milk production per day by village and household.....	271
Table 4.82: Ranches to which animals move to	273
Table 4.83: Number of animals sold in Bura and Garsen auction yards in 2006	276
Table 4.84: Livestock Sales from Garsen Division in 2006 (number).....	277
<i>Table 4.85: Average market prices (KES) of live animals in TRD Auction Rings, 2006</i>	279
Table 4.86: Proportion of cattle, sheep and goats sold in last 12 months in 7 villages	279
<i>Table 4.87: Cattle sold per household in last 12 months and selling price</i>	279
Table 4.88: Market prices of Milk and Milk Products in TRD	281
Table 4.89: Prices of hides and skin (KES/kg) by grade and curing Method	281
Table 4.90: Reported cases of cattle, sheep and goat diseases in Garsen Division (2006)	282
Table 4.90: Scheme for feeding receiving diet	286
Table 4.91: Composition of one ton of the proposed diet.....	286
Table 4.92: Daily and Annual Feed ingredient requirements.....	287

NON -TECHNICAL SUMMARY

Mumias Sugar Company (MSC) Ltd. and Tana and Athi River Development Authority (TARDA), in a planned private joint venture, are proposing to put up the Tana Integrated Sugar Project (TISP) in Garsen Division of Tana River District and partly in Lamu District, about 200 km North of Mombasa City. The project area extends from Sailoni village in the north to the villages of Handarako and Arithi in the south covering an area of about 33,000ha of land. The proposed project is 30 km away from the Tana Delta. The main features of the proposed project are as follows: irrigated sugarcane production through estate (16,000ha) and out grower (4,000ha) systems, water supply to the project, a sugar factory, and co-generation facility of up to 34 MW power capacity, an ethanol production plant, and livestock supporting activities including fisheries. Project design is such that both the rice irrigation scheme and the new project will need 28 cumecs of water from the Tana River. Existing water abstraction, control and delivery systems will be rehabilitated and/or new ones established to supply the needed water. There will be two canals to supply water to the rice and sugarcane farms separately. Land clearing, land levelling, field drains, construction of a ring dyke, roads and bridges, and establishment of a factory are the major activities of the proposed project. The Matomba brook will be regulated to minimize flooding risk to the project. There will also be activities involving transport of material within the project area and in the region directly related to the proposal.

The proposed project is in accordance with the mandate given to the Tana and Athi Rivers Development Authority (TARDA) by Cap 443 of the Laws of Kenya. The Act empowers TARDA to carry out, amongst other functions, implementation and coordination of development projects within its area of jurisdiction. The project is also in line with the the Authority's strategic objective in its 2004-2009 Strategic Plan. The project is also in line with Mumias Sugar Company's strategic plan for the period 2003-2008 and the Kenya Sugar Industry Strategic Plan of 2004-2009 which emphasizes self sufficiency in sugar production, competitiveness and value addition by 2008. The development of the Lower Tana, and in particular the implementation of the proposed integrated sugar project, is among priority areas of development focus of *Vision 2030*. The Tana Integrated Sugar Project (TISP) will help bridge the national sugar production deficit currently standing at 200,000 tons/year. At full production the project will provide relatively cheaper sugar into the domestic market and hence prevent the influx of sugar in the country once the COMESA safeguard measures are lifted in year 2008 and in the face of the EU sugar reforms the effects of which will start being felt in 2008.

Tana River district has an area of 38,466 km² and a population of 227,317. The average population density is 5 /km² increasing to over 20 in Wenje, Tarasaa and Kipini. Garsen Division where the bulk of the project will be located has a population density of 4. Absolute poverty in the district stood at 76% in 1999 but has decreased to about 42.2% against a national average of 52.6%. Thus, it is one of the poorest areas of Kenya that is in need of development assistance. The Lower Tana with its delta and flood plains is one of Kenya's most ecologically and biologically diverse, socially and economically important ecosystems. The river floodplain and delta support a gallery of ecosystems ranging from forests, swamps, dunes, beaches and ocean. It supports exotic plants and animal species, some of which are listed as endangered. The delta and flood plains are immensely valuable to the local people who have built an intricate relationship between their lifestyles and the dynamics of the delta's ecosystems. High rainfall at the coast supports crop production especially around Kipini where cash crops like cashew nuts, cotton, mangoes and food crops such as bananas and maize are grown. The dry climate in the hinterland supports nomadic pastoralism. The average annual temperatures are about 30^oc, with humid conditions along the coast. The pastoralist communities are mainly found in the hinterland of the district. The district is generally sparsely populated mainly due to harsh climatic conditions exemplified by low and erratic rainfall and high temperatures.

In accordance with Section 58 of the Environmental Management and Coordination Act (1999) and Legal Notice No. 101 of 2003, a project of this magnitude is supposed to be subjected to a full Environmental Impact Assessment (EIA). Procedural guidelines on the EIA study are spelt out in Legal Notice No. 101. The procedural steps involved in this study included the following:

1. Identification of key stakeholders
2. Scoping and development of the ToRs using a variety of methods and tools
3. Baseline Studies
4. Consultation and public participation
5. Impacts identification and analysis
6. Development of mitigation measures
7. Analysis of project alternatives
8. Development of social and environmental management plan

The objectives of the EIA study were to:

- a) Consider all possible positive and adverse impacts to the delta including flood plains, critical habitats, endemic species, wildlife, aquatic ecosystems and the overall fauna and flora.
- b) Determine effects of irrigation on soil/water salinity, logging, leaching, microbes, and soil erosion.
- c) Determine socio-economic impacts of the project
- d) Assess environmental hazards and risks associated with the project
- e) Design and prepare mitigation measures and action plans to address all possible significant negative environmental impacts.

The terms of reference for the EIA study were to establish baseline conditions, impact assessment, development of mitigation measures and an environmental management plan with respect to habitat and vegetation, socio-economics and community participation, demography and settlement, historical, archaeological monuments and cultural heritage, physical environment, wildlife and fisheries, livestock and range resources, agriculture, pests and diseases, forest products and wood energy, community environmental health, analysis of legislative and institutional framework for environmental management in Kenya, and analysis of project alternatives. It was also required to establish institutional needs to implement the recommended action plans.

A number of institutions, professional individuals/groups, local people and their leaders and academicians were consulted for their inputs to the study. Over 2,600 individuals were consulted through one-to-one meetings, completion of a questionnaire, public meetings organized to collect views from as many stakeholders as possible and radio and newspaper advertisements. Relevant previous studies on the various aspects of the terms of reference were reviewed. The baseline studies were carried out by a multidisciplinary team involving: socio-economics, ecology, population, livestock, environmental, fisheries, agricultural, agronomy, engineering, and economics experts. They applied accepted field methodologies for data collection e.g. checklists, Leopold matrix, questionnaires, focus discussion groups, transects, geographical information systems (GIS), and soil, water and air sampling techniques as well as analysis and reporting. Guidelines on natural resources management were most useful during the initial stages of the EIA process. The Systematic Sequential Approach (SSA) was the most useful method that required the development of conceptual model that represented the causal chain: activity – changes – impact – mitigation. Spatially based methods were useful in screening alternative project sites.

Following is a summary of issues that were raised during the consultation and public participation process:

- Concern by livestock farmers that implementation of the project will replace their current grazing land with cane growing.
- Concern the project will reduce livestock watering points along the river and interfere with livestock corridors.
- However, others felt that it will control animals from neighboring Somali
- Even though the project land is currently given to TARDA by the Government for development, the local people still believe that they own it.
- That the villages in the project area should be involved in project planning and implementation. Salama Village residents in particular requested for a meeting with MSC before the project takes off to sort out the case in court of 1994. The Ndalaku Village elders also requested for a special meeting with MSC before the project starts because they have no idea what is sugar cane.
- There was concern that some people may be moved out and re-settled else where
- That TARDA should revive the rice Irrigation project which requires quick rehabilitation to help the local people.
- Competition for water by different users
- Concerns on the environmental implications of the project to the existing forest patches which partly form the basic livelihood assets of the local people. It was there fore concluded that the riparian forests along the meandering course of the lower Tana River and other identified and mapped patches should not be cleared but be preserved for local sustainable use because they are a major source of fuel wood, building/ timber materials, fruits, honey, traditional medicinal herbs, palm wine, etc.
- Protection of mangrove ecosystem which is about 30 Km downstream from the project's negative impacts.
- The members of the public noted that boreholes/ wells, permanent and seasonal oxbow lakes and wetlands (including Tana River) were the main source of water for livestock, domestic use, wildlife, fish and local irrigation to rice and maize by the farmers. Lakes also act as important fresh water fish breeding grounds. The stakeholders recommended that all these should not be interfered with.
- The youths and women expressed that the project will partly solve the problems of unemployment in the area among the school leavers.
- The locals greatly appreciated that the proponent had given them a chance to participate in the decision making process concerning the proposed project.
- The local community should be involved in project implementation to ensure the resources are well utilized for the benefit of everybody.
- It was indicated that the project will basically depend on the assurance that the Tana River floods could be tamed permanently to reduce disastrous impacts in case of the reoccurrence of the El-Nino rains in future.
- Most residents were also worried about the positing of the dykes to protect the floods. As much as the local people liked to be enclosed within the dyke for protection purposes, a policy should be put in place on ownership and management of the dykes to ensure that the people are not categorized as squatters. The existing conflicts on dyke positing in the Rice scheme need to be sorted out through community negotiations. To avoid risks, the stakeholders suggested that the river regimes should be monitored carefully and ensure that it is controlled for utilization to improve local standards of living. Damage from the cattle and other animals should also be monitored closely and avoided
- Due to the long-term dependence on food relief in Tana River and Lamu Districts, a strong food security component was recommended alongside the proposed project.
- The unemployment in the project area is extremely high among school leavers. Most youths without any formal education are engaged mainly in cattle grazing. Illiteracy levels are also very high in the area. Because of this background, the community

members raised concerns that casual laborers may be imported from other places in Kenya and yet they have a large base of cheap labor/workforce amongst their unemployed youth. They felt that the recruitment for employment should be through their local village elders committee since they live with them and know virtually all the educated and responsible youth within their community who could provide the required labor. Furthermore, due to the poor education levels in the area, recruitment of local people for non-technical jobs (e.g. cane cutting, factory operations, etc) should not be based on similar competitive criteria with people from up-country.

- Due to the existing culture among the Tana River and Lamu Districts communities, the women and youth leaders expressed concern that most projects in the region discriminate against them in the decision making process and yet they are the most affected in terms of high poverty and unemployment levels in the area. Hence, the proponent should incorporate them throughout the project cycle
- Most people in the project area live in rural villages. Their sources of income are very limited with over 42% of the rural populations in the area surviving on less than 1 USD per day. They survive on very little income that comes from engaging in cattle trade, selling mangoes, crocodile eggs, milk, fish, basketry and some agricultural products.
- Many stakeholders recommended that proponent in collaboration with the Government, should assist in upgrading the existing infrastructure (especially roads and bridges) and assist in developing new ones. Other facilities that the local people wanted to be developed include water supply system by providing economical water points at village level, electricity and communication networks.
- Due to the poor education levels in the area, the local people requested for more sensitization on the environmental and economic benefits of sugar cane production using a village-to-village contact approach especially among the non-crop farmers.
- The local community suggested that an MoU should be developed with the local communities touching on the following issues: Direct and /or indirect compensation for loss of grazing land, water and land rights, preservation of forest resources, water, wetlands, birds and other wildlife, floods control, management/ administrative systems of the project, food security, Corporate Social Responsibility (CSR), employment opportunities, gender considerations, provision of social amenities and services, and human resettlement.

A number of project alternatives were considered in the study. These include the “no project” alternative. Although this would lead to preservation of the environmental conditions, the communities living in the area are among the poorest in Kenya amidst a rich resource base. This alternative was the least favourable.

The other consideration was use of the site for mixed development i.e. sugarcane production and enhanced habitat conservation. Potential for sugar cane production was identified for the project area in 1969. This is due to favorable soils and climatic that favor fast maturity of 8 months compared to 18-24 months in western Kenya, and high yields (over 100 tonnes per Ha compared to 35 tonnes per Ha elsewhere in the country). There is also availability of enough land and water for large scale irrigation in Lower Tana. The COMESA tariffs arrangements in favor of Kenya will end in 2008 and may lead to a collapse of the sugar industry in the country due to outdated and inefficient existing production and processing technologies. The country is also currently faced with serious sugar deficit of 250,000 tonnes per year compared to current production of 400,000 tonnes per year. Continued importation of sugar has drained foreign exchange and exported jobs. Through the planned utilization of sugar bagasse for co-generation, the proposed project will further assist in gap filling the energy needs of the country using cheaply produced plantation cane to obtain 34Mws of electricity. The project also will generate about 25million liters of power alcohol for the Kenyan economy. The major challenge for the project is the appropriate management of agro-chemicals and water abstraction and usage, as well as proper management of possible socio-economic impacts.

Habitat conservation is essential for mitigating decline in biodiversity due to sugar cane development. The establishment of conservation areas within Lower Tana River project area is an important mechanism for achieving this aim. In addition to protecting biodiversity, conservation areas hold economic value: supporting local livelihoods, protecting watersheds from erosion, harboring flora and fauna, supporting thriving recreation and tourism industries, providing for science and education. These benefits will continue to grow in importance as more and more green area is developed with time. The cane farms; sugar, ethanol and co-generation plants; and other associated facilities will be an attractive educational facility of the primary, secondary, college and university students in the coast province. It will be a major teaching facility for agriculture, engineering and environmental sciences in the recently established Pwani University.

When considering that the Delta and flood plain areas are about 200,000ha, habitat conservation plans should be developed at ratios ranging from 1:1 to 3:1 (Conserved Area: Developed Area) because of the ecological sensitivity and the presence of endangered species of the region. This has also taken into consideration the previous scientific studies that have indicated that 100,000ha of Lower Tana has high potential for agricultural crop production. These ratios can be used as general guidelines when the Lower Tana Development Master Plan will be formulated to allocate space/ land to other viable developments. Some of the negative impacts resulting from the proposed sugar cane development can be minimized by restricting the total area to only 20,000ha, in favor of expanding the forest conservation area to facilitate the creation of unique ecotourism attraction. This is consistent with habitat conservation criteria or ratios set above. Eliminating cane development closest to the proposed forest conservation areas would increase the ecological buffer zone between the development and the existing important forest patches within the project area. Other advantages include the maintenance of woodlands by the creation of forest conservation areas and wetland reserves to continue supporting local livelihoods like fishing, livestock keeping, etc. This alternative is the most acceptable, recommendable and favorable to the project area because it will help to reduce the current poverty level by creating employment, ensuring food security, enhancing livestock activities, and controlling the current environmental degradation.

Perhaps the most environmentally friendly alternative to the current proposal would be to fence and declare the area a Nature Reserve to be used primarily for eco-tourism (wildlife and bird-watching), research and education. The extent of infrastructure near the site would be limited to sanitation, garbage disposal, and off-site parking facilities. Access to the Nature Reserve would be fee-based and would be restricted to pedestrian traffic only. Car access to the reserve would not be permitted. Revenues generated through entrance fees would support the Reserve maintenance crew as well as environmental wardens to monitor the conservation area. This scenario would protect the current state of the aquatic and terrestrial ecology and offer long-term protection from future development initiatives. The present extensive and uncontrolled conversion of forested lands to pasture or agricultural use would also be curtailed by this alternative while maintaining the integrity of the site for use by endemic resident and migrant species of avifauna. This alternative does not provide for agricultural development, or for the level of economic benefits attendant to Alternative 2. This alternative, although attractive, is not to be recommended for reasons cited above regarding welfare of communities in the project area.

Analysis of alternative irrigation technologies (sprinkler versus furrow) showed that the furrow method is the best from cost and even technical considerations.

To select the factory site, the 4 steps below were followed:-

1. Demarcation of cane production area
2. Determination of the geographical centre of production.
3. Within the rough centre an area was sought with suitable acceptable soil conditions for construction.
4. Availability of a water source nearby.

With these criteria in mind, four (4) locations were initially recommended. These are the following and the coordinates:-

1. The area between Tarasaa and Ngao (40 0 11' E -20 26' S)
2. North of Somiti Singwaya Swamp (40 0 12' E -20 22' S)
3. Near the Center of the Project area (40 0 14' E -20 22' S)
4. South of the Rice Project office (40 0 11' E -20 16' S)

Site No. 1 (Between Tarasaa and Ngao) is far from the centre of the plantation, hence the cost of hauling sugar cane from the field to the factory will be higher. This site is also located in the opposite side of the Tana River; hence there is a need to construct bridge for cane hauling. Another disadvantage of this site is that the direction of the prevailing wind is 10 0 SE to 10 0 NW which is directly towards Tarasaa or Ngao villages. This posts some pollution concern regarding fly ash and bagacillo from the boilers. This alternative was, therefore, rejected.

Site No. 2 (Near the Centre of the Project area) is a low land (El = + 12 m) and therefore prone to flooding. The soils are also not very stable. This is not recommended for factory site.

Site No. 3 (South of the Rice Project office) is already a developed area because of the existing rice mill project. However, this site being in the northern most part of the project site is very far from the centre of the plantation making cane hauling cost more expensive. The site is also a low land with elevation of only El. = 14 m. and also subject to flooding during rainy seasons. This is also not recommended for factory site.

Site No. 4 (North of the currently dry former Somiti Singwaya Swamp) is the recommended site for the factory because it's nearer to the centre of the cane plantation. This site is of higher elevation (El. = + 16 m) and therefore not prone to flooding. The prevailing wind direction is 10⁰ SE to 10⁰ NW. with wind velocity of about 25 miles / hr. (40 kms/hr). The prevailing soil type has higher load bearing capacity than the other four sites hence reduces the cost of civil works. There are no recorded seismic activities in the area. There are some houses in the proposed factory site made from local materials: i.e. roof made from palm leaves and walls from bamboo and clay. Vegetation types are mostly palm trees and other small trees averaging three meters high. There are also some domesticated animals such as chicken, goat and cattle but no wild animals. In terms of the land tenure, the proposed factory site is a public land owned by the Government of Kenya through Tana River County Council. The site is about 4 km from Ngao Village/ market. The main source of livelihood is farming, fishing in the Tana River and raising domesticated animals like chicken, goat and cattle. Majority of the people around the factory site are Christians and small percentage of Muslims.

The project is likely to have both positive and negative impacts during construction, operation and even decommissioning phases. **Construction phase** negative impacts include: loss of vegetation cover and biodiversity, alteration or destruction of wildlife and wildlife habitat, dislocation of populations and communities, stress on infrastructure as a result of increased population, loss of graves and the cultural value attached to them, loss of businesses, soil erosion, surface and ground water hydrology changes and water quality degradation, ecological imbalances, solid waste generation, noise pollution, dust emissions, generation of exhaust emissions, increased water demand, increased energy consumption, increased use of building materials and energy, accidents; creation of

informal settlement, physical and economic displacement, diseases, conflicts between locals and newcomers. The mitigation measures to reduce the impacts include: efficient water use in the fields, factories and domestic areas, release of water from the dams upstream of the project area during dry periods, use of cleaner production tools to reduce waste generation at source, use of non- or less hazardous input materials, protection of river banks and canals, awareness creation and education of the project communities regarding HIV/AIDS and other diseases, safe routing of storm water, and enterprise development e.g. development of eco-tourism to assist the local communities.

On the other hand the anticipated positive impacts include: creation of employment opportunities, improving growth of the economy, improved living standards, and provision of market for supply of construction materials and other services.

Operation phase negative impacts include: increased water use and reduced downstream flow, generation of industrial effluents, reduced water quality, waterlogging and salinization, sedimentation of canals, risk of flooding due to structural failure of the dykes, ground water pollution, noise, increased incidence of water borne diseases, increased soil erosion, contamination of soils with herbicides and other agro-chemicals, water logging and salinization of soils, algal blooms, weed proliferation and eutrophication, terrestrial and aquatic ecological changes, increased run-off from new impervious areas, solid waste generation, air pollution and occupational health and safety risks, increase in diseases, alcoholism, changes in lifestyles, increased road accidents, conflicts over resources. Like in the construction phase, the mitigation measures to reduce the impacts include: efficient water use in the fields, factories and domestic areas, release of water from the dams upstream of the project area during dry periods, use of cleaner production tools to reduce waste generation at source, use of non- or less hazardous input materials, protection of river banks and canals, awareness creation and education of the project communities regarding HIV/AIDS and other diseases, safe routing of storm water, and enterprise development e.g. development of eco-tourism to assist the local communities.

The anticipated positive impacts include: employment generation, sugar self-sufficiency, electricity and ethanol generation, increase in revenue, increased rural development, improved security, provision of amenities to the local community including water, electricity, roads and bridges, schools, health facilities, afforestation, promotion of enterprises e.g. eco-tourism and other community-based income generating projects, direct and indirect employment opportunities of over 20,000 people, targeting mainly the local population. The project will be a model of "industrial symbiosis" where wastes in one industrial unit become input raw materials in another unit. Therefore bagasse and molasses wastes generated during sugar processing will be transformed into useful by-products – fuel for the boilers and ethanol. The global benefits of this will be fewer footprints in greenhouse emissions and global warming. This will further earn the country money from the world carbon credits markets.

Decommissioning phase impacts include loss of direct and indirect employment, demolition waste, noise pollution, dust and exhaust emissions, and occupational health and safety hazards.

The preliminary findings during public consultations with stakeholders indicated that most of the community members supported the project as long as: they are involved, it is transparent, their livelihoods are taken care of, and they are fully sensitized on what the project involves.

The Environmental and Social Management Plan that was developed for this study outlines the actions that are required to address the identified negative impacts,

responsibility, implementation stage, costs and relevant regulations/standards to guide monitoring and auditing of the effectiveness of the proposed mitigation measures.

The proposed project offers many significant positive impacts at the local, regional, national and even international levels. On the other hand, potential significant negative project impacts may affect environmentally sensitive areas such as wetlands (rivers, brooks, lakes and the ocean), groundwater and humans and their cultural properties. The main issues are geographically limited, well defined, and well understood in Kenya. Thus, the proponents' major task in respect of the ESMP is to show clearly how it will manage the negative impacts while enhancing the positive ones to ensure a project that is economically, socially and environmentally sustainable. Thus, the proposed project could be approved for implementation provided that the proponent shows capacity to implement the ESMP. In this regard, it is worth to note that Mumias Sugar Company is a well known industry leader in promoting eco-efficiency in its operations and has accumulated credible experience in handling environmental matters in the sugar sector.

LIST OF ABBREVIATIONS AND ACRONYMS

ADC	Agricultural Development Corporation
AEZ	Agro-ecological zones
AWC	Available Water Capacity
BOD	
C	Carbon
COD	
CLO	Community Liaison Officer
COMESA	Common Market for Eastern and Southern Africa
CSR	Corporate Social Responsibility
DC	District Commissioner
EC	Electrical Conductivity
ECD	Environmental Control Department
ECM	Environmental Control Manager
EIA	Environmental Impact Assessment
ELO	Environmental Liaison Officer
GIS	Geographical Information Systems
ESMP	Environmental and Social Management Plan
EU	European Union
FC	Field Capacity
FMT	Farm Mechanization and Transport Department
IBAs	Important Bird Areas
KEMFRI	Kenya Marine and Fisheries Institute
KESREF	Kenya Sugar Research Foundation
KSB	Kenya Sugar Board
MSC	Mumias Sugar Company
MW	Megawatts
N	Nitrogen
NIB	National Irrigation Board
NPEP	National Poverty Eradication Plan
OP	Operational Policy (World Bank)
P	Phosphorus
PRSP	Poverty Reduction Strategy Paper
PWP	Permanent Wilting Point
R & D	Research and Development
RSD	Ratoon Stunting Disease
SSA	Systematic Sequential Approach
TARDA	Tana and Athi Rivers Development Authority
TCD	Tons cane per day
TDIP	Tana Delta Irrigation Project
TISP	Tana Integrated Sugar Project
ToRs	Terms of Reference

2 INTRODUCTION

Mumias Sugar Company (MSC) and Tana and Athi Rivers Development Authority (TARDA) have requested HVA of the Netherlands to carry out a feasibility study for the proposed Tana Integrated Sugar Project (TISP) in Garsen Division of Tana River District and partly Witu Division in Lamu District. The project will entail irrigated sugar cane growing on 16, 000ha of nucleus estate and 4,000 ha of outgrower production. The water for irrigation will be obtained from Tana River. The project will also involve construction and operation of a sugar factory, co-generation of electricity, manufacturing of ethanol, livestock production, animal feeds production and a number of infrastructural improvements in the project area. A project of this nature and magnitude is supposed to undergo an environmental impact assessment.

The project corresponds with the central features of the TARDA's mandate to spearhead projects aimed at alleviating poverty in their area of jurisdiction and MSC's core function of ensuring domestic self-sufficiency in sugar production, creation of employment opportunities and contributing to foreign exchange earnings from competitive sugar markets in the COMESA region. The proposed project is also in line with the following government policies, and international conventions and treaties:

- Economic Recovery Strategy For Wealth & Employment Creation which emphasizes irrigation and value addition in manufacturing enterprises
- Strategy For Revitalizing Agriculture 2004-2014 which recognizes the central role of the agricultural sector, and in particular the important role the sugar sector can play in national development. It emphasizes the need to promote irrigation and private sector involvement
- Private Sector Development Strategy 2006-2010
- Importance of The Sugar Sector in Kenya and Challenges Facing it
- Vision 2030
- Relevant Regional & International Conventions & Treaties: e.g. the Ramsar Convention on wetlands, Convention on Biological Diversity, and Kyoto Protocol on Climate Change

This is the report of a study to produce an environmental and social impact assessment study report for the proposed project in accordance with Section 58 of the Environmental Management and Coordination Act (1999) and Legal Notice No. 101 of 2003.

The objectives of the study were:

- To assess the potential environmental and social impacts of the proposed Tana Integrated Sugar Project (TISP), whether positive or negative, and propose mitigation measures which will effectively address these impacts;
- To inform the Technical Steering Committee (TSC) charged with technical oversight responsibilities regarding the Feasibility Study of the potential impact of different alternatives, and relevant mitigation measures and strategies;
- To inform stakeholders of the proposed project and to seek their views regarding it's potential environmental and social impacts as well as measures to mitigate the negative impacts
- To develop an Environmental and Social Management Plan (ESMP) for the project

The EIA report is organized as follows:

- Chapter 1* - Introduction
- Chapter 2* - Environmental Assessment Methodology
- Chapter 3* - Description of the Project
- Chapter 4* - Baseline information

- Chapter 5* - Policy, legal and institutional framework
- Chapter 6* - Consultation and Public Participation
- Chapter 7* - Environmental and Social Impacts
- Chapter 8* - Analysis of Alternatives for the proposed project
- Chapter 9* - Environmental and Social Management Plan
- Chapter 10* - Institutional Needs to Implement the ESMP
- Chapter 11* - Environmental Monitoring Plan

2 ENVIRONMENT IMPACT ASSESSMENT METHODOLOGY

The scope of this study was guided by the requirements in the Environmental Management & Coordination Act No. 8 of 1999) and in particular by the Environmental (Impact Assessment and Audit) Regulations, 2003. The Kenyan requirements were supplemented by reference to World Bank Operational Policies (OP 4.01 – Environmental Assessment, OP 4.04 – Natural Habitats, OP 4.36 – Forests, 4.09 – Pest Management, 4.20 – Indigenous Peoples, and OP 4.12 – Involuntary Resettlement).

A wide range of methods were used in the various stages of the study. They included methods used by the various specialists for:

- Stakeholder analysis
- scoping of key issues and development of the Terms of Reference for the study
- consultation and public participation
- carrying out the various baseline studies
- definition of the project's sphere of influence
- impact analysis and
- the development of environmental and social management plan

The range of interested and affected parties was identified through consultations with the project proponent, the National Environment Management Authority, leaders and local communities, relevant Government Departments with knowledge of Coast Province, especially Lower Tana including the provincial administration, NGOs working in or with interest in the proposed project area, and the academic community.

The purpose of the scoping exercise was to capture issues that required investigation in the EIA study. The scoping was conducted in a number of consultative meetings with individuals or groups in Nairobi, the project area, Coast Provincial Headquarters, Coast Development Authority, Kenya Marine and Fisheries Research Institute (KMFRI, Mombasa) and at the Kenya Sugar Research Foundation Station at Mtwapa. The meetings were designed to encourage debate about the project. A questionnaire was also developed and circulated to a wide range of stakeholders to provide their views on the project (Appendix 3).

In line with Regulation 17 of Legal Notice No. 101 (2003), five public meetings were held at Garsen town (upstream of the project area), Ngao market (middle of the project area, Kipini market (downstream of project area), Witu market (in Lamu district) and in Nairobi (See pictures below taken during the meetings).



Figure 2.1: Members of the public giving their views at Garsen town



Figure 2.2: Members of the public giving their views at Ngao Village (note the sugar cane in a container used to demonstrate their support of the project)

The purpose of the meetings with the interested and affected parties was to explain to them about the project and its effects and to receive their oral or written comments. Appropriate notices were published for two consecutive weeks in both the *Daily Nation* and *Standard* newspapers. Announcements of the notices were made on the *KBC* radio as well as being posted in suitable places in the project area. In consultation with NEMA, suitably qualified co-ordinators were appointed to receive and record comments from the stakeholders.

To assess potential environmental impacts, use was made of descriptive checklists and matrices. Sectoral guidelines on natural resources management were most useful during the initial stages of an EIA process. The Leopold Matrix was used because it allowed for a systematic analysis of the interactions between project activities and environmental components. The Leopold matrix proposes a three-step process to estimate the impact:

First step: for all the interactions considered significant by the experts, the first step was to mark the corresponding boxes in the matrix with a diagonal line.

Second step: once the boxes with supposed significant interactions were slashed, the experts evaluated each box by applying a number from 1 to 10 (1 is the minimum and 10 the maximum) to register the magnitude of the interaction. This number was transferred to the upper left hand corner. It represented the scale of the action and its theoretical extent.

Third step: the final step for this method was to mark (from 1 to 10), in the lower right hand corner, the real importance of the phenomenon for the given project. It then gave an evaluation of the extent of the environmental impact according to the assessor's judgment.

The Systematic Sequential Approach (SSA) was the most useful method during the assessment. The SSA required the development of conceptual model that represented the causal chain: activity – changes – impact – mitigation. The SSA method led to an understanding of how the environmental, social, and economic systems were interrelated, and how they will react to human disturbances. This met the objectives of the various tasks of the EIA process detailed in the TOR. The above assessment has been buttressed by mitigation measures which may alter the project design to ensure environmental sustainability.

Spatially based methods were useful in screening alternative project sites or routes before a detailed EIA is completed. Spatial methods were used to assess carrying capacity and landscape changes. Where conventional change detection techniques could not yield satisfactory results, a Geographical Information System (GIS) approach was used to indicate the change in quantitative terms. GIS was also used in determining optimal routes for irrigation, and road maintenance.

All these methods were used concomitantly with the *ad hoc* method, that is, expert judgment. Previous EIAs done in the project area were key sources of secondary data to review habitat and vegetation; demographic and settlement; the physical environment; historical archeological monuments and cultural heritage. The review of literature has included work done by Tana and Athi River Development Authority (TARDA), government Lead Agencies, local and international Non-governmental Organizations (NGOs). These assessments have formed the background information for the present EIA.

Besides the approach outlined above, a significant part of the objectives of the EIA were achieved through primary data collection. The baseline studies included: habitat and vegetation; demography and settlement; various aspects of the physical environment; wildlife and fisheries; livestock and range resources; agriculture, pests and diseases; forest products and wood energy; community environmental health, and environmental law and policy aspects. The methods applied in these baseline studies are described below.

Aspects of the physical and biological environment studied included physical features of the project area, agro-ecological zones, soils and their physical and chemical properties, status of soil erosion, nutrient cycles and food chains, potential ecological problems due to soil erosion, siltation and accumulation of

pollutants in the soil, air and water, hydraulic changes, and pests and diseases. Data was obtained from both secondary and primary sources. Climate and agro-ecological information was obtained from the Kenya Meteorological Department and Farm Management Handbook of Kenya. The soils information was obtained from previous reports (e.g. Haskoning, 1982). However representative and profile and top-soil soil samples were taken for fertility analysis at the National Agricultural and Research Laboratories in Nairobi, and Polucon Laboratories in Mombasa.

The vegetation and habitat study involved literature review of recent work (e.g. Luke et al., 2005) and an examination of secondary data (e.g. from TARDA and East African Wildlife Society) with regard to Lower Tana ecosystem (Appendix 19.1.8). Due to inaccessibility of a greater part of the project area, a rapid vegetation assessment approach was adopted. In the dry eco-type, field transects were made along motorable areas with spot vegetation survey/sampling. Where field conditions allowed, transects were made on foot, although this was limited by several factors among them time and accessibility

Riverine vegetation was surveyed using a combination of transect on foot. A TARDA boat was used to survey vegetation types along the riverbanks, which was done both along Matomba channel (ca. 7km) and the main Tana River channel (ca. 30km). Discussions were also held with local communities regarding perceived vegetation change overtime where possible. This was important so as to assist in collaborating changes detected from the field. Vegetation species, which could not be identified in the field were collected and preserved using a vegetation press for identification in herbarium at the University of Nairobi, School of Biological Sciences. Geographical Positioning System (GPS) coordinates were also taken at each vegetation community or at unique sites such as swamps, villages, forest remnants and erosion features. Since no satellite image or aerial photography was available, great importance was put on secondary data to supplement the primary data that was collected.

A number of methods were used in collecting data for the fisheries and other aquatic life study (Appendix 19.1.8). First was a review of literature and other information pertaining to the fisheries. Secondly, interviews were conducted with fishers, fish traders, fish consumers, Fisheries Officers, Government officers and other stakeholders. Third, the team conducted field observations, particularly of fish habitats and breeding areas, fish species, other aquatic fauna and physical and environmental features of interest. The team also checked various fishing gears set along the river course, in lakes and other water bodies. It included assessing physiological parameters such as length and maturity stages of fish caught by fishers as well as in the markets. Photographs were taken of most of the fish species and fishing activities, including fish processing at the markets. The study area included the whole area earmarked for the project and riparian zones likely to be impacted on by the project. It included the entire lower River Tana system from Sailoni to Ungwana Bay, oxbow lakes, swamps and other water bodies, villages, markets and town centers within and immediately outside the project area. Markets located further away, for example, in Garsen and Hola, were also studied to understand the distribution scope for the Lower Tana fishery.

The approach used in the livestock and wildlife component involved literature review, field surveys, group discussions and questionnaire survey involving 180 respondents (Appendix 19.1.8). The literature review involved review of relevant publications produced by TARDA, KWS, AU-IBAR, Arid Land Resource Management Project, GL-CRSP and reports by Government departments. Information captured included: Livestock numbers, ownership, productivity, seasonal movement, diseases and disease control methods and feed resources available.

From the reconnaissance survey done at the beginning of the study, 26 villages close or within the proposed project area were identified. Twelve of these villages were purposefully selected for the administration of a structured questionnaire. The inhabitants of these villages include Pokomos, Ormas, Wardeis, Wasanye and Giriama. The Pokomo and the Ormas form the majority of the inhabitants with each community accounting for 44 % of the total. The Wardei is a small community composing only 8% of the total. The others (Wasanye, Giriama etc) account for the other 4%. The questionnaires were administered to 180 people, 75 of whom were Pokomos, 75 Ormas and 30 Wardeis.

Transects were made in the following habitats within or close to the proposed project area: Mitapani bridge along the border dyke to the Matumba brook opposite and near On Kolde village, Forest patch across the Tana river opposite Ngao village (Somiti, Singawa swamp), Lango la Simba and the area around Moa lake and village.

Focus group discussions were held in Kipao, Ngao, Dalu, Danisa B, Sailoni and Hewani villages. A sample of the questions/issues handled during the focus group discussions is provided in Appendix 8.

Discussions were also held with stakeholders as shown below:

(i) Garsen Division Headquarters

- a. **Government officers:** District officer, Division Range Officer, Division Animal Health officer, Division agricultural officer and Senior Warden, KWS.
- b. **NGOs:** World vision

(ii) Tana River District Headquarters:

Government officers: District Livestock Production officer, District Veterinary Officer, District Range officer, Drought Management Officer, District Agricultural extension Officer, Deputy District veterinary Officer, District development Officer, District Warden (KWS)

(iii) Technical Steering Committee: Members of this committee were met during the reconnaissance survey.

The socio-economic survey was based on structured questionnaires and participatory people-centered approach. The methodology used at the field level entailed the administering of a conventional questionnaire and participatory tools that had an instruction guide to enrich the findings. Checklists with direct questions were also administered to selected groups e.g. the marginalized, trading centres residents and women. The NGOs working in the area were also approached through answering questions from a detailed flyer. The sampling was done using a purposive sampling methodology to ensure that all project geographic, tribal, density and other considerations were taken care of. The main criteria were the 3 distinct ethnic groups of Pokomo, Wardei and Orma being covered adequately. Special care was taken to make sure that the small population of Wardei's was covered with a minimal statistical sample of at least 30 respondents. This then was computed with the other two groups of Pokomos and Ormas to give a full sample size of 180 respondents. On the selection of villages, a simple random sampling method was used allocating a larger sample to villages within the TARDA scheme and rest from outside following the indicative ethnic composition noted earlier. The urban centres in the area covered were Idsoe, Garsen, Ngao, Witu and Tarasaa. Detailed Focus Group Discussions were also held in the sampled villages as a control of the results.

To ascertain existing land tenure systems in the proposed project area, a desk study was performed and interviews conducted with TARDA officials. A field reconnaissance was made to the project area (Appendix 8).