

KIBOS FERTILIZERS LTD



**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT STUDY REPORT FOR THE PROPOSED
BIO-FERTILIZER PLANT ON LR NO. 654/52,
MIWANI CENTRAL LOCATION, MUHORONI SUB-
COUNTY IN KISUMU COUNTY**
At longitude 34.5⁰ – 35⁰ East and latitude 0⁰
1⁰North and 0⁰ 25' South

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AUGUST 2019


REPORT AUTHENTICATION FORM

We, the **KENYA NATIONAL CLEANER PRODUCTION CENTER (KNCPC)**, a firm of experts, contracted by **KIBOS SUGAR AND ALLIED INDUSTRIES LTD (KSAIL)** to carry out an **Environmental and Social Impact Assessment** for the **Proposed Kibos Bio-Fertilizer Planton LR NO. 654/52, Miwani Central Location, Muhoroni Sub-County In Kisumu County** do hereby certify that this Study report has been prepared based on the information provided by the KSAIL management as well as information 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 under the EMCA, 1999 [2015].

Consultant

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The Director: Kenya National Cleaner Production Center (KNCPC)

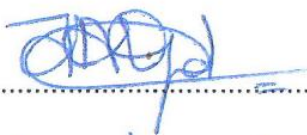
Signature..... 
Date..... **23rd Aug. 2019**



Project Proponent

The Managing Director: Mr. Raghbir Singh Chatthe

Kibos Sugar and Allied Industries Limited (KSAIL) a.k.a. The Chatthe Group

Signature..... 
Date..... **31st August 2019**



EXECUTIVE SUMMARY

Kibos Sugar and Allied Industries (KSAIL) is one of the private key players in Kenya's Sugar industry located in Muhoroni Sub-County; Kisumu County at longitude 34.5⁰ – 35⁰ East and latitude 0⁰ 1⁰North and 0⁰ 25' South of the equator at an altitude of 1175 metres above sea level, covering about 500km² to East of Kisumu City in Miwani Division. It borders the Kibos River, one of the three major rivers flowing into the Nyanza Gulf; Lake Victoria Basin, on one side, and is across the road from the Kibos Correctional Facility and Kibos School for the Visually Impaired on the other side. KSAIL group currently has five operating facilities within its complex which are symbiotically related i.e. sugar milling plant, the sugar refinery plant, the cogeneration plant, the distillery and the paper mill.

From these plants, the group has in the recent past had challenges in managing its waste namely, filter mud, fly ash, boiler ash and vinasse (spent wash). These waste streams have posed a serious pollution challenge. Due to this pollution challenge, the Chatthe Group has commissioned the Kenya National Cleaner Production Centre (KNPC) to undertake this Environmental and Social Impact Assessment (ESIA) study for the proposed bio-fertilizer plant on LR NO. 654/52, Miwani Central Location, Muhoroni Sub-County in Kisumu County. It is envisaged that the proposed plant shall utilize the by-products from the sugar plant (Boiler ash & filter mud) and the spent wash (Vinasse) from the distillery as the primary raw materials to make organic fertilizer.

These process by-products have been identified as outstanding problematic streams that have caused pollution on water (effluent), air and land. This ESIA Study has identified some of the significant negative impacts likely to be generated by the activities of the proposed project. However, most of these potential negative impacts have been mitigated in the Environmental and Social Management Plan (ESMP) which the management of KSAIL (Chatthe Group) need to adhere to.

This proposed project is also meant to create some green jobs both directly and indirectly. At the factory, over 100 people shall be employed as other people shall be employed indirectly through backward and forward linkages, including transportation, distribution and selling of the bio-fertilizer. Indeed this is a green plant that is proposed to be

constructed. It is important to also note that this proposed project shall mop up similar wastes from other sugar factories and distilleries which over the years has been a source of pollution into the Lake Victoria. Indeed this project is meant to close the loop in terms of waste management since no waste shall be disposed into the environment. Thus the project promotes the circular economy as envisioned in our national Green Economy Strategy and Implementation Plan (GESIP).

From the perspective of the public views and opinions gathered, the analysis has revealed that establishment of the bio-fertilizer plant in its intrinsic right shall not present any fundamental social and environmental threats. Instead, the substance of the public views and opinions obtained that command the directions for mitigation measures are premised on the histories of relations between the existing KSAIL family of factories and its ecosystem. Much of the concerns raised from the consultations centered on the need for the operations and management of the bio-fertilizer plant to be in tandem with local community requirements

- i. for zero effluent discharge into the River Kibos and surrounding drainages which feed into River Lie Lang'o flowing to Lake Victoria;
- ii. no fly ash from the chimney;
- iii. limited noise from steam purging;
- iv. no dust from roads during heavy vehicles movement; and
- v. no smell from the fermenting waste water and gas from bio digester.

Other social issues raised included:

- i. inadequate corporate social responsibility on matters of education and health;
- ii. inadequate employment of the locals;
- iii. lack of close liaison with the community; and
- iv. co-decision making and sharing of proceeds from investments by the KSAIL firm.

To this end, the following considerations have informed the development and structure of the proposed ESMP for the bio-fertilizer plant which KSAIL management needs to adhere to.

- I. Establishment of an inclusive Grievances Redress and a proposed plant Feedback Mechanism for purposes of capturing, negotiating and streamlining social and environmental impacts that may arise over time in the life of the bio-fertilizer plant.
- II. Stepping up a more transparent and inclusive CSR strategy.
- III. Establishment of an explicit communication and decision making strategy.
- IV. Instituting a satisfactory Reallocation Plan for the primary schools, if deemed appropriate during the bio-fertilizer factory's operations phase.
- V. Establishment of a NEMA coordinated continuous monitoring and evaluation framework for management of the Plant.
- VI. Establishment of a strategy for continuous engagements between KSAIL and a competent technical support agency for Resource Efficient and Cleaner Production (RECP) improvements of the KSAIL family of factories, including the proposed bio-fertilizer factory.

Based on a succinct analysis of the views of the stakeholders and the expert observations, the proposed project will not compromise the well-being of the environmental condition as it is set to utilize the problematic waste currently generated by the group sister companies as raw material for the production of the bio-fertilizer and therefore, will in fact create employment for the Kenyan population and provide a clean environment.

TABLE OF CONTENT

EXECUTIVE SUMMARY	ii
Acronyms and Abbreviations Used in this Report.....	x
CHAPTER ONE.....	1
1.0 INTRODUCTION	1
Background	1
Project objective.....	2
1.1 Objectives of the EIA Study.....	2
CHAPTER TWO	3
2.0 EIA Study Methodology	3
2.1 Proposed Project Screening and Scoping.....	3
2.2 Development of Terms of Reference for the EIA study	3
2.3 The EIA study process	3
2.3.1 Literature Review.....	3
2.3.2 Collection of Baseline Information.....	4
2.3.3 Consultation and Public Participation.....	4
CHAPTER THREE	5
3.0 PROJECT DESCRIPTION, PHYSICAL ENVIRONMENT AND LAYOUT PLAN	5
3.1 Development of Kibos Sugar and Allied Industries	5
3.1.1 The Sugar Plant.....	5
3.1.2 Co-generation Plant	5
3.1.3 Paper Plant	5
3.1.4 Molasses Distillery.....	6
Figure 3.1: A schematic diagram showing a representation of symbiotic relationship at Kibos distillery plant.....	6
3.2 Current Problematic Wastes.....	6
3.2.1 Filter mud.....	7
Table 3.1: Physical properties and chemical composition of Sugarcane Press mud:	7
3.2.2 Boiler ash	8
3.2.3 Vinasse.....	8
Table 3.2: Vinasse Application and Nutritional Levels	8
3.3 The Proposed Bio-fertilizer Factory.....	8
Figure 3.2: Schematic Presentation of the Proposed Fertilizer Plant.....	10
3.4 Proposed Plan Layout.....	10

3.4.1	The Godown.....	10
3.4.2	Associated Blocks.....	11
3.5	Structural and Stability Arrangements	11
3.5.1	Sanitation in the Godown.....	11
3.5.2	Administration Office (480m ²).....	11
3.5.3	Ablution Block.....	12
3.5.4	Office Block.....	12
3.6	Electricity and Steam	13
3.7	Water	13
3.8	Security.....	13
3.9	Waste.....	13
3.10	Architectural and Structural Drawings.....	13
CHAPTER FOUR.....		14
4.0	PROPOSED PROJECT ALTERNATIVES	14
4.1	Alternative Sites	14
4.2	Technology Alternatives	14
4.2.1	Alternative 1: NO Project Alternative	15
4.2.2	Project Alternative 2. Potash Recovery	15
4.2.3	Project Alternative 3: Bio-methanation and Land Application	15
4.2.4	Project Alternative4: Biomethanation, Secondary Biological Effluent Treatment then Composting.....	16
4.2.5	Project Alternative 5: Biomethanation, Multiple Effect Evaporator, Composting or Incineration.....	18
4.2.6	Project Alternative 6: Bio-methanation, Multiple Effect Evaporator, Dryer, Granulation, and Fertilizer Blending	19
CHAPTER FIVE		21
5.0	PROPOSED PROJECT SITE LOCATION BASELINE CONDITIONS	21
5.1	Project Location	21
	Figure 6: Proposed Project Site.....	21
5.2	Physical Environment	22
5.2.1	Topography	22
5.2.2	Drainage	23
5.2.3	Geology and Soils	24
5.2.4	Climatic Conditions	25
5.2.5	Hydrology	25
5.3	Biological Environment	25

5.3.1	Flora.....	25
5.3.2	Fauna.....	26
5.4	Human Environment	27
5.4.1	Education	27
5.4.2	Population	28
5.4.3	Gender Aspects	28
5.4.4	Health.....	28
5.4.5	Poverty Aspects	29
5.4.6	Land use.....	29
5.5	Infrastructure Aspects	30
5.5.1	Transport.....	30
5.5.2	Water resources.....	32
5.5.3	Energy	32
5.5.4	Solid Waste management.....	33
5.5.5	Liquid Wastes Management	34
5.5.6	Security	35
5.6	Social and Economic Environment.....	35
5.6.1	Agriculture	35
5.6.2	Fishing.....	35
5.6.3	Economic Activities.....	36
5.6.4	Tourism.....	36
5.7	Environmental Hazards and Disasters Aspects.....	37
5.7.1	Flooding and Droughts	37
5.7.2	Invasive Species.....	37
CHAPTER SIX.....		38
6.0	POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK.....	38
6.1	General Overview	38
6.2	Policies	38
6.2.1	National Policy on Water Resources Management and Development	38
6.2.2	Sessional Paper on Environment and Development (No. 6 of 1999)	39
6.2.3	Sustainable Development Goals	39
6.2.4	The Constitution of Kenya, 2010.....	40
6.2.5	Kenya Vision 2030	41
6.2.6	National Environmental Action Plan (Neap) 2009-2013.....	41
6.2.7	Sessional Paper No. 6 Environment And Development	41

6.3	Legal Framework	42
6.3.1	Environment Management and Co-ordination (EMC) (Amendment) Act 2015	42
6.3.2	Environmental (Impact Assessment and Audit) (Amendment) Regulation, 2009	42
6.3.3	Occupational Safety and Health Act, 2007	43
6.3.4	Waste Management Regulations, 2006	44
6.3.5	EMC (Water Quality) Regulations, 2006	44
6.3.6	The Energy (Energy Management) Regulations, 2012,.....	44
6.3.7	The Occupiers Liability Ordinance, CAP 34.....	45
6.3.8	The National Government Co-Ordination (General) Regulations, 2014.....	45
CHAPTER SEVEN		46
7.0	ANALYSIS AND APPRAISAL OF ENVIRONMENTAL IMPACTS	46
7.1	Physical Environment (Biophysical Impacts)	46
7.2	Natural Environment	46
7.3	Social welfare, Economic and Cultural Environment.....	46
7.4	Environmental and Social Impacts Identification, Methodology and Appraisal	47
7.4.1	Physical Impacts	47
7.4.2	Biological Impacts	49
7.4.3	Occupational Health and Safety.....	53
Table 7.1: Summary of Project Activities, Potential Impacts, and Proposed Mitigation Measures		55
CHAPTER EIGHT		58
8.0	PUBLIC CONSULTATION AND PARTICIPATION (CPP).....	58
8.2	Data and Methods.....	59
8.2.1	Information Required and Sources	59
8.2.2	Participants' Mobilization.....	59
8.2.3	Collection of the Stakeholder views	60
8.2.4	Distribution of the Participants by Consultation Platforms	61
Table 8.1: Consultation Frequency Distribution, June-July 2019.....		61
8.3	Views and Opinions from the Consultations.....	62
8.3.1	Views and opinions from the public <i>baraza</i> meetings	63
Table 8.2: Issues raised during the meeting at Guba Centre, Kajulu		63
Table 8.3: Issues raised during the meeting at Kibos Market		64
Table 8.4: Issues raised during the meeting at Chiga Market		66
Table 8.4: Issues raised during the meeting at Kibos Agricultural Section		67
8.3.2	Views and Opinions from the Technical Workshop, Kisumu Central	69

8.3.3	Views and Opinions from the Environment and Natural Resources Committee	69
8.3.4	Views of the Area MPs	71
8.4	Summary of Public Views and Opinions	72
8.4.1	Thematic public preferences for mitigation measures	72
8.4.2	Potential positive impacts	73
8.4.3	Potential negative impacts	73
9.0	ENVIRONMENTAL MANAGEMENT PLAN.....	74
	Table 9.1 Environmental Management Plan	75
CHAPTER TEN.....		86
10.0	PROJECT DECOMMISSIONING	86
10.1	Decommissioning Phase	86
10.1.1	Removal of Waste.....	86
10.1.2	Site Restoration.....	86
10.2	Impacts during Decommissioning Phase	86
10.3	Handling Hazardous and Regulated Materials	86
	Table 10.1: Summary of the Decommissioning Plan for the Proposed Kibos Fertilizers Ltd. ...	88
CHAPTER ELEVEN.....		90
11.0	CONCLUSION.....	90
11.1	RECOMMENDATION	91
12.0	REFERENCES.....	93
13.0	APPENDICES	94

Acronyms and Abbreviations Used in this Report

DSW	Distillery Spent Wash
EMCA	Environment Management and Coordination Act
ENA	Extra Neutral Alcohol
EPSGG	Engaging the Private Sector for Green Growth
GESIP	Green Economy Strategy and Implementation Plan
KDL	Kibos Distillers Ltd
KFL	Kibos Fertilizers Ltd
KNCPC	Kenya National Cleaner Production Centre
KSAIL	Kibos Sugar and Allied Industries Ltd
LVEMP	Lake Victoria Environment Management Programme
MW	Mega Watt
NEMA	National Environment Management Authority
TCD	Ton Cane per Day
WB	World Bank

CHAPTER ONE

1.0 INTRODUCTION

Background

The award of the contract for this study was conceived after a visit by the Kenya National Cleaner Production Centre (KNCPC) and the World Bank (WB) team working with the Lake Victoria Environment Management Project Phase III (LVEMP III) to KSAIL. The team made a green value chain collaborative courtesy call to KSAIL management as part of engaging the private sector for green growth in the Lake Victoria Basin. During this meeting, the KSAIL management gave a nod for the proposed Kibos bio fertilizer project to be used as a candidate for the green value chain activity under the EPSGG project due to its unique industrial arrangement that has elevated the group companies to a circular economy mode of operation. During this meeting, it emerged that the fertilizer plant development would require a full EIA study for the National Environment Management Authority (NEMA) to license its construction and operation. It is at this point that the Executive Director KNCPC agreed to offer the EIA service to Kibos Fertilizer Ltd.

KSAIL is one of the private key players in Kenya's Sugar industry located in Muhoroni sub-county; Kisumu County at longitude 34.5^o – 35^o East and latitude 0^o 1^oNorth and 0^o 25' South of the equator at an altitude of 1175 metres above sea level, covering about 500km² to East of Kisumu City in Miwani Central Ward. It borders the Kibos River, one of the three major rivers flowing into the Nyanza Gulf; Lake Victoria Basin, on one side, and is across the road from the Kibos Correctional Facility and Kibos Secondary and Primary Schools for the Visually Impaired. KSAIL group currently has five operating facilities within its vast industrial complex which are symbiotically related i.e. The main sugar milling plant, the sugar refinery plant, the cogeneration plant, the distillery and the paper mill.

The group started operations with the main sugar factory in 2007 with a capacity of 1650TCD and has over time expanded this capacity to 3,500 TCD whose main products are; Sugar, Molasses and electric energy from a turbine alternator. By-products include bagasse, filter mud, boiler ash and waste water.

The co-generation plant was the second project in the chain utilizing bagasse as its energy material. It currently has a power generation capacity of 18 Mw. This plant supplies power to the entire group's facilities. To overcome the challenges and risks that come with excess bagasse, the group invested in a paper plant that uses the bagasse and waste brown paper as raw material in making various paper and packaging products.

The fourth plant to be installed was the sugar refinery whose aim is to refine sugar to food grade standards for the East and Central Africa markets. The distillery was the fifth plant to be installed within the complex to utilize the molasses by-product and

manufacture ethanol. The distillery has the capacity to produce 40,000 litres of extra neutral alcohol (ENA) per day with vinasse (spent wash) as a by-product. The Chatthe group has proposed to establish a fertilizer plant to utilize the waste products from the sugar plant and the distillery vinasse which has been identified as one of the most problematic effluent streams from the distillery.

Project objective

The main objective of the proposed project is to diversify the product offering of KSAIL group and to increase group revenue while safeguarding the environment through pollution control.

Specifically the project aims at utilizing the by-products from the group companies which have in the recent past caused environmental challenges through pollution. Contribution to the national economic growth through taxes cannot be over looked along with provision of employment opportunities in the entire project cycle hence creating a sustained socio-economic impact.

1.1 Objectives of the EIA Study

The main objective of study process is to assist the proponent ensure environmental and social concerns are integrated and accounted for in all stages of the project development and implementation.

The specific objectives are:

- i) To comply with and fulfil the legal requirements as outlined in section 58 of the Environmental Management and Coordination Act,(EMCA), 2015 and Section 3&4 of Environmental (Impact Assessment/Audit) Regulations, 2003 as well as other relevant regulations;
- ii) To undertake an open and inclusive consultation and public participation to gather environmental and social issues concerning the proposed project;
- iii) To determine whether or not the project is likely to have significant impacts; and if yes, identify potential significant environmental impacts, analyse significance of the adverse impacts, determine whether adverse impacts can be mitigated and recommend mitigation measures;
- iv) To develop an Environmental Management Plan (EMP) for the project outlining anticipated impacts and their mitigation measures.
- v) To generate baseline data for monitoring and evaluation of how well the proposed mitigation measures shall be implemented during the project cycle.

CHAPTER TWO

2.0 EIA Study Methodology

2.1 Proposed Project Screening and Scoping

The award of the contract for this study was conceived after KNCPC and the World Bank team paid a courtesy call to KSAIL and its management with a view to collaborate on a green value chain project viz Engaging the Private Sector for Green Growth in the Lake Victoria Basin (EPSGG-LVB) Project. During this meeting, the KSAIL management gave a nod for the proposed bio-fertilizer plant to be used as a candidate for the green value chain activity under the EPSGG-LVB Project due to its unique industrial arrangement that has elevated the group companies to a circular economy mode of operation.

During this meeting, it emerged that establishment of the bio-fertilizer plant within the KSAIL family of factories required a stand-alone full EIA study report for NEMA to license its construction and operations. It is at this point that KNCPC volunteered to undertake the EIA study for the proposed bio-fertilizer plant.

2.2 Development of Terms of Reference for the EIA study

The development of the Terms of Reference (ToRs) for the proposed project was the second activity in accordance with the requirements of EMCA, [2015 Amendments]. First, the EIA Team and the proponent visited NEMA headquarters for a briefing session with the NEMA Director General, the Director Compliance and Enforcement, the Chief Compliance Officer and other representatives of the EIA department. In this meeting, the best approach to the EIA full study was discussed and it was agreed that KNCPC go ahead and develop the ToR and submit to NEMA for approval. KNCPC then developed and submitted the ToRs which NEMA approved.

2.3 The EIA study process

After approval of the ToR for the proposed project, the KNCPC experts embarked on the full study activities for the proposed bio-fertilizer. The following study activities were undertaken.

2.3.1 Literature Review

This stage involved the collection and examination of existing secondary information about the proposed project technology; its previous successes worldwide, including relevant previous studies; project location baseline conditions (soil, land use, natural resources, environmental and infrastructural information); and policy and legal framework governing the proposed project that the proponent will be required to comply with. This

also involved designing and testing of data gathering protocols and tools for the public and stakeholder participation.

2.3.2 Collection of Baseline Information

The KNCPC Team visited the project site and collected baseline information required from within and around the project area via observations, photography and measurements. Appropriate tools and scientific methods of data collection were employed in the study. Detailed baseline conditions have been discussed in chapter five of this report

2.3.3 Consultation and Public Participation

The KNCPC developed appropriate programs for consultations with focused groups, key stakeholders, members of the public, suppliers and other interested parties as required by the law. Four public Baraza and one workshop were organized within Kibos area (Kolwa Central/Miwani Central), Chiga in Kolwa East, Guba in Kajulu East, and Kisumu City.

These public meetings and the workshop attracted 432 participants. The consultation activity was also extended to the National Assembly's Parliamentary Committee On Environment and Natural Resources at the national chambers. During these meetings, several issues were raised that KSAIL needs to consider in the entire project cycle and mitigate those that are already outstanding for the upstream some of the immediate issues raised were;

- *Ground Water pollution,*
- *air pollution (smell), biodiversity loss (papaya),*
- *community engagement in projects development,*
- *grievance reporting mechanism;*
- *Corporate Social Responsibilities;*
- *Employment issues;*
- *Noise;*
- *particulate matter dispersion (Fly ash);and*
- *dust from roads as a result of heavy vehicles movement.*

Detailed consultation and public participation results have been discussed in chapter seven of this report.

CHAPTER THREE

3.0 PROJECT DESCRIPTION, PHYSICAL ENVIRONMENT AND LAYOUT PLAN

3.1 Development of Kibos Sugar and Allied Industries

Given that Kibos Sugar and Allied Industries has other upstream projects namely the sugar plant, the cogeneration plant, the paper plant and the distillery plant whose waste generated is problematic to handle, the company has proposed utilization of waste and by-products generated from these to manufacture bio-fertilizer hence adding value instead of being disposed of into the environment. The wastes are from the following processes:

3.1.1 The Sugar Plant

This is the initial plant commissioned by the group in 2007 to manufacture sugar. The main material input is sugar cane and brown sugar for consumption is the main product. In the process of manufacturing sugar, a number of by products are produced namely; bagasse, filter mud, fly ash, molasses and waste water. Handling and management of these by-products poses serious challenges not only to the environment but also to the health of the entire ecosystem. In mitigating the negative impacts of one of the waste stream (Bagasse) the group set up the cogeneration plant.

3.1.2 Co-generation Plant

The co-generation plant was set up to provide energy and steam needs to the sugar plant. The plant utilizes bagasse waste from the sugar mill. However, this co-generation does not exhaust all the bagasse generated and therefore, challenges of handling excess bagasse, which was dumped in the open fields arose as is the same with all sugar factories in Kenya. Challenges of leachate to the environment during the rainy season and fine fibre fly coupled with the risk of fire during the dry season posed more environmental and health challenges. These challenges informed the construction of the paper plant to consume the excess bagasse.

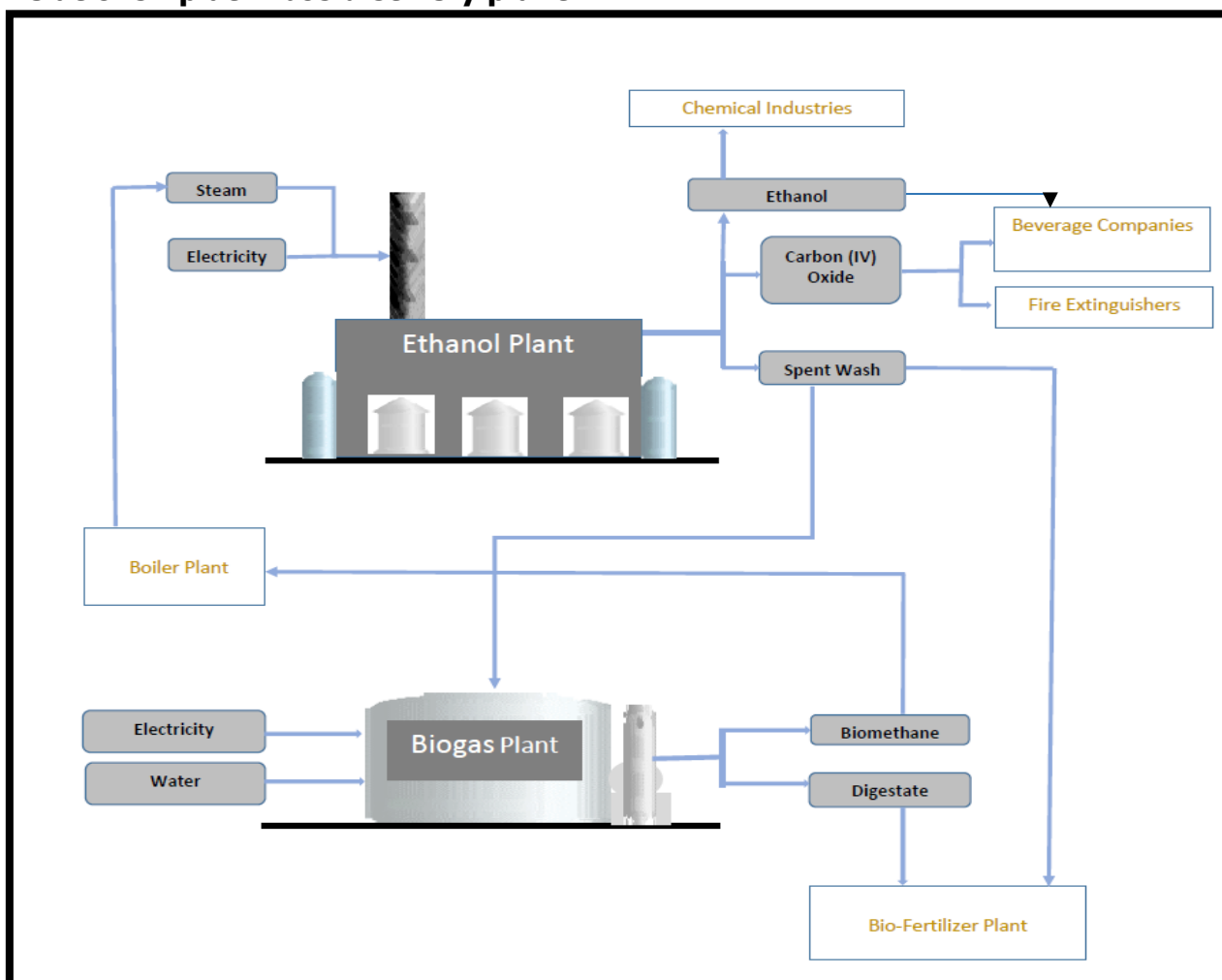
3.1.3 Paper Plant

The establishment of a paper manufacturing plant to use the excess bagasse was mooted. The Kibos Paper and Packaging Plant Ltd was established for the production of brown Kraft paper from both virgin pulp (bagasse) and waste paper procured externally to make paper and packaging products. This provided a solution to bagasse disposal in the open fields. Currently, the demand for bagasse within the group outweighs production and therefore, the group is buying bagasse from other sugar factories for internal use both as fuel and raw material for the paper plant.

3.1.4 Molasses Distillery

The setting up of distillery to consume molasses waste/by-product from the sugar plant to manufacture ethanol as the main product and other industrial alcohol products was the fourth project by the group. From the distillation process, spent wash comes out as residual product in wastewater. At Kibos distillery, first, this spent wash is anaerobically digested to produce biogas which is fired in the boiler as a source of fuel and the excess flared. The final discharge from the digester (vinasse) is the most polluting liquid solution. Currently, the management of vinasse at kibos distillery is by lagooning which has a negative impact of possible percolation into the ground water and bad odour. Part of the Vinasse diluted with water and transported to Kisumu Water and Sewerage Company (KIWASCO) open lagoons for natural treatment and ultimate disposal.

Figure 3.1: A schematic diagram showing a representation of symbiotic relationship at Kibos distillery plant.



3.2 Current Problematic Wastes

Three current waste streams are presenting a big environmental challenge for KSAIL. These are

- (i) filter mud from sugar clarification
- (ii) boiler ash from the co-generation plant, and
- (iii) spent wash (vinasse) from the distillery.

3.2.1 Filter mud

For every 100 tons of sugarcane crushed about 3 tons of filter mud cake is left behind as by-product/waste. Filter-cake which is also called filter mud is a solid residue obtained from the filtration of sugarcane juice. In some sugar industries, filter mud is disposed of as garbage, or used as fertilizer, whether as raw material or by converting it into compost. For a long time, Kibos has been using the residual filter mud for application in the sugar plantation. However, this type of waste takes sometime to biodegrade, can be smelly and if it rains, water is leached into the surface or ground water.

Conventionally, filter press mud contains considerable amount of organic matter and mineral elements required for plant nutrition, filter mud has already been utilized as a soil conditioner and fertilizer in several countries, including Brazil, India, Australia, Cuba, Pakistan, Taiwan, South Africa, and Argentina.

Table 3.1: Physical properties and chemical composition of Sugarcane Press mud:

S.No.	Parameters	Value
1.	pH	4.95 %
2.	Total Solids	27.87 %
3.	Total Volatile Solids	84.00 %
4.	C.O.D.	117.60 %
5.	B.O.D.(5 days at 27°C)	22.20 %
6.	Organic Carbon.	48.80 %
7.	Organic matter	84.12 %
8.	Nitrogen	1.75 %
9.	Phosphorus	0.65 %
10.	Potassium	0.28 %
11.	Sodium	0.18 %
12.	Calcium	2.70 %
13.	Sulphate	1.07 %
14.	Sugar	7.92 %
15.	Wax and Fats	4.65 %

From above analysis, Press mud contains a sizable quantity of macro and micro nutrients, besides 20-25% of organic carbon. Press mud is also rich in potassium, sodium, and phosphorous. It is a rich source of phosphorus and organic matter and has a large moisture content, which makes it become a valuable compost fertilizer if composted and

mixed with other nutrient rich materials such as ash rich in Phosphate and vinasse a by-product from the molasses fermentation and distillation process.

3.2.2 Boiler ash

Sugarcane bagasse ash produced from co-generation of electricity is another waste stream that presents an environmental compliance problem to Kibos. The ash has previously been used as a filler material on roads or mixed with filter mud and spread on farms as a soil conditioner. This is not a sustainable method of managing this residual waste.

3.2.3 Vinasse

Vinasse is generated in copious amounts as wastewater that presents a big threat to the local water bodies pollution. Vinasse is high in pollution load (approx. BOD₅ of around 4,000mg/l and COD of around 30,000mg/l) even after anaerobic treatment in a biogas digester. It is very difficult to treat in conventional treatment systems to achieve the Kenya effluent discharge standards of BOD₅-30mg/l and COD-50mg/l.

Vinasse is rich in organic matter and mineral elements i.e. Sulphur, Nitrogen, Phosphorous, Potassium, Calcium and Magnesium as shown in table 2.

Table 3.2: Vinasse Application and Nutritional Levels

Vinasse Rate and Nutrient Contribution to Soil						
					2.471	A/Ha
	Vinasse rate	20,000	Lt/Ha	8,094.000	lt/Ac	5,284.02 gal/Ha
	Analysis Range %		Rate amount (Kg)		Rate Kg/Ac	
Solids	8.5%		1,700		688	
Organic solids	0.035%	0.07%	700	1,400	283	567
Nitrogen	0.08%	0.1%	16	20	6	8
Phosphorous	0.01%	0.03%	3	5	1	2
Potassium	0.50%	0.75%	100	150	40	61
Calcium	0.15%	0.20%	30	40	12	16
Magnesium	0.15%	0.18%	30	36	12	15

3.3 The Proposed Bio-fertilizer Factory

The above three waste streams are expected to be managed by establishing a Bio-Fertilizer factory that feeds on these wastes as raw materials. The Bio-fertilizer plant shall utilize the by-products from the sugar plant (Boiler ash & filter mud) and the spent wash from the distillery as the primary raw materials to make organic fertilizer. These process

by-products have been identified as outstanding problematic effluent streams to the environment.

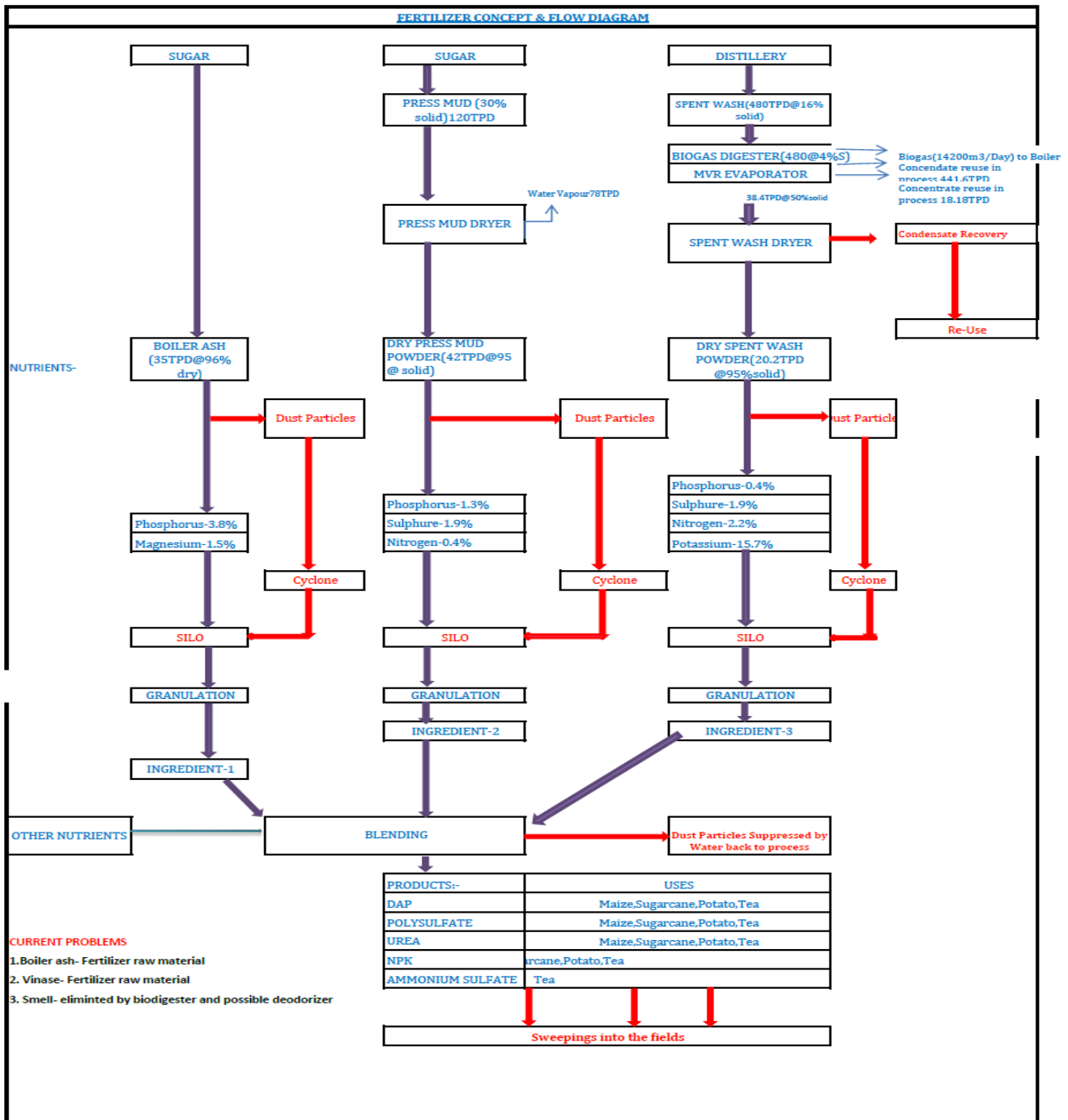
The concept of using waste from one production process as a raw material for another is called Industrial Symbiosis. Industrial Symbiosis is a Circular Economy tool for transitioning towards Green Growth. Engendering symbiotic activities between firms, brings about sustainable resource use at the inter-firm level, minimizing the input of virgin materials and concurrently eliminating waste.

Industrial Symbiosis involves inter-relationships between industrial processes executed by usually single industries, such as the physical exchange of materials, energy, water and by-products, to create shared benefits. The use of IS can confer competitive advantages to firms and improves their overall environmental and economic performance.

In the proposed project, KSAIL group plans to utilize the filter mud, boiler ash and vinasse available from the group companies in the manufacture of cost effective and quality fertilizer by blending with Phosphate rock from Uganda and Tanzania, imported Urea, DAP, NPK, and Sulphate Ammonia (SOA).

To date, the group is engaging the Toyota Group under their company Toyota Tsusho Fertilizer as the preferred partner. It is projected that the fertilizer production will be at a rate of 40,000 tons capacity per annum expandable to 170,000 tons per annum.

Figure 3.2: Schematic Presentation of the Proposed Fertilizer Plant



3.4 Proposed Plan Layout

The proposed project will be developed on land owned by the Chatthe Group. The group proposes the construction of a Go-down to house the production plant and associated blocks. The project comprises the following:

3.4.1 The Godown

- i. The import storage where the raw materials are received – size 120.00 x 80.00 x 12.00meters high.

- ii. The Factory Building where the materials are transformed into fertilizers size 120.00 x 80.00 x 12.00meters high.
- iii. The Finished Product Storage where the manufactured fertilizer is stored waiting for transportation to the clients.

3.4.2 Associated Blocks

- i. The two storey Kibos Fertilizer Administration Block size 20m x 12.00m (250m²)
- ii. Kibos Fertilizer Administration Offices size 3000 x 1500 (450m²).
- iii. Kibos Fertilizer Ltd. Time Office size 13.620 x 8.100 (110.3m²)
- iv. The Ablution Block 3000 x 1500 (450m²).
- v. The terrace, parking, security wall.

3.5 Structural and Stability Arrangements

The proposed development is on a deep black cotton soil with a low load-bearing strata prone to flooding. In consideration of the above factors the Structural Engineer has provided for a thick gravel compacted fill overlaid with an impervious Gauge 1000polythene sheet and a concrete floor size 1.200 meter thick reinforced with BRC mesh 142A is casted over the entire floor of the Godown.

The 2.1 Ton crane gantry conveyer steel, columns spaced at 6.000m centres along the whole length of the Godown. The Reinforced Concrete in alternative two is preferable as it provides stiffness at the base of the columns of the Godown.

3.5.1 Sanitation in the Godown

The high roof will ensure more fresh air in the manufacturing area. The large doors, windows and roof ventilators enhance fresh air circulation and natural light in the whole Godown. The aluminium latticed roof frame and roofing cover steel plates are easily accessible for repair.

The rain water collection is well arranged and disposed of to the ground by Reinforced Concrete Gutters.

3.5.2 Administration Office (480m²)

This is a two storied building with overall size 20.000 x 12.000 x 2. The structural design is based on structural framework carried by column bases Reinforced Concrete beams and Reinforced Concrete floor and stairs.

The column bases are 1.200 x 1.200mm x 200mm thick, the Reinforced Concrete column are 200 x 300mm reinforced with 4No D16 laced with D8 rings at 200mm centres. The Reinforced Concrete Beams are 200 x 450mm reinforced with 3No D16 at the bottom and 2No D16 at the Top bound by D8 rings at 200mm c.c. The Reinforced Concrete floors

are 150mm thick reinforced with D12 steel across the main span @ 200mm and D10 distribution steel at 250mm c.c..

Shear Steel across the beam are 2.000 long across all beams and external beams. The top beams are 300 x 200mm reinforced concrete beams with 3No D12 and 2No D12 laced with D8 stirrups at 200mm centres.

The stairs of 1200mm wide with reinforced concrete using steel 7No. D12 along the flight and D10 @ 150mm c.c. across the stairs. The concrete is casted to give 150mm waist where the steel is fixed.

3.5.3 Ablution Block

The ablution block is size 30 x 15 meters designed for ladies and gents, the facility provides for the following: -

The Gents have:

- i. 20No. Waste Hand Basins.
- ii. 6No. WCs
- iii. 2No Disabled
- iv. 2No. Stores
- v. 10No Showers
- vi. 6No Urinals
- vii. 2No Lockers Rooms
- viii. 1No Janitor Closet

The Ladies have:

- i. 6No. WCs
- ii. 2No Disabled
- iii. 12No Showers
- iv. 2No Lockers
- v. 20No. Waste Hand Basins.
- vi. 2No Stores
- vii. 1No Janitor Closet

3.5.4 Office Block

The area is 30.000 x 15.000m

Foundation and Walls

Reinforced foundation and walls for construction in poor strata, and prone to flooding is adopted. This consists of excavating in plinth area 200mm deep. All external walls to be 200mm thick and partition walls to be 150mm and 100mm and reinforced with 3/4" hoop Iron in alternate courses.

The top Reinforced Concrete Beam to be 200x 300mm reinforced with 3No D12 at the bottom and 2No D10 at the top binded by D8 Rings at 200mm c.c. The strip foundation to be reinforced with 3No D16 and laced with D10 at 200mm centres.

A ground beam 300 x 200mm to be cast along the foundation reinforcement 3No D12, 2No D12 at the bottom. The entire plinth to be filled with gravel and compacted to a height of 300mm above ground level. Polythene gauge 1000 to be spaced over gravel with 150mm lapses to stop ground water seeping up the concrete floor.

A BRC mesh 142A to be spread to cover the plinth area. The 150mm concrete floor to be casted in whole floor. The Roof frame is then built and covered as specified. All doors and windows frame are fixed in place the walls are plastered and 0.047m thick floors screed as specified ready for the next cover. Fix ceramic floor tiles to all walls and floors as indicated. Paint the ceiling and walls as directed.

3.6 Electricity and Steam

Electrical power and steam will be provided to the Fertilizer plant by both Kenya Power & Lighting Company (KPLC) and from the co-gen facility at the Sugar Factory.

3.7 Water

Adequate clean water will be provided by Kisumu Water and Sewerage Company (KIWASCO) through the Kajulu Water Treatment Plant not far from the project site.

3.8 Security

The whole Go-down is provided with electric Perimeter Fence and one Security Gate. The floor is roughly finished to provide a non-stop surface. The large doors and windows provide escape route in case of fire.

3.9 Waste

The Chatthe Group has contracted NEMA registered waste water and solid waste managers who periodically collect all wastes from the company premises for disposal into the City waste receptors.

3.10 Architectural and Structural Drawings

The site layout, structural layouts and other drawings are attached in the Annexes.

CHAPTER FOUR

4.0 PROPOSED PROJECT ALTERNATIVES

4.1 Alternative Sites

The setting up of the bio-fertilizer plant is meant to solve the pollution problems arising from residual product streams from three industries that are already in operation; the sugar mill, the bagasse co-generation plant and the molasses distillery. Consequently, the Bio-Fertilizer plant will need to be integrated with the sugar mill, the co-generation plant and distillery. The option of another site is not feasible.

4.2 Technology Alternatives

KSAIL has three problematic waste (residual-product) streams that need to be managed in order to address her environmental challenges. As explained in Chapter three, these are vinasse (distillery spent wash), bagasse boiler ash and press mud. The method of managing these residual product streams is mainly determined by DSW. It is rich in nutrients and therefore has a high potential for recovery of useful products. Treatment of distillery spent wash (DSW) is challenging because it is present in large amounts of water, has excessive pollution load (BOD₅: 40,000-50,000mg/l; COD 90,000-120,000mg/l), and high quantity and presence of an obstinate compound, melanoidin. About 70% of pollution from the distillery is attributed to DSW. Because of this, the Kenyan effluent discharge standards (30mg/l BOD₅ and 500mg/l COD) cannot be achieved by the biological treatment techniques available.

The best technological approach is 'zero discharge' of DSW using a train of treatment processes such as bio-methanation, multiple evaporators, drying, composting followed by land application, fertilizer blending or incineration and co-processing. It is important to note that already KSAIL has in place a biomethanation process. To achieve maximum efficiency and cost-effectiveness, these technologies are normally undertaken in combination for the treatment of the DSW and to help in regulatory compliance. For this project, six (6) project alternatives have been identified. The selected alternative is 6.

- i. Project Alternative 1: NO project Alternative
- ii. Project Alternative 2: Potash recovery
- iii. Project Alternative 3: Bio-methanation, land application
- iv. Project Alternative 4: Bio-methanation, secondary biological effluent treatment, composting
- v. Project Alternative 5: Bio-methanation, multiple effect evaporator, composting
- vi. Project Alternative 6: Bio-methanation, multiple effect evaporator, dryer, granulation, fertilizer blending (recommended).

All these technological alternatives must be preceded by pre-treatment including screening and equalization. The details description of the above project alternatives are covered in the sections that follow.

4.2.1 Alternative 1: NO Project Alternative

The NO project alternative implies that the current state remains with boiler ash continuing to pollute the air, press mud polluting the land and DSW being stored in temporary ponds. This is not desirable and as it will pose serious threat to the adjoining aquatic and terrestrial habitats as well as the human environment. Moreover, from the orders given by NEMA, the company is under pressure to find a lasting solution to these environmental challenges.

4.2.2 Project Alternative 2. Potash Recovery

Recovery of potash (potassium oxide) is one of the technology alternatives that would be realized by incinerating DSW. Application of potash on land will close the potassium nutrient cycle. The process would entail neutralizing raw DSW with lime and then filtering. This is further concentrated to about 60% solids in multiple evaporators. The resultant thick liquor is burned in an incinerator and converted into ash. The ash contains approximately 37% of potash as potassium oxide. The ash is leached with water to dissolve the potassium salts, neutralized with sulphuric acid (H_2SO_4) and evaporated. The potassium salts crystallized in a crystallizer.

The international estimates are that a distillery discharging 300 m³ of DSW per day could recover 3 tons of potassium as potassium oxide (K_2O), 5.34 tons of potassium sulphate (K_2SO_4) and 1.2 tons of potassium chloride (KCl) per day. Thus, Kibos that discharges about 20m³ of DSW per day will recover Kibos Distillery can recover 200kg/day of potassium as potassium oxide, 356kg of K_2SO_4 and 80 tons of KCl per day.

Disadvantage of alternative 2

- I. It will not address the problem of filter mud and boiler ash
- II. The market for the recovered products has not been explored

4.2.3 Project Alternative 3: Bio-methanation and Land Application

Biomethanation: After screening and equalisation, the DSW is sent for anaerobic digestion (bio-methanation) in a bio-digester. It is important to note that in Kibos, the anaerobic digester is already in place. This process reduces BOD₅ to 4,000-5,000mg/l and COD to 30,000-40,000mg/l respectively.

Land application: After bio-methanation, the digestate from the bio-digester is diluted with water and let out on land for agriculture. The application on land must be done using closed irrigation piping system and the application must be controlled. International standards require a buffer zone of 200m between the land and water source.

Disadvantage

- i) This process is considered inefficient with respect to water use and the digestate will still carry high organic pollution (BOD₅) as well as inorganic salts causing serious problems of ground water, surface water and soil contamination.
- ii) Direct land application could change the physical, chemical and biological properties of the soil if not applied scientifically (technical supervision required)
- iii) The small land holdings of outgrowers pose a limitation and including the impracticality of having to transport the aqueous DSW over long distances
- iv) It is not possible to have a piping irrigation system as the cane growing is not from a nucleus estate
- v) Lastly, this project alternative will not solve the problem of press mud and boiler ash that are currently a big environmental challenge to Kibos

4.2.4 Project Alternative4: Biomethanation, Secondary Biological Effluent Treatment then Composting

4.2.4.1 Biomethanation

Like alternative 2, this alternative will, after screening and equalisation, have the DSW channeled into the anaerobic digester for bio-methanation. KSAIL already has a bio-methanation system in place so this stage is already taken care of. From the results of the biomethanation digestate analysis done by NEMA, the biomethanation is able to reduce the BOD₅ to 4,000-5,000mg/l and COD to 30,000-40,000mg/l respectively.

4.2.4.2 Aerobic Treatment:

The post anaerobic treatment stage still has high organic loading and is high dark brown in colour, hence it is generally followed by a secondary, aerobic treatment to further lower BOD₅ and COD. Three aerobic treatment methods that can be considered including; activated sludge process, trickling filter and rotating biological contactor.

4.2.4.3 Activated sludge process:

The most common wastewater treatment is the activated sludge process. Activated sludge treatment is regarded as a suspended growth process due to microbes being suspended in the water. The activated sludge process and its variations utilize mixed cultures. This process is the most common biological method for the wastewater treatment use in industries and municipalities. The most important component in this process is the use of an aeration tank, wherein micro-organisms are mixed with incoming wastewater. The activated sludge process contains three component parts, such as

- (i) an aeration tank (reactor) where micro-organisms grow
- (ii) a clarifier, which is responsible for the liquid-solid separation and

- (iii) a recirculation system for transporting recovered sludge back to the aeration tank. Organic materials are biodegraded by being in contact with micro-organisms within an aerobic environment.

4.2.4.4 Trickling Filter (TF):

Trickling filters are an aerobic treatment system that is applied to wastewater to eliminate the organic material present in them. This system operates by micro-organisms that attach to a medium to ensure the removal of organic matter. Trickling filters are also called attached-growth processes. Filters contain fixed or rotating distributor arms that spray DSW wastewater over media or rock that are covered with a biological layer of slime. Due to the open spaces existing between the rock and other media, the process allows air to circulate through and consequently keep it oxygenated. The slime layer mainly consists of bacteria and algae but various other organisms (protozoa and metazoa) are also present that have the ability to break down the organic matter. Micro-organisms within the biofilm metabolise organic material into relatively harmless products.

4.2.4.5 Rotating Biological Contactor (RBC):

RBC is a biological process used for the treatment of carbon-based wastewater and is characterised as an attached growth process. It consists of a sequence of closely spaced circular plastic disks, which are partly submerged into a tank filled with untreated wastewater. Discs usually consist of lightweight, high-density plastic materials. Microbial films develop on the surface of the circular disks which move through the DSW wastewater as they rotate. Micro-organisms degrade organic material while being submerged in the wastewater and are provided with oxygen when the disks rotate into the air. RBC has similarities to the activated sludge and trickling filter treatments but the biofilm process is the principal feature of this treatment option. Advantages of RBC over fixed film processes include less land area requirement, fewer complications with noise and odours, the process control is less complex and high removal rates of Biological oxygen demand (BOD).

4.2.4.6 Composting:

The final effluent from the secondary aerobic treatment system then undergoes bio-composting through a method of activated bioconversion, whereby heterotrophic microorganisms act on carbonaceous materials the effluent. Composting the final effluent together with boiler ash and press mud or other organic municipal waste generates good quality bio-manure rich in potassium. Composting enables the degradation of obstinate coloured organics and reduces BOD₅. In the composting process, under aerobic conditions, thermophilic biodegradation of organic wastes at 40-60% moisture content occurs to form relatively stable, humus-like materials.

Disadvantage

- I. ***Aerobic treatment:*** Although aerobic treatment systems like the conventional activated sludge process are presently practiced by various molasses-based distilleries to achieve significant reduction in COD, the process is energy demanding and the color removal is still unsatisfactory.
- II. ***Composting:*** Composting needs huge land area that is not available within the KSAIL industrial site. Regular availability of organic matter is difficult since sugarcane growing is often seasonal. Composting is also time-consuming given the rapid solution needed to solve the current environmental problem in Kibos.

4.2.5 Project Alternative 5: Biomethanation, Multiple Effect Evaporator, Composting or Incineration

4.2.5.1 Biomethanation

Like alternative 2, this alternative will, after screening and equalisation, have the DSW channeled into the anaerobic digester for bio-methanation. KSAIL already has a bio-methanation system in place so this stage is already taken care of. From the results of the biomethanation digestate analysis done by NEMA, the biomethanation is able to reduce the BOD₅ to 4,000-5,000mg/l and COD to 30,000-40,000mg/l respectively.

4.2.5.2 Multiple effect evaporation

Dewatering through of DSW (12% solids, 88% water) in Multiple Effect Evaporators removes water to form Condensed Molasses Solubles (CMS) (50% solids, 50% water). The evaporated water undergoes condensate polishing and is recovered for use in steam generation.

4.2.5.3 Composting:

The dewatered DSW is bio-composted by activated bioconversion together with boiler ash and press mud or other organic municipal waste to generate good quality bio-manure rich in potassium. Composting enables the degradation of obstinate coloured organics and reduces BOD₅. In the composting process, under aerobic conditions, thermophilic biodegradation of organic wastes at 40-60% moisture content occurs to form relatively stable, humus-like materials.

4.2.5.4 Incineration or co-processing

The alternative to composting the dewatered DSW is incineration or co-process in cement kiln as a substitute for incineration. Therefore, KSPCB is promoting the co-processing of the sludge in the cement kiln as a substitute for incineration. Co-processing will have many benefits in terms of distillery waste such as, destroying the waste at very high temperature of around 1200-1400C, energy content of the waste gets utilized, inorganic content gets fixed with clinker, so no residue is left behind, acidic gas gets neutralized since raw material in cement kilns is alkaline in nature, and it conserves resource and energy

Disadvantage

- i) ***Composting***: Composting needs huge land area that is not available within the KSAIL industrial site. Regular availability of organic matter is difficult since sugarcane growing is often seasonal. Composting is also time-consuming given the rapid solution needed to solve the current environmental problem in Kibos
- ii) ***Multiple Effect Evaporation***: Though it is considered to be very efficient in the treatment of DSW, it is highly energy intensive and expensive. Also, incineration of the dried sludge is also associated with extra cost and risk of air pollution.
- iii) ***Cement factory***: There is no cement factory nearby Kibos

4.2.6 Project Alternative 6: Bio-methanation, Multiple Effect Evaporator, Dryer, Granulation, and Fertilizer Blending

Alternative 6 was considered to possess the train of processes that are the ideal cost effective, efficient treatment and environmentally sound. The alternative provides a system for combining the DSW, press mud, and to form granular fertilizer (Figure 1). It comprises 5 steps: (i) bio-methanation (ii) multiple effect evaporation (iii) drying (iv) granulation (v) blending. These stages are described in detail in the sections that follow below.

4.2.6.1 Stage 1: Bio-methanation

After screening and equalisation, have the DSW channeled into the anaerobic digester for bio-methanation. KSAIL already has a bio-methanation system in place so this stage is already taken care of. From the results of the biomethenation digestate analysis done by NEMA, the biomethanation is able to reduce the BOD₅ to 4,000-5,000mg/l and COD to 30,000-40,000mg/l respectively.

4.2.6.2 Stage 2: Multiple effect evaporation

Dewatering through of DSW (12% solids, 88% water) in Multiple Effect Evaporators removes water to form Condensed Molasses Solubles (CMS) (50% solids, 50% water). The evaporated water undergoes condensate polishing and is recovered for use in steam generation. The condensate from the evaporation process is recovered, polished and used back in the process.

4.2.6.3 Stage 3: Drying

The Condensed Molasses Solubles (CMS) is spray-dried on dryer to convert to powder. The dried DSW forms ingredient 3 that will go into the bio-fertilizer blending. Similarly, the press mud and boiler ash are also dried and will comprise ingredient 2 and 1 respectively.

4.2.6.4 Stage 4: Granulation

The dried ingredients 1(boiler ash), 2(press mud and 3 (CMS) are separately granulated in the granulator into pellets for utilization as a fertilizer material (K-5%, N-1%, Ca-0.4%, Mg -0.3% and S-1%. It also contains small amounts of Zn, Fe, Mn and Cu.

4.2.6.5 Stage 5: Blending

Blending of the three types of granules comprising the boiler ash, press mud and CMS is done in a blender to give organic fertilizer. The organic (bio) fertilizer can be enriched with other sources of nitrogen (urea and ammonium nitrate) and phosphate (phosphoric acid). The result is a complete N – P – K blend.

Already the bio-methanation plant is in place and working. So only the evaporator, drier, granulator and blender needed; all very simple physical processes

Advantages

- i) The process will get rid of the temporary DSW storage ponds
- ii) It will mop up all the boiler ash (air pollution), press mud (land/water pollution and smell) and all the vinasse (water pollution)
- iii) This alternative will do away with the temporary storage ponds for vinasse that generate smell on biodegradation. Consequently, the ponds will be decommissioned.

Disadvantage

High cost of stainless steel evaporators/energy costs for evaporation (doubles steam requirements). However, this is compensated by utilising methane from bio-methanation to generate steam.

CHAPTER FIVE

5.0 PROPOSED PROJECT SITE LOCATION BASELINE CONDITIONS

5.1 Project Location

The project is located on LR No. 654/52, Miwani Central Location, Muhoroni Sub-County in Kisumu County located on points A (Latitude -0.05090 and Longitude 34.82520), B (Latitude -0.05090, Longitude 34.82280) C (Latitude -0.05249, Longitude 34.82284) and D (Latitude -0.05227, Longitude 34.82541). The general location is 0° 02' 44.1"S 34°51' 06.8"E. It is specifically within KSAIL next to the Kibos Distillers Ltd (KDL) vinasse lagoons that are adjacent to the Kibos-Otok Road as indicated by an Arrow in the Satellite map here-below.

Figure 6: Proposed Project Site

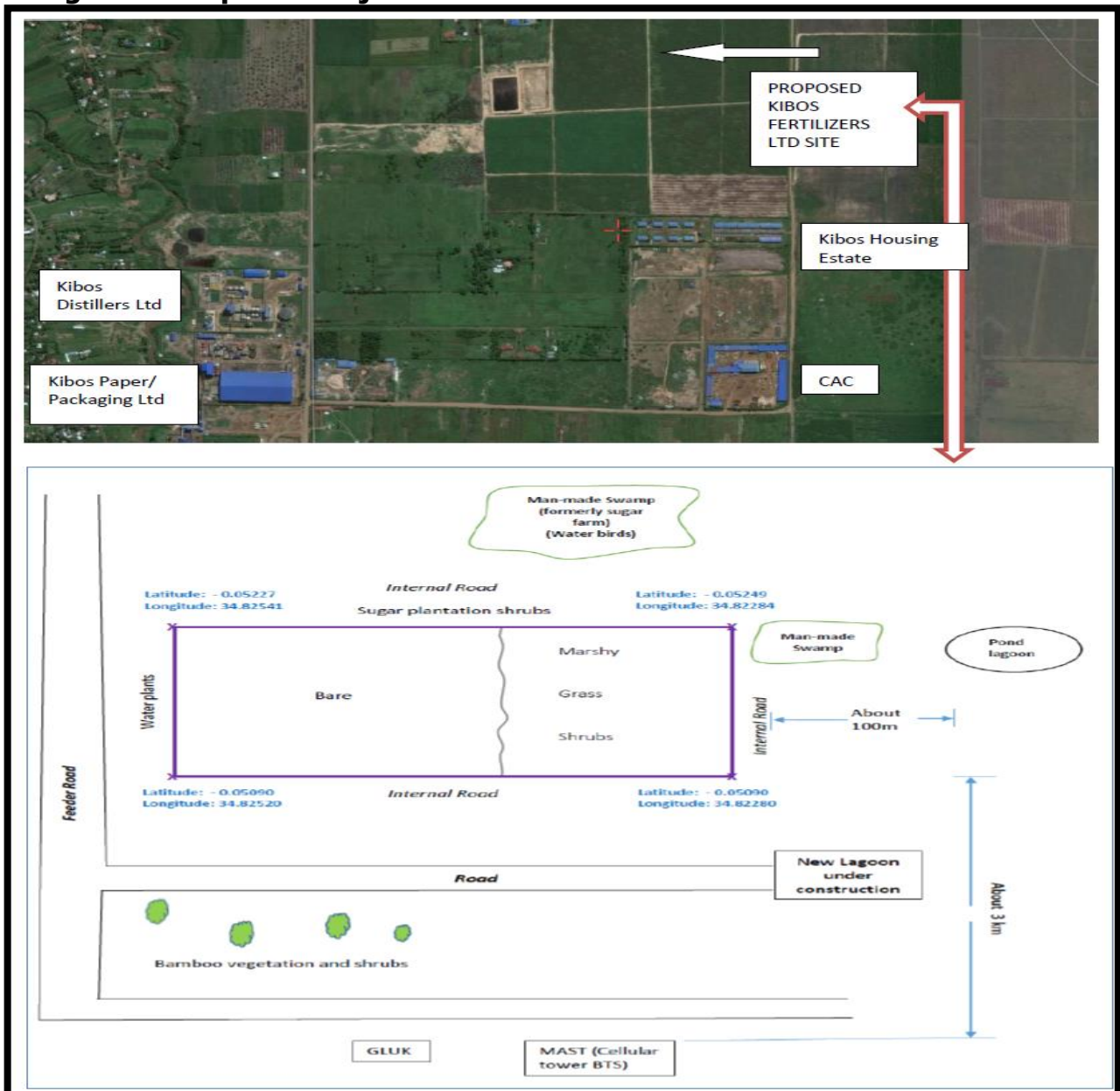




Plate 1: The Proposed Project Site where the Kibos Bio Fertilizer will be constructed

5.2 Physical Environment

5.2.1 Topography

The proposed Kibos Bio Fertilizer Factory site is located within Kibos in Kisumu County and Kisumu County lies in a down warped part of large lowland surrounding the Winam Gulf, at the tip of which is Kisumu Town. East of Kisumu Town is the Kano Plains occasionally broken by low ridges and rivers. There are some notable physical features such as the scarps in the north, east and south. Others include the hill slopes and piedmont plains spreading across the vast Kano Plains. Kisumu county can be divided into 3 topographical zones namely: the Kano Plains, the upland area of Nyabondo Plateau and the midland areas of Maseno. The Kano Plains lie on the floor of the Rift Valley, which is a flat stretch bordered to the North and East by the escarpment, while the upland area comprise ridges which rise gently to an altitude of 1,835m above sea level.

The major physical features in the Kisumu County are the overhanging huge granite rocks at Kisian and the legendary Kit Mikayi in Kisumu West Sub-county, the Lake Victoria, which is the second largest fresh water lake in the world, the geographically famous rice-growing Kano Plains, and lake islands (e.g. Ndere National Park which are major tourist attraction). The granite rocks are exploited (in small scale) by the local population to produce building ballast. While the varying types of soils and rivers deposits are mined for building sand and baked bricks for building in Maseno and Nyakach.



Plate 2: The Proposed site for the factory which is flat floor land

5.2.2 Drainage

The proposed project site is about 1km away from River Kibos which is among the three major rivers flowing into the Winam Gulf of the Lake Victoria. The other two rivers are Nyando and Sondu. The rivers are heavily silted, resulting in the extensive formation of lakeside swamps. The Kano Plains, due to the structure on the floor of these escarpments is vulnerable to flooding during heavy rains especially the lower Kano Plains and in particular low lying areas of Nyando. Kisumu county has a long shoreline along Lake Victoria. This shoreline is 90 km long and has more than 17 beaches all of which are fish landing bays. Within Kisumu City, the shores have been used to put up beautiful tourist hotels like Kiboko Bay, the Yatch Club and Tilapia Beach Resort.

The proposed project site lies at a plain flat area at a relatively lower slope and since the nearest river is river Kibos (which is used as the main source of water for the Kibos Industries), it is likely that the same river shall be used for drawing additional water and any surface run off from the factory shall drain to the same river. During the construction phase, most likely the water to be used will be from the same river as will be the case during the operational phase. It will be important that the main raw material i.e vinasse be store at least 200 metres away from the river Kibos.

Within the proposed project area, there is a temporal water collection dam which is collected during the rainy season.



Plate 3: The temporal water collection dam within the proposed project site

5.2.3 Geology and Soils

The soils in the study area similar to the entire county are dominated by lake sediments, commonly sand and clay soils. In Kano Plains the soils are dark brown and grey, poorly drained and are generally very deep and firm. In the western part of Kano Plains are dark cotton soils commonly associated with the swamps. These types constitute more than 70 per cent of all soil types found in Kisumu County. These soils are suitable for brick making and sand harvesting especially at Maseno and Nyakach. The soil at the project site is a mixture of rich black cotton and loam-clayey soils which support a rich diversity of vegetation including trees, herbs and shrubs. These soils are deep, fertile and well drained, with rich agricultural potential.



Plate 4: The grass, shrubs, sugar cane around the project site showing the rich agricultural soils

5.2.4 Climatic Conditions

The area has two rainy seasons, with the long rains occurring in March and May while the short rains occur in September to November. During the short rains the average annual rainfall ranges between 450mm and 600mm. Rainfall data indicates that the Kisumu county largely receives substantial rainfall. The mean annual rainfall varies with altitude and proximity to the highlands along the Nandi Escarpment and Tinderet. The project area, i.e Kibos has a mean annual rainfall of 1,290 mm. Although there is no entirely dry month, the peak generally falls between March and May, with a secondary peak in September to November. The high rainfall and the nature of soils in within the project area have supported small scale agricultural production and also large scale farming mainly sugarcane. However, small-scale farmers find it difficult to prepare the land for planting since black cotton soils are difficult to work on manually during dry season and also during heavy rains.

The mean annual maximum temperature ranges 25°C to 35°C and the mean annual minimum temperature ranges 9°C to 18°C. The altitude in Kisumu county varies from 1,144 metres above the sea level on the plains to 1,525 metres above sea level in the Maseno and Lower Nyakach areas. This greatly influences temperatures and rainfall in the county.

5.2.5 Hydrology

Kisumu County is most known for its association with Lake Victoria the largest lake in Africa and one of the largest lakes in the world. Its highest water source is from direct precipitation. There are approximately 25 major rivers that flow into Lake Victoria from the 194 000 km² basin surrounding the lake. The main rivers in the Lake Victoria basin Kenya include the Migori, Mogusi, Nyando, Gucha, Nzoia and Yala. River Kibos is of particular interest in this study. The lake outflows into the White Nile and the Katonga River, both part of the upper Nile river system.

5.3 Biological Environment

5.3.1 Flora

Part of the project proposed site is bare though a greater part is has vegetation that includes some hedges, shrubs and grass. Since this is within the sugarcane farms, some of the adjacent areas are covered with planted sugarcane



Plates 5: Showing part of the grass, planted sugarcane and other shrubs around the proposed project area

5.3.2 Fauna

The proposed project area being within an agricultural industrial area, there are buildings for the industries nearby i.e Kibos Sugar Refinery Ltd, Kibos Sugar, Kibos Distillery Ltd and Kibos Paper. On the other hand, the Kenya Sugar Research Foundation (KESREF), the Great Lakes University, Kibos Prisons, Kibos School for the Blind, residential houses for the factory workers are within the vicinity of the project area.



Plate 6: Showing part of the KSAIL industries and the Workers' residential houses

The temporal water collection dam has attracted some bird species that seasonally visit the dam.

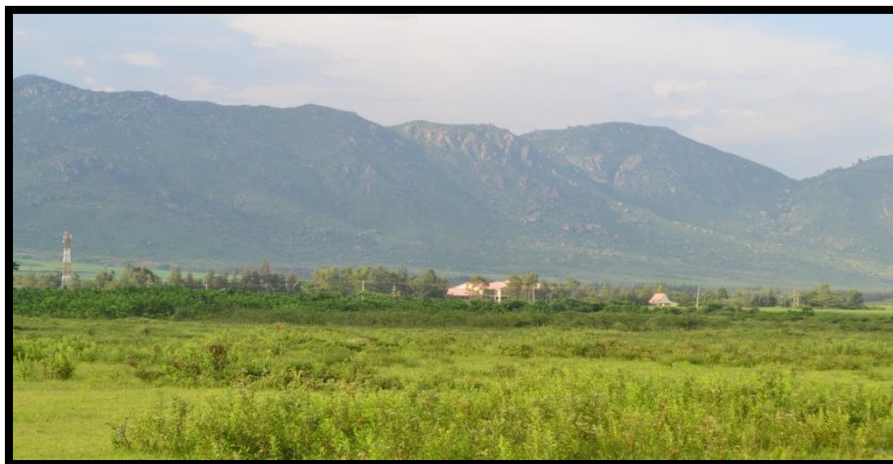


Plate7: The Great Lakes University located nearby.



Plate 8: Some of the seasonal birds that come to the dam when there is water

Generally, Kisumu County is rich in fish species with the Nile perch, the minnow and Nile tilapia alongside a few haplochromines being in abundance. Other fauna found in Kisumu County include: aquatic dependent reptiles, amphibians mammals, planktons and fresh water molluscs. In particular there is a high species richness of frogs with over sixty species. Aquatic species in the Lake Victoria environs include: five species of fresh water turtle, two aquatic snakes, monitor lizard, Nile crocodile, three species of otters and hippopotamus (*Hippopotamus amphibious*). The waters of Lake Victoria are rich in plankton species for example with around 80 species of planktonic diatoms. Bird species found around lake Victoria but rarely ever seen anywhere else in Kenya include: the blue-breasted, bee-eater, blue swallow, swamp flycatcher, warbler, white-winged warbler, papyrus yellow warbler, carruthers' cisticola, papyrus gonolek, red-chested sunbird, redheaded quelea, slender-billed weaver, yellow-backed weaver, northern brown throated weaver, black throated seedeater and the papyrus canary. Other animals found in around Lake Victoria include: roan antelopes, Rothschild's giraffe, Jackson's hartebeest and tiny orbit antelopes.

5.4 Human Environment

5.4.1 Education

Kisumu County, the percentage of population with primary education is 62%; those with secondary education constitute 15% of the population while those who can read and write form 65.8%. Primary and secondary education is provided by 706 primary schools and 173 public secondary schools, including one of the oldest secondary schools in Kenya; Maseno School, which is also one of the best performers in the whole country. The enrolment in primary school and secondary school stood at 240, 538 and 38, 815 as of 2009. The teacher to pupil ratio was 1:51 for primary and 1:30 for secondary. The main

schools near the project site are Kibos Primary, Kibos Secondary and Kibos School for the Blind. It is also important to note the Great Lakes University is within the project area.

5.4.2 Population

According to the 2009 national census, the Population in Muhoroni Sub-County, the study area was 28,092 inhabitants with 14,676 being male and 13,416 female. The population for Muhoroni Sub-County was projected to have grown to 184,220 by last year 2018 and Miwani Ward where the project site is was projected to be 24,551.

5.4.3 Gender Aspects

In Muhoroni area, the population of men is proportionately higher than that of women in the project area. There is no clear division of productive activities based on gender as males and females are involved in similar socio-economic activities, however with varying proportions and intensify. Men dominate in activities that require strength (e.g. pulling carts, carrying heavy baggage, construction and mechanical among others). Women are engaged in domestic chores of fetching water and taking children to school as well as undertaking light business activities of vegetables selling and office works of preparing and serving tea. They are also employed in jobs that require less energy e.g. packing and cleaning. In construction industry, women are mainly hired for curing the construction buildings, cooking for the male workers etc

5.4.4 Health

Health in Kisumu County is provided by several institutions that are either private or government funded. There is one provincial hospital, three district hospitals, 5 sub-district hospitals, 53 dispensaries and six health centres in the county. The naming system is set to be changed due to the fact that the system of government has changed. The county government shall now have jurisdiction over the provision of health in the county. The Infant Mortality Rates for Kisumu County is medium, at 95/1000. The under-five mortality rates for the county are 149/1000. The location of Kisumu County puts it in major breeding ground for mosquitos, and malaria has been a perennial problem since time immemorial. The nearest medical facility to the proposed project site is the Kibos Dispensary and the Kibos Prisons Dispensary. However, Kisumu Town is a few minutes' drive from the project site where there are major health facilities.

5.4.4.1 HIV/AIDS

According to the National HIV Surveillance Report 2010, the national prevalence rate stands at 6.3 per cent, Nyanza Province 15.3 per cent, Kisumu 11.2per cent, where Kisumu town has a prevalence of 15 per cent and Kisumu Rural 8per cent. The impact of HIV/AIDS continues to be felt in most sectors of the economy in the county with the economically active population (20-49) years being the most affected. In the health sector, most resources have been diverted to the prevention and treatment leading to a

strain on the entire health sector. Consequently, HIV/AIDS is hindering the efforts to create wealth and employment by draining national economic resources.

The education sector has not been spared either as most students continue to drop out of school to either care for the sick or their young siblings leading to an increase in the rates of school drop-outs. The key players in the fight against HIV/AIDS include: the National AIDS Control Council (NACC), the Ministry of Health, Social Services Department, and NGOs such as AMREF Maanisha Programme, Plan International, APHIA II Nyanza, World Vision, Christian Children Fund, ADRA and others, and the private sector e.g. Marie-Stoppes Kenya (Jiokoe Project).

5.4.5 Poverty Aspects

High poverty level is one of the major developmental challenges in Kisumu County. Estimates show that over 60 per cent of the population are poor compared with the national average of 46 per cent as at 2006. Poverty levels are higher in the urban areas (70 per cent) compared with rural (63 per cent). The main causes of poverty include HIV and AIDS pandemic, collapse of local agro-based industries, unemployment, low agricultural and fish production. Food insecurity, inaccessibility to affordable healthcare, lack of proper storage facilities, erratic and unreliable rainfall, poor and inaccessible road network, frequent floods, problems with the sugar, rice, cotton and fish industries, lack of title deeds, poor water and sanitation systems, malaria, and water borne diseases worsens poverty situation in the county.

5.4.6 Land use

Kisumu County is generally a satellite City with 80% of the land area is predominantly rural in character and thus demanding a unique set of planning responses. The land ownership type in the County is mainly freehold, putting direct influence on pattern of development on the individual owner's docket. With the ever rising population especially in and around the City and other areas depicting urban character, emerging land use trends (mainly residential and commercial) are taking up land space that was not initially zoned for them. Areas like the Kibos which was initially zoned for industrial investment has been taken up but residential user, the Riat hills which was reserved for conservation now being a prime residential investment area, parts of agricultural land at Ahero is now being consumed by industrial development (mattress & bread factories) and massive subdivision of initial agricultural land in the hinterland of existing market centres such as Katito/Pap-Onditi, Maseno etc. for residential and commercial developments. Also areas of Muhoroni initially set for commercial agriculture being sold out in smaller portions for residential settlements. There is therefore urgent need for reviewing the county spatial planning to address the aforementioned current realities.



Plate 9: The Sugarcane plantation next to the project proposed site

5.5 Infrastructure Aspects

5.5.1 Transport

Kisumu city derives its very early origins from being an inland port associated with the arrival of the railway in 1901. Since then it has continued to serve as a regional transportation node for the wider East Africa region, providing road, rail, water and air connections.

5.5.1.1 Water Transport

Kisumu port was founded in 1901 as the main inland terminal of the Uganda Railway and named Port Florence. Although trade stagnated in the 1980s and 1990s, it is again growing around oil exports. Today, water transport on the lake is provided mostly by private operators in wooden boats with outboard engines, although a ferry service exists. The services connect towns on the shores and also help in crossing the lake. They also link the county with the other three lakeside counties and the countries of Tanzania and Uganda. The port of Kisumu is very inactive at the moment but has the potential to become a regional centre of lake transport and a gateway for Kenya into the rest of the African Great Lakes region. It is important to note that the rehabilitation of the Kisumu Port is ongoing and that the Offices of the Port are about 3km away from the proposed project site.

5.5.1.2 Air transport

Before the jet airline era, Kisumu was a landing point on the British flying boat passenger and mail route from Southampton to Cape Town. Kisumu linked Port Bell and Nairobi. Kisumu is served by Kisumu Airport which has international status, with regular daily flights to Nairobi and elsewhere. Kisumu International Airport has been upgraded and

now has the potential to be an entry port for the entire region. Schedule flights land from Nairobi, Mombasa and several cities in neighboring countries.

5.5.1.3 Railway transport

The Uganda Railway from the port of Mombasa reached Kisumu in 1901. The city of Kisumu was founded as a terminal for the railway, and therefore has an important railway station. The narrow gauge railway moves both passengers and cargo, linking Kisumu with other cities and towns along the line. Currently there are no passenger trains that operate between Nairobi and Kisumu. A railway is also existent within the locality of the proposed project area but is poorly maintained.

5.5.1.4 Road transport

Kisumu County has several paved roads, the major one being the Nairobi-Bondo road, which has a branch at Kisian heading to Busia. Important roads are paved with asphalt. County roads are mostly murrum but provide all weather movement all year. Public transport services are provided by matatus and buses either operating singly or as parts of franchises and companies. Bicycle and motorcycle boda-bodas also exist in significant quantities for short distance travel. The proposed project site has a tertiary class access road that connects it to the main Kisumu-Muhoroni highway which is currently worn out though being maintained by KSAIL. The other access road is the Kisumu – Kibos – Muhoroni that is tarmacked up to Kibos market. From the market to KSAIL factories and then to the project area, access is by all-weather murramed roads. The route is mainly used by tractors fetching sugar cane to the factory and motorcycles.

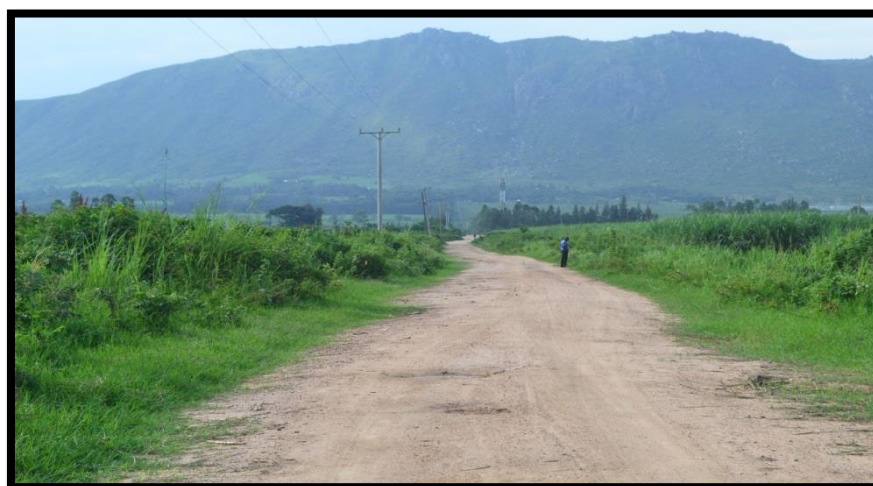


Plate 10: The All-weather access Murrum road next to the project

5.5.1.5 Intra-city transport

Intra-city transport has seen the emergence of a large influx of bicycle taxis (non-motorised transport) commonly known as 'boda boda'. Since such a development was not anticipated, no commensurate provisions were made for cyclists e.g. bicycle tracks, with a resultant increase in accidents and congestion on the city roads. The challenge remains

on how to integrate this economic activity into the urban transport system, while minimizing user conflict and ensuring safety.

5.5.2 Water resources

Generally, Kisumu City residents obtain water from individual connections, yard tap connections, public tap connections, boreholes, springs and water vendors. As of September 2008, KIWASCO had 7,704 domestic water connections and 287 water kiosks. About 52 percent of Kisumu residents used piped water delivered to dwellings or compounds, and 13 percent depended on protected shallow wells/springs or roof catchment. Hence 65 percent of Kisumu residents had access to an improved water source, while 35 percent relied on unimproved water sources, including water vendors, open wells/springs, streams and ponds.

In informal settlements, although some residents have access to piped water, most residents rely on water kiosks, handcart vendors and boreholes for their water supply. The reliance on shallow wells and boreholes in the neighborhoods is problematic because water from these sources is of poor quality. Kisumu City has high water tables; consequently, shallow wells are easily contaminated by overflowing pit latrines, industrial waste, poor wastewater management and inadequate drainage systems. Many residents in peri-urban areas also use water from shallow wells situated in close proximity to the pit latrines, thereby increasing the chances of cross-contamination, especially during the rainy season, when dependency on such readily contaminable water sources contributes to dangerous outbreaks of such diseases as diarrhoea, cholera, typhoid, dysentery and malaria.

KSAIL Factories abstract water for use from River Kibos. This water is treated internally first before it is used for both industrial and domestic use. The proposed project shall use part of this water.

5.5.3 Energy

Energy is a key player in the realization of the County's development aspirations and the Kibos Bio Fertilizer Factory operations. KSAIL has a cogeneration plant that uses bagasse and generates 18MW that all the KSAIL Industries use. The new proposed plant shall be using the internally generated power for its operations.

For Kisumu County in general, the current demand for energy in the County is such that the available supply has been challenged in meeting the County's requirements. This has manifested in the slow economic development obtaining. The positioning of the County vis-a-vis her natural resources is that there is a huge potential to produce enough energy to competitively anchor the expected economic growth within the County and even to release to the National Grid. With construction of two dams on River Nyando and one on River Awach, the County is poised to produce enough energy that should be able to sufficiently supply the proposed industrial zone, the transport system (the proposed

standard gauge rail line and the tram ring around the city of Kisumu), the health facilities, the satellite towns and markets and the educational facilities.



Plate 11: The Power lines from KSAIL Co-generation plant next to the proposed project site

5.5.4 Solid Waste management

Generally in 2001 it was estimated that only 20 percent of the 400 tons of solid waste generated each day in Kisumu City was collected. By 2008, the daily generation of household waste was estimated to be 437 tons. Fortunately, about 63 percent of the waste generated in Kisumu is organic; hence there is enormous potential for composting. The city authority (MCK) only has four trucks (two 2-ton trucks, an old 7-ton compactor truck and an old tractor with a trailer) for collecting waste.

These vehicles are in poor condition and often break down. As a result, many households, particularly in the peri-urban areas, have no access to public services and are unable to access private waste collection due to fees levied. They therefore resort to burning or burying their waste. Some common dumping grounds have developed on open lands within densely populated neighbourhoods. The poor management of solid waste blocks sewers and drainage systems provides a breeding ground for disease vectors and contributes to the generation of leachates, which pollute the ground water and further contribute to waste related diseases.

The proposed bio-fertilizer plant is a very unique project that will sit in a highly unique complex. The proposed project will make use of waste streams from the sugar and distillery plants. The Boiler ash from the co-generation, the filter mud from the sugar plant and the vinasse from the distillery shall be major ingredients in making the bio-fertilizer. By the time the project will be operational, some of the major wastes that have been problematic for most of the other sugar factories in the region may turn to be a source of revenue for them. Thus the project is meant to mop up the sugar wastes from the other sugar factories, especially those factories situated in Kisumu County.



Plate 12: Filter Mud from the factory that shall be used as one of the raw materials for the new bio fertilizer factory.

5.5.5 Liquid Wastes Management

The proposed project is meant to mop up the DSW which has been a menace as it is highly polluting due to its high levels of BOD and COD. This waste if it finds its way to a water cause, can kill most of the aquatic life. The project shall even source for DSW from nearby distilleries e.g Agro Chemicals and Food Company (ACFC), Mumias Sugar Factory Distillery, Spectre International, etc.



Plate 13: The DSW from the distillery storage lagoon next to the project site

For other liquid wastes, there are two types of sewer systems in Kisumu City: a conventional sewer system and a lagoon system. However, the 6,800m³ sewer system serves less than 10 percent of the population, and the two sewer systems do not accommodate most of the generated wastewater. In addition, frequent sewer bursts and

blockages are water-related diseases. The low-lying areas of Manyatta and Nyalenda have no sewer system, as they are lower than the conventional sewer.

Areas with access to the public sewer network include Lumumba, Makasembo, Milimani, Ondiek and Robert Ouko. However, some toilets are emptied into storm sewers soak pits and cess pits, where faecal waste presents an environmental health hazard. The capacity of the sewerage infrastructure is 17,800m³/day (if operating at full capacity), far less than what is required. The sewers were built more than four decades ago, and there has been no rehabilitation or extension of the sewer system, except for the Kibos Trunk sewers, which were built in 1980. Upgrading and expanding the sewerage infrastructure is therefore urgently required.

The proposed project area lacks a sewerage facility for mass treatment of waste from the various facilities within the sub county. The liquid waste that shall be generated shall be channelled to a septic tank.

5.5.6 Security

A security office is existent within the proposed facility with trained personnel who provide security. The KSAIL group of industries shall procure the services of a security firm. Also a fence shall be put in place as a physical barrier to secure the facility from non-permitted entry.

5.6 Social and Economic Environment

5.6.1 Agriculture

The project area is within an agricultural land where sugar cane has been planted though Kisumu County is most known for its association with Lake Victoria the largest lake in Africa. Agriculture by far is the main stay of the inhabitants. Food crops include maize, bananas, cassava, sorghum, millet, rice, sweet potatoes and an assortment of vegetables and fruits. Main cash crops include coffee, cotton and sugar cane.

5.6.2 Fishing

The lake contributes a very large part to the economy of the two counties since it supports the fishing and fish processing industry the county's main economic activity. There are a number of fisheries in the Kisumu County at Dunga and Luang'ni beaches. Fishing is undertaken for both subsistence and commercial goals. Most of the fishing folks have been fishing over the years as a source of their livelihood. In the past decade fishing became increasingly commercialized threatening even the nutrition source for the LVB inhabitants. Most fish and particularly Nile Perch is sold to fish processing plants or other agents as a result increased prices that are out of reach of most poor to average households. Fishing remains a major economic asset to both large and small-scale fishers and the regional economy in general are now common sources of nutrition to these

households. Fish catch is also declining due to increased fishing effort and illegal fishing methods. Opportunities exist in further developing this sector for local and export markets. However these efforts could be threatened by the occasional occurrence of water hyacinth.

5.6.3 Economic Activities

The proposed project site is in a large scale agriculture (cane farming), enriched with a high agricultural potential as reflected in the cash crop farms in the sub county. Sugar cane farming is the main economic activity in this area and Kibos Sugar Factory has over the years played an integral part in providing ready market for agricultural products. Livestock keeping is also practiced though on a limited scale. Other economic activities include subsistence farming and trading in the local Kibos and Chiga markets while Kisumu City.

5.6.4 Tourism

Kisumu County is endowed with various tourism attractions such as the Kisumu Museum, the Impala sanctuary, the Hippo Point, Kit Mikayi rock formation, Ndere Island in Kisumu West and others. Pollution due to anthropogenic activities has greatly diminished this tourism potential especially in most beaches within the county. The following are some of the tourism attractions that are adjacent to the lake that are likely to be affected by pollution activities from upstream.

5.6.4.1 Dunga Beach and Wetlands

Dunga Beach and Wetland is known for its unique eco-cultural attractions due to its biodiversity and cultural rich and diverse papyrus wetland ecosystem and local community respectively. Eco finder Kenya has established Dunga Wetland Pedagogical Centre at Dunga Beach is a grass-root led intervention whose overarching cardinal goal is empowerment of Dunga Wetland Community and improvement of livelihood security of its people. Therefore, some of the main focuses in the centre are promoting Eco-Cultural Tourism and facilitate the conservation of the Dunga Papyrus Wetland Ecosystem.

5.6.4.2 Hippo Point

Hippo Point is a 600 acres (240 ha) viewing area on Lake Victoria. Despite its name, it is better known as a viewing point for its unobstructed sunsets over the lake than for its occasional hippos. Hippo point is near the village of Dunga, a few kilometres South West of the city. The village also has a fishing port and a camping site.

5.6.4.3 Kisumu Impala Sanctuary

As its name suggests, it is home to a herd of impala. Some hippos, as well as many reptiles and birds are also present. Additionally, several caged baboons and leopards that faced difficulties of one sort or the other in the wild are held in cages there. Over 115 different species of birds live there. The Sanctuary is located about 3km from Kisumu city.

It was gazetted in 1992 and later branded in March 2010 as 'a lakeshore walk with impalas'. It is a home to both free ranging and captive animals as well as a home to over 115 species of birds, a variety of trees, grass & herbs amongst others.

The sanctuary has all the big five animals except the Elephant. Captive animals include the leopard, spotted hyena, blue monkey, pata monkeys, grey parrots, buffaloes, grey duikers, ostriches, hartebeest, cheetahs, lions, lionesses, white rhino, guinea fowls, tortoises and several cats amongst others. The free ranging animals include hippos, impalas, zebras, monitor lizards, Sitatunga, red tailed mongoose etc. The sanctuary holds its annual Kisumu Impala conservation boat racing event in November which is a fundraising event aimed at conserving the endangered Sitatunga antelope found within the sanctuary as well as its neighbourhood. The sanctuary is a key site for research, education and recreation. Activities include: game viewing, picnicking, boat rides, bird watching, nature walks, partying, weddings and camping.

5.7 Environmental Hazards and Disasters Aspects

5.7.1 Flooding and Droughts

Climate change has led to increased amount and intensity of rainfall resulting in frequent flooding especially in the Kano Plains as well as frequent dry spells leading to droughts. Moreover, continued loss of fertile soils and siltation of rivers and water ways leading to frequent flooding especially in the lowlands.

5.7.2 Invasive Species

Continued discharge of raw waste and industrial effluent into the Lake Victoria has promoted the growth of water hyacinth that has engulfed the lake. In addition, climate change has led to increased temperature resulting in increased algal blooms in the lake which favour invasive species such as the water hyacinth

CHAPTER SIX

6.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

6.1 General Overview

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental impact assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Coordination Act 1999. EIA studies are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts whilst providing effective mitigation measures for the negative effects. The requirements on EIA are contained in sections 58 to 67 of the Act. According to section 68 of the environmental management and coordination Act (EMCA) 1999 amended in 2015, the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment.

The government has established regulations to facilitate the process on ESIA's and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, legislative supplement No. 31, and legal notice No. 101 of 13th June 2003. In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

6.2 Policies

6.2.1 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Industrial, business and large scale agricultural development activities, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood and further downstream are not negatively impacted by the discharges.

As a follow-up to this, EMCA 1999 amended in 2015 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during Elias are implemented. In addition, the policy provides

for charging levies on wastewater on the basis of quantity and quality. The “polluter-pays-principle” applies in which case parties contaminating water are required to meet the appropriate cost of remediation. The policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing.

Kibos Fertilizer Ltd (KFL) should ensure that it develops appropriate sanitation systems to protect community health and water resources from industrial pollution, and follow standards to protect water bodies.

6.2.2 Sessional Paper on Environment and Development (No. 6 of 1999)

The key objectives of the Policy include:

- i. to ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,
- ii. To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,
- iii. To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a “sustainable development” approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness raising and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

KFL should ensure all its processes take into consideration the environment to facilitate sustainable development. KFL has endeavoured to comply with this policy from the outset and undertaking this EIA shows demonstrates its interest in complying with the requirements of this Sessional paper.

6.2.3 Sustainable Development Goals

Goal 1; No poverty

Kibos Fertilizer Ltd will support the attainment of SDGs, it will provide employment opportunities for the Kisumu inhabitants and its surrounding environs thus reduction in poverty levels

Goal 5; Gender Equality

The operation of the facility will be creating employment for both male and female; skilled and unskilled labor. This will be through recruiting workers who will be providing different services.

Goal 6; Ensure access to water and sanitation for all.

KFL Management will ensure that all water sources are of the highest sanitary standards and disposal of waste is in accordance with relevant regulations.

Goal 7; Ensure access to affordable, reliable, sustainable and modern energy for all.

The facility should incorporate the use of clean renewable energy sources i.e. solar and ensure energy is efficiently used during its operation.

Goal 8; Promote inclusive and sustainable economic growth, employment and decent work

The operation of the facility will create quality employment opportunities that will in turn stimulate the economy and protect the environment.

Goal 12; Ensure sustainable consumption and production patterns

The facility Management is obliged to ensure that all materials and equipment for all the project life cycle will be used in a manner that preserves the environment as per the regulation.

6.2.4 The Constitution of Kenya, 2010

Article 42 of the Constitution of Kenya states that every person has the right to a clean and healthy environment. This includes the right; to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69.

To have obligations relating to the environment fulfilled under Article 70 .On application under clause (1), the court may make any order, or give any directions, it considers appropriate;

- a. To prevent, stop or discontinue any act or emission that is harmful to the environment;
- b. To compel any public officer to take measures to prevent or discontinue any act or emission that is harmful to the environment; or
- c. To provide compensation for any victim of a violation of the right to a clean and healthy environment.

KFL should ensure that all her employees and other stakeholders are clear with their rights to clean and healthy environment through training and induction process.

6.2.5 Kenya Vision 2030

Vision 2030 presents comprehensive social and economic interventions aimed at improving the quality of life of all Kenyans and Kenyan residents and are specifically tooled to focus on reforms and development. Coming soon after the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation (2003), the Kenya Vision 2030 envisions a globally competitive and prosperous Kenya as a rapidly industrializing middle-income nation by the year 2030 through five year medium-term rolling plans. The Vision is anchored on 3 key pillars, namely, economic, social, and political.

KFL operations will have to go a long way towards the realization of the economic and social pillar of the Vision which aims at achieving an average economic growth rate of 10 per cent per annum by 2012 while sustaining the same till 2030 in order to generate more resources to meet the MDGs and Vision 2030 goals as well as a just, cohesive and equitable social development in a clean and secure environment respectively.

6.2.6 National Environmental Action Plan (Neap) 2009-2013

NEAP 2009-2013 represents a multi-disciplinary and multi-sect oral process that implements a participatory approach in identifying challenges that face the environment and including mitigation measures to these challenges in development plans.

KFL management team has to ensure that the operations of the fertiliser plant should conform to the NEAP as set out by the National Environmental Committee through ensuring environmental concerns are implemented through the EMP formulated.

6.2.7 Sessional Paper No. 6 Environment And Development

The overall goal is to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development. The policy paper emphasizes that EIA must be undertaken by the developers as an integral part of a project preparation. It also proposes for periodic environmental auditing to investigate if the developer is fully mitigating the impacts identified in the assessment report.

KFL is obliged to comply with the provision of this sessional paper for proper disaster preparedness and mitigation.

6.3 Legal Framework

6.3.1 Environment Management and Co-ordination (EMC) (Amendment) Act 2015

EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High court if this right has been, is likely to be or is being contravened. The law has made provisions for the establishment of NEMA, which has the statutory mandate to supervise and co-ordinate all environmental activities in the country.

Part II of EMC (Amendment) Act of 2015 states that every person in Kenya is entitled to clean and healthy environment and has duty to safeguard the same.

Part IV section 68(2) stipulates that the owner of a premises or the operator of a project for which an environmental impact assessment study report has been made should keep accurate records and make annual reports to the Authority describing how far the project conforms in operation with the statements made in the environmental impact assessment study report submitted under section 58(2).

In reference to section 68(3) The owner of premises or the operator of a project should take all reasonable measures to mitigate any undesirable effects not contemplated in the environmental impact assessment study report submitted under section 58(2) and should prepare and submit an environmental audit report on those measures to the Authority annually or as the Authority may, in writing, require. In its second schedule, EMCA identifies the academy as one of the project which must be subjected to environmental audit.

By undertaking this EIA study, the company has complied with the regulation. It is envisaged that the management will continue with this positive gesture and regularly and timely carry out subsequent audits.

6.3.2 Environmental (Impact Assessment and Audit) (Amendment) Regulation, 2009

The EIA/EA regulation, 2009 provide the guidelines that have been established to govern the conduct of environmental assessments and environmental audits in Kenya. Section 31(1) of the EIA/EA regulation stipulates that an environmental audit study should be undertaken on ongoing projects commenced prior to the coming into force of these regulations and new projects undertaken after completion of an environmental impact.

Section 31(2) provides that an environmental audit should be conducted by a qualified and authorized environmental auditor or environmental inspector who is an expert or a firm of registered experts.

In reference to Section 35(1), the process should be carried out through environmental questionnaires, environmental site visits in the manner specified in the regulation. Section 35 (2) stipulates that in conducting an Annual environmental audit an environmental auditor should consider the description of the project and also indicate the objective, scope and criteria of the audit, and also verify the level of compliance with the conditions of the environmental management plan.

KFL shall be required to commit to implementing the environmental management plan laid out in this annual audit report and any other conditions laid out by the authority.

6.3.3 Occupational Safety and Health Act, 2007

OSHA (2007) calls for the safety, health and welfare of workers and all persons lawfully present at workplaces. Part II section 6 (1) stipulates that every occupier has to ensure the safety, health and welfare at work of all persons working in his workplace.

The occupier is charged with the responsibility of ensuring safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances that have a bearing on health and safety.

Part II section 6(2) and Part II section 7 (1) (a) stipulate that it is the duty of every occupier to prepare and, as often as may be appropriate, revise a written statement of his general policy with respect to the Safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy.

As stipulated in PART VI section 47(1) Every workplace shall be kept in a clean state, and free from effluvia arising from any drain, sanitary convenience or nuisance, As per section 48(1), an occupier shall ensure that his workplace shall not, while work is carried on, be so overcrowded as to cause risk of injury to the health of the persons employed therein.

Before any premises are occupied, or used a certificate of registration must be obtained from the chief inspector. The occupier must keep a general register. The Act covers provisions for health, safety and welfare.

KFL has to secure a certificate of registration from DOSH and other relevant certifications by the ministry. They will be required to adhere to all the regulations which are laid down in this Act.

6.3.4 Waste Management Regulations, 2006

Waste management regulation requires that no one should dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle as mentioned in Part 11 Section 1. As per section 2 any person whose activities generate waste should collect, segregate and dispose or cause to be disposed of such waste in the manner provided for under these Regulations.

In reference to section 3 any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose of such waste in a designated waste disposal facility. In preventing water pollution section 4 of part II points out that every person shall refrain from any act which directly or indirectly causes, or may cause immediate or sub-sequent water pollution.

The regulation also stipulates that it shall be immaterial whether or not the water resource was polluted before the enactment of the Act and also no person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

In support of compliance to this regulation in the county, Kibos Fertilizer Ltd should invest in processing waste which would have otherwise littered in the environment hence more pollution

From the foregoing, KFL should ensure that it has proper disposal mechanism of its waste and that they adhere to the waste management regulation as stipulated in the Act.

6.3.5 EMC (Water Quality) Regulations, 2006

The Regulations provide for Prevention of water pollution. They require every person to refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution. The regulations also require that no person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

This requires KFL to guard water resources against any form of pollution and require individuals to take the necessary precautions in an attempt to avoid water pollution.

6.3.6 The Energy (Energy Management) Regulations, 2012,

Legal Notice No.102, Section 6. (1) States that the owner or occupier shall cause an energy audit of the facility to be undertaken by a licensed energy auditor at least once every three years.

KFL should incorporate other energy saving mechanisms e.g. the use of energy saving bulbs, use of natural lights. Deliberate efforts should be made to avoid wastage and to keep proper records.

6.3.7 The Occupiers Liability Ordinance, CAP 34

Under Section 3 of the Act, an occupier of premises owes the common duty of care to all his visitors, except in certain restrictions, modifications or exclusion to a visitor by agreement. The common duty of care is defined, as the duty to take care as in all circumstances of the case is reasonable to see that the visitor will be reasonably safe in using the premises for the purposes of invitation or permission.

KFL management and staff must ensure safety of the visitors in the facility is guaranteed through implementation of the necessary infrastructure. To achieve this, the management team should ensure various safety warnings are displayed for communication to both their staff and other stakeholders.

6.3.8 The National Government Co-Ordination (General) Regulations, 2014

These regulations underline the procedures in service delivery after the devolution of government in 2013.

KFL should source services such as water, electricity and sanitation from the national government at the County level.

CHAPTER SEVEN

7.0 ANALYSIS AND APPRAISAL OF ENVIRONMENTAL IMPACTS

In order to accurately identify the proposed development impacts, the following issues were considered pertinent and important for the coverage.

7.1 Physical Environment (Biophysical Impacts)

- i) Water quality aspects for both surface water sources like piped water, storm water, and other related aspects
- ii) Soil conditions, soil contamination and landscape alterations/degradation (based on aesthetic aspects) associated with the proposed project.
- iii) Drainage patterns especially in relation to wastewater effluents discharges channeled into the drainage ditches.
- iv) Air quality aspects especially atmospheric emissions from the plant chimney
- v) Noise and vibration (sonic factors) where applicable

7.2 Natural Environment

- i) Natural flora and fauna from the adjacent ecosystem (i.e. effects to natural plants and animals where applicable).
- ii) Adjacent water bodies, tributaries and streams-pollution indicators, impacts on water flow patterns and quality aspects, user interference and contamination.

7.3 Social welfare, Economic and Cultural Environment

- i) Determination of implications to the human society distribution, demographic details, settlement patterns, changes to the cultural lifestyle and indigenous knowledge of the local society/public where applicable.
- ii) Notable changes in land use systems and the general land utilization types where applicable.
- iii) Aesthetic, landscape alterations and changes to infrastructural facilities, among others.
- iv) Effects associated with the construction and operation activities and related handling and disposal of wastes generated during the operations.
- v) Effects associated with income generation opportunities created by the project due to the upcoming operations.
- vi) Introduction of nuisances, such as pests and related multiplication breeding sites

7.4 Environmental and Social Impacts Identification, Methodology and Appraisal

7.4.1 Physical Impacts

7.4.1.1 Air Quality

NO_x and SO_x can cause adverse health effects, through both acute and chronic exposure. Chronic exposure may result in increased incidences of respiratory illnesses in the exposed population.

a. Project Site Preparation and Construction Phases

It is expected that during these phases of development, there may be some changes in the air quality. Vegetation clearing for site preparation, storage of raw materials and spoilage, and preparation of access roads are all expected to liberate dust and other forms of particulate matter, which currently is within the set limits for particulate matter (PM). While most of the dust generated is likely to settle a short distance from these sources, smaller particles may be transported across a wider area. The magnitude of dispersion will be influenced by the local meteorological conditions. The dust generated from the site preparation and construction activities is likely to have a major negative long-term local environmental impact. Movement of heavy construction vehicles and the increase in traffic may cause an increase of local greenhouse gas emissions including NO₂ and SO₂. Short and long term exposure to NO₂ and SO₂ may result in the development of both acute and chronic respiratory illness. Chronic exposure may result in increased incidences of respiratory illnesses in the exposed population. The impacts although negative, may be short term, and not significant.

b. Operation Phase

The operation of the proposed fertilizer plant will mean an increase in Carbon Monoxide and the Oxides of Sulphur and Nitrogen in the area emissions to the atmosphere due to the nature of raw materials and chemical additives to be used in the manufacture of fertilizer. Air emissions from fertilizer production plants include the gaseous products of sulfur dioxide (SO₂), nitrogen oxide (NO_x), carbon dioxide (CO₂), and water vapor. Emissions are reduced through costly treatment of the flue gas. Nitrogen oxide is typically controlled using selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR). SCR involves the use of a catalyst and ammonia or urea while SCNR involves the injection of specific nitrogenous reagents to drive a reaction that will reduce the amount of nitrogen oxide in the emissions. Particulate matter is controlled using fabric filters (bag houses) or electrostatic precipitators (ESP) that impart a negative electric charge onto the particles which then moved to electrically grounded plates for collection. Visible emissions from the smokestack are a very uncommon occurrence and only happen when the combustion process is out of control or the emissions treatment process has failed.

7.4.1.2 Water Quality

a. Site Preparation and Construction Phases

The activities involved in these phases of the project development may cause a major negative long-term impact on the surface (terrestrial) and ground water quality within the development area. This will be as a result of many of the activities which are slated to take place in these phases which includes the possible transfer of vinasse waste stored in open lagoons next to the proposed site. The clearing of the vegetation within the development area may also have a synergistic negative long term impact on the water quality in the area as well.

b. Operation Phase

This phase of the development may have the most negative, long term impact on the surface water (aquatic and terrestrial) quality if not properly monitored and managed and is potentially irreversible. This impact on the water quality will be from several sources such as storage of DSW raw material for the bio fertilizer plant, storage of additive mineral elements and handling of the bio fertilizer product. These materials and product if not well handled, have significant negative impacts.

7.4.1.3 Water Quantity

a. Site Preparation and Construction Phases

The water consumption in these phases of the development will be minimal when compared to the rate of consumption in the operation phase. Water will be used for the construction of buildings and roadways, as well as for domestic use among labourers employed to the site. The projects area currently is well served by KSAIL group treated water which is adequate and complemented by borehole water thus there will be no strain on the current water supply from river Kibos.

b. Operation Phase

The Operation of the bio fertilizer plant will mean an added pressure to the existing water supply by KSAIL group and the city county of Kisumu. Best water source alternatives should be considered.

7.4.1.4 Soils and Geology

a. Site Preparation and Construction Phases

The activities involved in the site preparation and construction phase of the bio fertilizer plant may have major negative and moderate impact on soil and geology of the project site. This is due to the removal of vegetation from the area which will leave considerable areas of soil exposed to the elements, which may result in soil erosion. Heavy machinery will be traversing the site due to the construction activities this may lead to soil compaction and erosion of the soil. Hazardous substances such as diesel used for the operation of machinery and stand-by generators, may be stored on the property. This may have a significant negative long-term impact on soil quality in the area if leakages occur.

b. Operation Phase

The use of chemicals for the maintenance of the turf and the use of treated effluent for the irrigation of the turf may affect soil quality, by changing the soil's chemistry through changes in pH. This environmental impact may be long-term, major, irreversible and negative. Soil compaction during the operation of the facility may also affect the natural infiltration of soil and therefore run-off may be affected.

7.4.1.5 Hydrogeology

a. Site Preparation and Construction Phases

These phases of the development may have a moderate and negative impact on the hydrology of the area. Heavy equipment used in these phases of the development can cause soil compaction and therefore result in increased surface runoff, which changes the natural internal drainage capacity.

b. Operation Phase

The Operation Phase of the development is likely to have a minor negative, long-term impact on the hydrology of the area. This is however not significant as runoff levels predicted are marginal and will be guided through constructed storm drains.

7.4.1.6 Noise & Vibration

a. Site Preparation and Construction Phases

The site preparation and construction phases of the Bio fertilizer plant may likely have the most negative impact to the ambient noise and vibration in the development area. A number of measures may be undertaken by the developer/s to reduce the impact of noise on the existing and potential residents as well as the workers involved in the project. This is temporary, however, and the aim at this point is to make the increase in noise as minimal as possible until this phase is complete. The cumulative impact of the construction activities occurring simultaneously with the operation of other KSAIL group companies already in existence may increase the noise and vibration levels in the area significantly.

b. Operation Phase

The Operation Phase of the project is not expected to cause a major negative impact. Although the property will be operated as an industrial facility it is likely that the noise limits will not be a problem to the public.

7.4.2 Biological Impacts

7.4.2.1 Terrestrial Environment (Flora)

a. Site Preparation and Construction Phases

The construction phase will result in the removal of some vegetation in the area. The development may have a moderate, short-term, irreversible negative impact on the floral composition of the area. No rare or threatened species has been observed at the proposed

project site. This shows that from an ecological point of view, the area is not one of very high ecological importance.

b. Operation Phase

Much of the area will be vegetated after the construction and its auxiliary components have been constructed. The activities involved in the maintenance may have a High negative long-term irreversible impact on the remaining vegetation of the area. These main impacts may be associated with the use of chemicals as raw material and those that will be used in the maintenance of the lawns which may have direct (use of herbicides for turf maintenance) and indirect impacts (alteration of soil chemistry and water quality). The machinery used in maintenance activities may also affect this vegetation.

7.4.2.2 Social Structure (Demography)

a. Site Preparation and Construction Phases

The inflow of workers who choose to reside in the community during these phases of the development may not have any impact on the demography of the area. The numbers of workers anticipated to be employed in these phases is estimated at approximately 250 workers per phase who will be directly employed from the local communities.

b. Operation Phase

The change in the demography of the area is not likely to increase due to the operation of phase.

7.4.2.3 Infrastructure (Road Network)

a. Site Preparation and Construction Phases

These phases of the development may have a major negative impact on the present road network in the area. The roads in their current states may not be able to handle the increase in heavy-duty equipment traffic. Thus it is proposed that the proponent improves on the road network at the project site.

b. Operation Phase

The operation phase of the project may have a major negative impact on the road network in the area as the volume of traffic associated with the development i.e. Material and product transportation will be significantly increased, therefore placing a strain on the road network which needs improvements and continuous maintenance.

7.4.2.4 Utilities (Electricity)

a. Site Preparation and Construction Phases

These phases of the development will not have an impact on the electricity supplying the area. The site is supplied with electricity by KPLC and own generated power from the cogeneration plant.

b. Operation Phase

This phase of the development will not have any impact on the electricity consumption in the area as most of the electricity to be used will be from group own generation.

7.4.2.5 Utilities (Telecommunications)

a. Site Preparation and Construction Phases

These phases of the development will not have an impact on the telecommunication services in the area. The area is well covered with all mobile providers.

b. Operation Phase

The development may have a major positive impact on the telecommunications services available in the area. The development may see an addition of other services such fast internet to the area.

7.4.2.6 Waste (Solid Waste)

a. Site Preparation and Construction Phases

A significant amount of solid waste will be generated in this phase through the clearing of vegetation for construction. This will therefore have a major negative short-term impact on solid waste collection in the area. The proponent should take the initiative of removal of the solid waste which is expected to be generated during this phase of the development.

b. Operation Phase

The operation phase of the development will have a major long-term negative impact on the solid collection in the area. Solid waste (filter mud and Boiler ash) will be used as raw material in the manufacture of the fertilizer. These materials if not handled well may have negative impacts. Solid waste will also be generated from the maintenance of turf. This will be in the form of grass clippings and other debris generated from maintenance activities. Pesticides and fertilizer packaging may be a potentially hazardous waste if not disposed of properly.

7.4.2.7 Waste (Sewage and Industrial Effluent)

a. Site Preparation and Construction Phases

Currently this site is not connected to the sewer line thus due diligence on sewer effluent (toilets) need to be considered.

b. Operation Phase

Sewage will be generated by employees, customers and its auxiliary activities as well as visitors to the development. If this is not properly maintained, poses a major threat on surface and ground water quality. This may also have a major impact on human health. The proposed bio fertilizer plant will use waste water from the distillery plant as a raw material. In the proposed designs, waste water will not be generated. Only condensate water will be recovered for other used within.

The Use of vinasse as a raw material will mean that there will be site holding. Concentrated vinasse is a high pollutant for both water and soil. Thus maximum attention need to be taken in its handling.

7.4.2.8 Social Services (Health Services)

a. Site Preparation and Construction Phases

There may be an influx of workers for these phases of the project. It is however anticipated that most of these workers will be recruited from within the project area and therefore these phases of the project will have a no impact on the Health Services in the area.

b. Operation Phase

The operation phase of the project will have no impact on the health services in the area. as part of corporate social responsibilities, KSAIL has partnered with Tenwek hospital to construct a modern health care facility in the area thus this will enhance health care services in the area.

7.4.2.9 Emergency Services (Fire Services)

a. Site Preparation and Construction Phases

The site preparation and construction phases may have minor negative impacts on the fire services in the area. The storage of diesel and other flammable substance for use in machinery used in this phase of the development poses the possibility of fires. This is increased by the climatic factors such as levels of rainfall and wind speeds and the presence of large vegetated areas within the development. In mitigation of this, KSAIL has its own fire engines and the county government of Kisumu also has stand by fire engines.

b. Operation Phase

The operation phase of the project may have minor negative on the Fire Services in the area. Most of the materials to use at this project phase are mostly not flammable therefore minimum risk and where risk occurs i.e. electrical fault, fire engines available within the group and those of the county will mitigate.

7.4.2.10 Emergency Services (Police Services and Security)

a. Site Preparation and Construction Phases

Crime might increase to influx of youth seeking employment in the proposed project site Therefore these phase of the development have a minor negative, short term effect on the levels of crime and violence in the area and therefore have an impact on the police services in the area. To curb on crime due to an influx of youth seeking employment, the proponent must provide security by using security guards, installation of surveillance equipment and closely work with the police in the area.

b. Operation Phase

The fertilizer plant will be a major income earner and it is therefore expected that large sums of money will be handled at the site daily for payment of suppliers, wages etc. This may attract criminal elements to the site and also increase the level of crime and violence in the surrounding communities. This possible surge in crime and violence may place a strain on the police services that are responsible for the area. In order to ensure the safety of the workers, it is recommended that the proposed mitigation measures be implemented.

7.4.2.11 Transportation

a. Site Preparation and Construction Phases

Access to public transportation is currently not a problem within the development area. This stage will therefore not have an impact on the transportation network in the area.

b. Operation Phase

The proponent is advised to provide transport for workers to and fro the project site.

7.4.3 Occupational Health and Safety

7.4.3.1 Technological Hazards

Fire and explosions may be described as Technological Hazards, which can cause serious injury or result in loss of life and damage to vegetation.

a. Site Preparation and Construction Phases

Flammable substances including diesel and motor oil may be stored or used on the project site for heavy-duty equipment. These substances are precursors for fires and explosions, which may range from small incipient to larger fires of great intensity, which generates heat causing damage to property, injuries or loss of human life.

b. Operation Phase

In this phase of the development, large volumes of chemical substances used in the fertilizer production and other facility maintenance will be stored on the property, most of which are highly flammable and may cause explosions. In addition, the operation of a possible kitchen or restaurant for workers on site will mean the storage of LPG on site which is also highly flammable, which may increase the vulnerability of the operation to a fire or an explosion

7.4.3.2 Accidents/General Human Health

Due to the nature of development accidents may be possible. These may occur during the all stages of the development. These accidents often happen unexpectedly and unintentionally and can result in the loss of life and injuries, as well as damage to property. In addition it is very important that the developer considers the health and safety of its workers and customers.

a. Site Preparation and Construction Phases

The probability of an accident occurring at the project site during these phases of the development is high. This is due to the intense use of machinery and other heavy-duty equipment used in this phase. The levels of dust in the area are also likely to increase, which may cause respiratory illnesses in humans. It is therefore important that the mitigation measures outlined are implemented to ensure the safety of staff members during these phases of the development.

b. Operation Phase

Accidents will happen whether by human error or failure of machinery. Therefore the probability of an accident happening during this stage of the development is high. Copious amounts of hazardous chemicals will be stored and used in the maintenance. It is therefore imperative that measures be implemented to ensure the safety of workers and guests of the facility.

Table 7.1: Summary of Project Activities, Potential Impacts, and Proposed Mitigation Measures

PHASE	ACTIVITIES	POTENTIAL IMPACTS	RATING	MITIGATION MEASURES
PRE-DEVELOPMENT PHASE	-Transportation of materials such as cement, aggregates, sand, equipment and labourers	<ul style="list-style-type: none"> ✓ Possibility of oil spillage, spillage of materials, noise, dust pollution, soil contamination, heavy traffic 	High	<ul style="list-style-type: none"> ✓ Ensure use of serviceable vehicles and equipment Contractor to ensure no spillage occurs. ✓ Take short period to implement project ✓ Indicate along the road the direction where heavy vehicles are likely to be found
	Excavation and laying down construction materials Using heavy equipment during construction	<ul style="list-style-type: none"> ✓ Construction of building foundation likely to compromise the safety ✓ possibility of noise and dust pollution 	High	<ul style="list-style-type: none"> ✓ Ensure use of manual labour where appropriate ✓ Ensure use of hand tools where appropriate ✓ Ensure serviceable heavy construction machinery used ✓ Ensure the contractor takes the shortest time possible
	Storage of building materials	<ul style="list-style-type: none"> ✓ Destruction of soil structure ✓ Possibility of fire outbreak 	Medium	<ul style="list-style-type: none"> ✓ Ensure proper storage of material ✓ Ensure no smoking at the site ✓ Ensure labour regulations are adhered to strictly
	Human movement at the development site	<ul style="list-style-type: none"> ✓ Solid waste generation by workers ✓ Possibility of accidents during 	High	<ul style="list-style-type: none"> ✓ Ensure no litter is brought in by workers to the site ✓ Ensure effective collection of litter generated, ✓ ensure workers operate in a noise free environment
OPERATION	Facility operations	<ul style="list-style-type: none"> ✓ Increase noise, solid waste and waste water production 	High	<ul style="list-style-type: none"> ✓ Ensure proper management of waste

		<ul style="list-style-type: none"> ✓ Possibility of occupational hazards ✓ Socio-economic benefit to the people through employment, a more vibrant economy 		<ul style="list-style-type: none"> ✓ Ensure treatment for adequate effluent discharges and solid waste collection system is in place ✓ Adhere to rules governing Occupational Health and Safety ✓ Ensure 'No smoking' signs within the site ✓ Adhere to labour laws
OPERATION PHASE	Water supply & consumption	<ul style="list-style-type: none"> ✓ Increase in water demand 	Medium	<ul style="list-style-type: none"> ✓ Install efficient plumbing fittings, appliances and devices to optimize water use efficiency
	Energy consumption	<ul style="list-style-type: none"> ✓ Increase in energy demand 	High	<ul style="list-style-type: none"> ✓ Install efficient electrical fittings, appliances and devices to optimize energy use efficiency
	Waste water disposal	<ul style="list-style-type: none"> ✓ Contamination of ground water and surface water 		<ul style="list-style-type: none"> ✓ Demonstrate suitability and capacity of the bio fertilizer plant for effective treatment and disposal of waste water generated. ✓ Develop and adhere to a effluent treatment plant (if any) maintenance program ✓ Regularly monitor and reduce waste water generation

<p style="text-align: center;">DECOMMISSIONING PHASE</p>	<p>Demolition Transportation Disposal</p>	<ul style="list-style-type: none"> ✓ Possibility of oil spillage, Noise and dust pollution ✓ Soil structure destruction and contamination ✓ Material spillage 		<ul style="list-style-type: none"> ✓ Ensure use of serviceable vehicles ✓ Ensure use of manual labour and hand tools ✓ Ensure proper storage of used materials ✓ Ensure removal of all the materials brought in during construction ✓ Adherence to use of PPEs.
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CHAPTER EIGHT

8.0 PUBLIC CONSULTATION AND PARTICIPATION (CPP)

The consultation process took place in two phases. The first phase was primarily inaugural; aimed at highlighting the premise of the engagement between KSAIL and KNCPC on EIA for the proposed bio-fertilizer plant. Accomplished in a formal meeting at the Nairobi NEMA offices, it was done at the behest of the Director General, NEMA and focused on elaborating the relationship between KSAIL and KNCPC in relation to the latter's partnerships with industries in Kenya under the LVEMP II and EPSGG-LVB multinational projects, brainstorming on the scope and issues for the EIA exercise, and defining the terms of reference (ToR) for the EIA study. The second phase was the actual EIA itself.

This chapter presents the views and opinions mapped out from the consultations with relevant stakeholders and surrounding community members/public (CPP) held. In accordance with sustainability principles that emphasize application of participatory approaches to development, and also stipulated in Part III, Section 17 of the Kenyan Environmental (Impact assessment and Audit) Regulations 2003 [2009], this EIA study sought out the views and opinions for purposes of discerning pertinent environmental and social impacts that need to be mitigated in the entire life cycle of the project. Thus conceived, the consultations exercise was organized around three thematic perspectives:

- (i) Determining the indicative social and environmental issues for the bio-fertilizer plant;
- (ii) Analyzing and singling out the core social and environmental concerns for consideration in the development of the environmental management plan (EMP) for the proposed bio-fertilizer plant; and
- (iii) Discovering public concerns which are not directly related to the bio-fertilizer plant yet, in the absence of responsive mitigation measures, they present significant influences on its set up and subsequent operations.

The rest of the CPP component of the Report is organized as follows:

- i) Section 8.2 describes the nature of the data required for the CPP exercise, their sources, and the methods followed.
- ii) Section 8.3 is the most expansive component of this chapter, to the extent it presents the details on of CPP deliberations. In this section, a summary of key potential social justice risks and environmental threats associated with the bio-fertilizer plant arising from the CPP deliberations are presented. Section 8.3 also presents the preferred mitigation measures for the possible negative effects.

iii) Finally, section 8.4 outline the summary of critical social and environmental public concerns about the proposed bio-fertilizer plant, thereby being the basis for the recommendations contained in the subsequent EMP for the plant. The supportive CPP delivery aid tools are in Appendix 8.1.

8.2 Data and Methods

8.2.1 Information Required and Sources

The focus of the consultation was seeking the views on how the bio-fertilizer plant, in the context of sustainable development, could induce changes in the existing natural and entire social and economic ecosystem elements. This task entailed unraveling the concerns of the people in relation to how the planned project might conform with or part ways with the quality of their bio-spherical bases and socio-economic and cultural life forms; and enlisting, in their own self-expressions, the preferred mitigation measures in the entire life cycle of the bio-fertilizer plant. This meant that the EIA exercise maps out an extensive and inclusive views and opinions of the public and relevant stakeholders.

To this end, the CPP process reached to a wide range of participants with equally diverse knowledge, experiences and technical skills about how technological innovations in the sugar industry work and interact with the wider societal elements. This was accomplished through organized meetings with local community members (public forums [*baraza* meetings]), representatives of specialized state agencies and non-state actor organizations in the sugar industry governance, and face-to-face interviews with local opinion leaders and high level political office holders.

8.2.2 Participants' Mobilization

A combination of mobilization strategies were employed for different target participants. The mobilization process for participants in the first three *baraza* meetings entailed the use of announcement and invitation posters placed at conspicuous points within the location of the venues. These were complemented with the efforts of the local administration chiefs and assistant chiefs and local area leaders. The participants in the last *baraza* meeting, held at Kibos Agricultural Section, was organized by Muhoroni Sub-County Commission Office upon the recommendation by the local area Member of Parliament (Muhoroni Constituency), Hon. James K'oyoo. Initially it was scheduled to be held at Karunga Market Centre, but this was later changed in favour of the Kibos Agricultural Section following advice by the area DCC on the strength of security risks at Karunga.

As the list of participants attached to this report indicates, this *baraza* attracted participants across administrative boundaries, gender and local community social and economic

representation scales, including 7 Members of Kisumu County Assembly ([MCAs], cane growers, local administration officers, incumbent local political party leaders, organized environmental conservation pressure and/or special interest groups, local traders, and 'boda boda' cyclists/operators.

For the Technical Workshop, official letters were sent to the respective target participants 14 days prior to the date of the event - 20th June 2019, followed by phone calls. Official letters were sent out also to the target area members of the national assembly ([MPs] for Muhoroni Constituency & Kisumu East).



Plate 14 Public announcement poster for the EIA public baraza meeting

8.2.3 Collection of the Stakeholder views

During the consultative meetings, participants were first provided with essential background information on the bio-fertilizer plant proposal with a view to making them constructively ventilate their views and opinions. This action involved treating the participants to the evolution of the KSAIL factories, the environmental challenges KSAIL have faced and addressed over the period, the remaining challenges. And, ultimately, with the aid of written Technical Briefing Note (Appendix 7H), explaining how the bio-fertilizer concept is designed to work and its tailoring towards addressing the remaining social and environmental health challenges. After the initial awareness creation sessions, the participants were granted the opportunity to freely air their opinions and views regarding the proposal in the form of questions that seek clarifications on the bio-fertilizer concept, comments on its intent, and suggestions for input to and/or improvement of the plant's life cycle.

The resultant statements contained in the field notes were, thereafter, examined for common patterns in the expressed views and opinions on social and environmental risk factors and potential mitigation measures for the bio-fertilizer plant. At the end of the public consultation sessions, the EIA Team informed the participants that a further platform would

be presented to them for further input when NEMA analyses the EIA Report finally publishes invitations for public hearings for ultimate decision on the proposed plant.

8.2.4 Distribution of the Participants by Consultation Platforms

The meeting at the NEMA offices was attended by 9 people, Four (4) *baraza* meetings were held for the CPP exercise at different points across parts of the Kibos neighborhood - at Guba Market Centre in Kajulu East, Chiga Market Centre in Kolwa East, Kibos Market Centre in Kisumu East, and Kibos Agricultural Section in Muhoroni Sub-County. One (1) Technical Workshop was held, with 47 participants in Kisumu Central.

A total 432 people were consulted through the *baraza* meetings and the technical Workshop (385 and 47 respectively). The frequency distribution of participants is as presented in Table 8.1. The resultant minutes of the deliberations are in appended in this report.

Table 8.1: Consultation Frequency Distribution, June-July 2019

Meeting Site & Date	Members of the Public	MCAs	Administrative Officers	Media Houses	Specialized Organizations	MPs	Total
Guba Market Centre, 19 th June	88	0	2	0	-		90
Kibos Market Centre, 19 th June	79	0	1	0	-		80
Chiga Market Centre, 20 th June	74	0	3	0	-		77
Kibos Agricultural Section, 12 th July	138	7	7	9	-		161
Simba Club, Kisumu Town, 21 st June	-	-	-	-	47		47
Continental House (Meeting with MPs from the Proposed Project Site, Kisumu County)	-	-	-	-	-	2	2
Continental House Nairobi (Meeting with PSC on Committee on Environment), Nairobi, 23 rd July						14	14
Key informants	-	-	-	-	-		5
Total	379	7	13	9	47	16	476

To enlist the views and opinions of specialized state agencies and interest groups, the approaches employed were twofold: a consultative workshop and key informant interviews. The total number of participants in the consultative workshop was 47, and comprised

representatives of state and non-state actor organizations and institutions in industrial development, health, environment and water resources management.

The responses were received through key informant interviews with professionals within the KSAIL ecosystem. In addition to key informant interviews and baraza meetings, the opinions and views of 3 area opinion leaders (2 officials of the area Water Resource Users Association [WRUA] & 1 former MCA), and 2 incumbent area members of the national assembly ([MPs] for Muhoroni Constituency & Kisumu East) were also solicited. Finally, the EIA Team also held a meeting with the National Assembly's Select Committee on Environment and Natural Resources.

An attempt was made to convene a formal consultative meeting also with Committee on Water, Environment and Water Resources of the Kisumu County Assembly (letter of request for a meeting is Appended to this report). However, this did not materialize as the Assembly would be out of session in the remaining period of the EIA study exercise.

8.3 Views and Opinions from the Consultations

The consultation exercise was successful in enlisting critical views and opinions of the public and specialized agencies on potential social and environmental impacts that need to be factored in the design and priority actions in the life cycle of the bio-fertilizer plant. They are described in this section. For potential high risk social and environmental factors, the corresponding mitigation measures are provided for in the EMP.

8.3.1 Views and opinions from the public *baraza* meetings

8.3.1.1 Guba Market Centre, Kajulu East

Table 8.2: Issues raised during the meeting at Guba Centre, Kajulu

Intervention theme	Typical view and/or opinion(s) expressed
Surface water degradation and the human health	<p>“There used to be a water quality problem here but now there is a positive change, but when it rains, the smell is just horrible! We are not sure if we will survive in five-years!” In the same vein, Another participant added that, “the question of offensive smell and the water quality need to be addressed,” further noting, amidst overwhelming applause and echoes of endorsement, that “the smell is so bad that when you are sitting near your wife, you can even accuse her of having failed to clean the child properly because of the smell”.</p>
Research as premise & driver of the proposed bio-fertilizer plant	<p>“Is there any research that has been done to ascertain that the fertilizer factory will reduce the smell from Kibos?”</p>
Economic effects	<p>“There will be good benefits such as more jobs for our people. We appreciate that. But we want to see more benefits. What other benefits will come from this fertilizer factory? Will it be given to the farmers?”</p> <p>In rejoinder reactions, some participants remarked that, “We are not going to simply assume that the factory will employ us! Please, give us even a quarter of the jobs and remain with three quarters. We need our people in the management positions, (rather than) just working as welders”.</p>
Integrating the local community in the factory decisions and actions	<p>Participants deplored the absence of an explicit framework for continuous engagements between them and the KSAIL management. The discussions revealed that the structure for dialogue between the two entities has been overtly weak, even not precisely defined.</p> <p>At the very outset, one participant began by saying that, “what we have seen today is unusual and extremely unbelievable! Kibos has never come down to talk to us like they have done today. We hope that it is not a way of using us as the rubberstamp! We want this discussion to continue even after this meeting”.</p>



Plate 15: A stakeholder making remarks at the public baraza held at Guba Market Centre, Chiga Location.

8.3.1.2 Kibos Market Centre, in Kisumu East

Table 8.3: Issues raised during the meeting at Kibos Market

Intervention theme	Typical view and/or opinion(s) expressed
Surface water degradation and the human health	<p>Protecting the local community from the adverse health effects of wastewater/effluent discharge was boldly expressed. One participant mused that, “Kibos must resolve the issue of wastewater before it puts up another factory, and I think NEMA has seriously failed us! <i>Onge ng’ato kae ma en ok oduar dongruok ma chalo gi ma!</i> (There is not even a single one person here that is opposed to a development initiative of this kind!). You can say all things about the environment and development but if you do not fix the water (pollution) issue <i>ongge gima uwachonua kar kae</i> (there is nothing you are telling us here!)”.</p> <p>Another participant was a little more optimistic. He said that, “I am very glad to learn that Kibos is planning another factory that is going to reduce the boiler ash which has been a big health problem for many people in this area. What we need to do is to have a good waste management strategy”.</p>

<p>Corporate Social Responsibility (CSR)</p>	<p>Participants expressed the view that the CSR strategy for KSAIL had not been adequate. Pointing to rare investments by KSAIL in the local social services and physical infrastructure amenities like schools, hospitals and road repairs, they suggested that proceeds from the proposed bio-fertilizer plant should go way to improve the lives of the local people in these respects. One person profusely lamented: "Kibos has never constructed even a single primary school, not even a dispensary!"</p> <p>Concomitantly, another participant (Cane grower) emphasized that, "<i>Hata mbolea ukienda kuomba unanyimwa. Nyinyi watu wa Kibos wacheni kuwa wachoyo!</i> (Even when you go there and ask for manure [in reference to the <i>filter mud</i>], you are denied. You people from Kibos Company stop being misers!)"</p>
<p>Economic effects</p>	<p>"Will they (KSAIL) employ the local residents?" and "we want people from Kisumu East to be employed. We also have mechanics and engineers".</p>
<p>Integrating the local community in the factory decisions and actions</p>	<p>Like at the Guba Market Centre baraza, participants deplored the absence of an explicit framework for continuous engagements between them and the KSAIL management. To this end, one participant that <i>Community Policing</i> should be made part of the KSAIL management. A particular participant in this forum specifically suggested that the KSAIL management develops a written communication strategy for her engagements with the local community. The unclear structure for KSAIL links with the local community became notable when a top official of the local area Water Resource Users Association (WRUA) was in attendance but when he rose to make his contribution, no participant had ever met him nor had an idea what WRUA does; notable because KSAIL is a corporate WRUA member.</p>



Plate15: Participants making their points, public baraza meeting, Kibos Market Centre.

8.3.1.3 Chiga Market Centre, Kolwa East

Table 8.4: Issues raised during the meeting at Chiga Market

Intervention theme	Typical view and/or opinion(s) expressed
Surface water degradation and the human health	Comments indicating public concerns with this matter were expressed in remarks such as “what will be the by-product, and how will it be managed?”
Management plans / strategy for anticipated waste from proposed bio-fertilizer factory	A participant demanded the answer for the question: “We cannot assume that because the factory is going to depend on the current waste (stream) from Kibos, it will not produce waste itself. Where will the waste from this factory, even if it is from the factory clean up, go to?”
Economic effects	“What percent of the jobs will you reserve for us?” was a resounding question raised. On the same account, one participant posited that, “[using the metaphor of] ‘the nearer the bone, the sweeter the meat’ how will this plant, and the many other Kibos factories, benefit the farmer? We would like to be told how the extra money made from the fertilizer help the farmer?”
Corporate Social Responsibility (CSR)	Like in other public <i>baraza</i> meetings, participants expressed the view that the CSR strategy for KSAIL had not been adequate. For example, a participant lamented that, “There are people who lost their lives for this factory (the very first sugar milling plant) to be built here. Now they (KSAIL management) have completely forgotten us!” Another participant added that, “Kolwa East has never received any support for school pupils from Kibos Company”.



Plate16: Participants making their points, public Baraza meeting, Chiga Market Centre

8.3.1.4 Kibos Agricultural Section, Miwani Central

Table 8.4: Issues raised during the meeting at Kibos Agricultural Section

Intervention theme	Typical view and/or opinion(s) expressed
Surface water degradation and the human health	<p>Comments indicating public concerns with this matter were expressed. One participant asked, "what will be the by-product, and how will it be managed?"</p> <p>One MCA summed it up by remarking that,</p> <p>"I have studied the mood of this meeting and it shows that we all support this project, and we support it fully! Our position is that this thing (the proposed bio-fertilizer plant) is good. But, do not spoil the river from where we get our water. We do not want any politician <i>kuleta opus!</i> (engage in an act of sabotage)".</p> <p>We hear that there are some young people calling themselves <i>Okoa River Kibos</i>. If you truly mean well, and you have an issue, why don't you come and air it here?"</p>

Management plans/strategy for anticipated waste from proposed bio-fertilizer factory	<ul style="list-style-type: none"> • The question of participatory approach to the proposed plant's leadership and/or stewardship was evoked: "Kibos should form a committee in which members of this community are represented to work with the KSAIL management". • "We need a task force so that any problem is not allowed to accumulate till we start fighting". • "Also, work together with the County Government". • "We need to talk to each other so that we avoid conflicts. There is need to engage professions who can tell people exactly where the problem is, who is lying about it."
Research as premise & driver of the proposed bio-fertilizer plant	"Put up some demonstration centres to show us how this fertilizer factory is going to work".
Economic effects	The community were concerned about the possibility of KSAIL sharing out the proceeds "As a farmer I support this project. We will stand with you (KSAIL) but when you make profit <i>kula na kila mtu</i> (eat with others)"
Corporate Social Responsibility (CSR)	Participants advised that the proceeds from investments in the bio-fertilizer plant should be used, for example, to facilitate renovation of the local roads.



Plate17: Participants making their points at the public Baraza held at Kibos Agricultural Section.

8.3.2 Views and Opinions from the Technical Workshop, Kisumu Central

The proponent and the consulting team organized for a technical workshop which was held at Simba Club, Kisumu Central, 21st June 2019. The workshop attracted a total of 47 participants. among the key issues raised from the workshop included: the periodical pollution of Kibos river by the sugar factory and the DSW, fly ash from the chimney, Noise from the steam purging, dust from roads during heavy vehicles movement, smell from the fermenting waste water and gas from bio digester other social issues raised were inadequate corporate social responsibility on matters of education and health, inadequate employment of the locals and lack of close liaison with the community. In this workshop, questions of the health risks for the final products and its application to food crops were raised. The KNCP director and the group projects development manager provided comprehensive mechanisms for mitigating the issues raised. Issues raised during this workshop have been mitigated in the EMP in Chapter 9.



Plate 18: Proceedings of the Technical Workshop, Simba Club, Kisumu Town

8.3.3 Views and Opinions from the Environment and Natural Resources Committee

8.3.3.1 Tacit support for the proposed bio-fertilizer plant

There was a general affirmative view of the proposed plant as a noble technological innovation in the sugar industry. For a notable count of participants, they welcomed the bio-fertilizer initiative because they viewed its utility as likely to go beyond curing the environmental challenges for the KSAIL family of factories to also present a viable vehicle for a long-term solution to the problems of pollution by the entire sugar milling factories and distilleries in Kenya. An outstanding typical remark in this direction was made one member of Environment and Natural Resources Committee who remarked that,

"Actually I can see a solution to an environmental problem coming out of this! This is probably the way industries should go. I would encourage KNPC to work with Kibos (in reference to KSAIL) in this journey. It is a very unique and very important project not just for Kibos but also for all sugar companies in the country".

Similarly supportive comments were made by the chair of the Committee in his concluding remarks. He mused:

"As a Committee, and I believe, also on behalf of fellow Kenyans, we are very optimistic and prayerful that this great project succeeds. We want to learn more about how the plant works. We will appreciate you sharing with us the experiences of Vietnam from where the technology is to be adopted as you have said. On our part, we will be there to support development of any legislations that seek to enable transitions to cleaner industries like this one".

8.3.3.2 Technical Capacity Requirements for Sustainability of the Initiative

A significant range of voices in the consultation process raised concerns about the need for a strategy to ensure continual improvements on actions aimed to reduce environmental pollution from the Kibos factories. They urged the EIA Team and NEMA to work with KSAIL not just at the point of the EIA exercise, but throughout the implementation phase. One respondent recognized the need for continuous technical performance monitoring and review for the proposed Plant.

On consulting the Managements of the neighbouring Kibos Prisons and the two schools for the Visually Impaired, the following key issues were raised:

- The fly ash from the sugar factory has covered their green vegetables (mostly Sukuma wiki) and they are no longer harvesting their own vegetables. They are forced to buy more to supplement
- The fly ash makes it difficult to wash and sun dry white linen.
- Dusty roads causing air pollution as a result of the tractors and high payload trucks delivering cane to KSAIL.
- *Unresolved question of relocation proposal on the schools for the Blind.* This concern was raised by the heads of the schools. They felt that the problem of the dust particulates from KSAIL had generated deep health challenges and learning discomfort.

8.3.3.4 Views from the Key Informants

In addition to re-affirming the views and opinions gathered from the public *baraza* meetings, an important concern emerged from consultations with opinion leaders regarding the bio-fertilizer plant and local community expectations. Proposals for integrating local community

expectations for their social and economic life forms in the operations of the proposed bio-fertilizer plant were repeated by both the opinion leaders. Several participants felt that proceeds from the existing KSAIL factories had not adequately translated into the Company's Corporate Social Responsibility (CSR).

8.3.4 Views of the Area MPs

The EIA Team met and discussed on the proposed bio-fertilizer plant with two area MPs. Neither of them (the two MPs for Muhoroni Constituency and Kisumu East Constituency, Hon. James Onyango K'oyoo and Hon. Shakeel Shabbir respectively) raised concerns that portend fundamental opposition to the concept of the bio-fertilizer plant. For both, the key concerns are resolvable into two critical lines of suggestion:

8.3.4.1 Co-existence of bio-fertilizer plant with the natural ecosystem

Arguments in favour of building bases for sound integration of the bio-fertilizer plant with the natural resource base/ecosystem elements was firmly expressed by the two MPs consulted. This was especially with respect to protecting the surface water resources, notably the River Kibos, and restoration of the air quality consequent to the air particulates arising from the KSAIL factory. The repeated anecdote run like, "*Nobody in his right sense can be against development of this kind! Yes, we need development, but this development should not mean sacrificing our health and killing our people*". This concern has been considered in the crafting of mitigation measures carried in the EMP for the Bio-fertilizer plant.

8.3.4.2 Exhaustive public consultations

While a series of public consultations in the form of 3 rounds of *baraza* meetings, and interviews with key informants and opinion leaders had been accomplished up to the time of meetings with the Environment and Natural Resources Committee of Parliament, the two political leaders suggested that still, further public consultations would be necessary. In particular, the MP for Muhoroni Constituency, Hon. James Onyango K'oyoo, advised that an additional *baraza* meeting be held at Karunga Market Centre, and that it be organized by the Deputy County Commissioner (DCC).

For the MP for Kisumu East, consultations with representatives of local community based organizations (CBOs) would be vital, notably with the Okoa River Kibos and the Kolwa CBO. These pieces of advice were respected and informed the organization and participant constitution of the fourth *baraza* meeting. As per the view of the two leaders, this *baraza* was successful in bringing together diverse participant categories to dialogue on the proposed project, including local MCAs. The MP for Kisumu East asked the EIA Team for a

written technical brief on the project and this was delivered as per the request (Appendix 7J).

The MP for Muhoroni Constituency, Hon. James Onyango K'oyoo, had earlier indicated that he would himself be present or be represented by the Manager for his Constituency Office but neither of these options occurred. Instead, at the tail-end of this *baraza* meeting, the EIA Team received a letter from him (the MP). This letter (Appendix 7K) reaffirmed his earlier enlisted view in support of the proposed bio-fertilizer plant. Other concerns raised therein had been adequately addressed in the fourth public baraza meeting refers.

8.4 Summary of Public Views and Opinions

8.4.1 Thematic public preferences for mitigation measures

In sum, the overall pattern of the views and opinions obtained can be summarized into four (4) interdependent thematic categories:

- (i) Approvals for the bio-fertilizer concept;
- (ii) Mutual integration of the Plant with the setting's natural ecosystem elements;
- (iii) Local community expectations and the bio-fertilizer plant; and
- (iv) Technical capacity requirements for sustainability of the bio-fertilizer initiative.

8.4.2 Potential positive impacts

<i>Environmental impacts</i>	<ul style="list-style-type: none"> a) Reduction of in the air particulates, leading to improved air quality. b) The circular approach to the residual products management will reduce the KSAIL waste streams. c) Minimal toxic discharge to the surface water sources such River Kibos through to Lake Victoria. d) KSAIL to be a front runner demonstration site for circular waste management in the sugar industry. e) Opening alternative route for transition from waste-to-resource through industrial waste exchange in the sugar industry in the country.
<i>Economic impacts</i>	<ul style="list-style-type: none"> a) Affordable home-grown fertilizer for cane growers and other farmers. b) Increased agricultural productivity. c) Direct and indirect employment opportunities d) Increased revenue for other sugar mills resulting from possible sale of their by-products needed by the proposed bio-fertilizer plant as its raw materials. e) Contribution to Kenya's GDP and the 4 Big Agenda. f) Expanded resource base for KSAIL's CSR.
<i>Social impacts</i>	<ul style="list-style-type: none"> a) Additional income from the green jobs created can be channeled into social services such as investments in education and health. b) Improved security in the Kibos locality. c) Improvements in the quality of health for local area residents due to possible water pollution reduction.

8.4.3 Potential negative impacts

<i>Environmental impacts</i>	<ul style="list-style-type: none"> a) High likelihood of alterations in traffic/transport flows during construction. b) Possible congestion of the road connecting the proposed site of the bio-fertilizer facility to the main Road (Kibos-Miwani Road) during constructions and functioning of the proposed plant. c) Possibility of increased volume of the vinasse currently stored in the temporary lagoons.
<i>Economic impacts</i>	<ul style="list-style-type: none"> a) Possible non-equitable distribution of the resultant job opportunities for the surrounding community members.
<i>Social impacts</i>	<ul style="list-style-type: none"> a) Possible dislocation of the neighbouring schools due to further industrial activity. b) Prospects for further disturbance from the noise usually generated during the power start-up of the boiler.

CHAPTER NINE

9.0 ENVIRONMENTAL MANAGEMENT PLAN

This chapter outlines an environmental management plan (EMP) covering impacts and their mitigation in various stages of the bio-fertilizer development. It is the responsibility of proponent to ensure incorporation of these measures in the development and operation of the bio fertilizer plant. It is envisaged that the Project Manager will appropriately define project specific responsibilities, terms of reference and lines of communication in the entire project cycle.

It is imperative that this study report is made available to the relevant project team members prior to mobilization, the proponent should include all proposed mitigation and management measures in his schedule of works, and the supervising consultant should ensure that the schedule and the environmental management and monitoring is complied with. This will lend a sense of ownership, in addition to instilling a thorough understanding of the pertinent issues identified in this study.

The responsibility for the supervision and implementation of all the proposed mitigation measures during development, operation and the defects liability period; and the responsibility for maintenance lies with the proponent, including monitoring activities.

Table 9.1 below provides a detailed EMP for the impacts identified, responsibilities and approximate budget for their implementation.

Table 9.1 Environmental Management Plan

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
IMPACT ON PHYSICAL CLIMATE			
SITE PREPARATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Maintain all mature trees • Remove only vegetation that is absolutely necessary; • Ensure that buffer areas and green belts are incorporated in the project design; • All raw materials must be sourced as close as possible to the construction site; • Use locally sourced labour during the construction phase; • Ensure that all vehicles are properly maintained and serviced; and Machines must not be left idling to save fuel and reduce emissions. 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Implement a traffic system that involves appropriate signals and signs. • Ensure that buffer areas and green belts that are incorporated in the project design are delineated by containment measures • Re-vegetate open areas with fast growing trees. 	KSAIL Management	150,000
IMPACT ON AIR QUALITY			
SITE PREPARATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • The clearing of vegetation must be carried out on a phased basis • All material (sand and aggregate) stockpiled on the site should be regularly sprayed using water. • All trucks carrying aggregate and sand should be covered during delivery to the site. • Spill control measures should be in place to prevent spread. • Ensure sprinkling of water to reduce dust in periods when wind speed is greatest and the rainfall amounts are lowest. • All staff employed at the construction site must be provided with dust masks and be trained to use them. • All waste must be transported off-site to designated area approved by NEMA. • Perform road repair and construction at times that persons are at work. 	KSAIL Management & contractor	As Per Bill of Quantities

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
OPERATION PHASE	<ul style="list-style-type: none"> • Use wet scrubber system on the chimneys to manage emission of toxic gasses • Use 'environmentally friendly pesticides' • Irrigate after the application of pesticides to reduce the level of volatilization. 	KSAIL Management	4,000,000
IMPACT ON WATER QUALITY			
SITE PREPERATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • All diesel and motor oil should be stored in a designated area that is properly contained. • Store all Vinasse raw materials away from the water bodies. • Install siltation traps within the drainage design to collect silt and sediment. • Conduct periodical water quality monitoring to ensure that standards are maintained. 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that all areas of the project site lined with geotextile material to prevent the contamination of ground water in the area; • Maintain a vegetation buffer around natural environments to reduce the nutrient loading to these waterways. • Fertilizer applications should be based on the results of regular soil testing to avoid over application of nutrients. • Use as far as possible slow-release fertilizers to reduce the potential of leaching and run-off into water bodies • The application of these fertilizers must be timed to minimize the leaching from soil by rainfall or irrigation. • Monitor irrigation of the turf especially in periods of high levels of rainfall; • Establish 'no-spray' zones and buffer areas particularly around areas where there are water features and other surface waters. • Ensure that all chemicals are properly stored and properly labeled. The area where chemicals will be stored and handled must be constructed with an impermeable surface. • Ensure that there is proper storage and disposal of waste generated 	KSAIL Management	2,000,000

	<ul style="list-style-type: none"> • Conduct regular water quality monitoring of the waste water treatment facilities, water courses to ensure that these are in keeping with the prescribed water quality standards • Ensure that there is proper blending of irrigation water with fresh water from runoff; this water must be tested regularly. • Purchase and store only the amount of pesticide needed for the immediate future. • Develop and follow an Integrated Pest Management Policy due to vermins from stored fuel material 		
IMPACT ON SOIL AND GEOLOGY			
SITE PREPERATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Install appropriate drainage systems to direct water away from slopes; • Avoid as far as possible the traversing of bare soil by vehicles to reduce soil compaction; • Designate a main access route for heavy machinery; 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Apply practices and use products that reduce the potential for contamination of soils including the physical removal of weeds, use of slow-release products and choosing the most `environmentally friendly products available • Prevent the contamination of soils by the designation of a maintenance area for the maintenance of vehicles and other equipment to be used for the upkeep of the turf. This area should be lined with an impervious material and all run-offs from this area channeled and collected in a catchment area. • Use slow release fertilizers and employ spoon-feeding application of these fertilizers • Develop and follow an Integrated Pest Management Guidelines this should outline the times when treating pests and other turf problems will be most effective and environmentally sound 	KSAIL Management	100,000

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
IMPACT ON HYDROLOGY			
SITE PREPARATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Ensure that the drainage plan proposed is implemented as stipulated on the plan. • Additional drainage may be put in place to convey the flood discharge and the retention areas used primarily to retain water for irrigation and smaller flood discharges. • The provision of a system of culverts should be considered. 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that all drains and culverts collecting water within the site are regularly cleaned and maintained. 	KSAIL Management	200,000
IMPACT ON NOISE AND VIBRATION			
SITE PREPARATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Silenced machinery and instruments should be employed to reduce the impact of noise on the existing residents and workers. • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. • These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected, for example during periods where most residents are at work or school. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Temporary barriers such as earth berms, zinc fencing and sound dampening fencing such as acoustic screens should be employed to reduce the impact of noise to the existing residents; • Ensure that construction activities for the development and the other developments proposed for the area are staggered to decrease the levels of noise and vibration in the area; • Construction hours should be limited to the hours of 8:00 a.m. and 6:00 p.m. daily except Sundays. • The delivery of raw materials must be limited to 8:00 a.m. and 6:00 p.m. 	KSAIL Management & contractor	As Per Bill of Quantities

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that there is proper traffic signage and signals where necessary or appropriate to effect the free and safe movement of traffic and there reduce the noise caused by traffic build-up. • Ensure that deliveries to the facility are made between 8:00 a.m. and 5:00 p.m. daily. • Ensure that maintenance works occurs between the hours of 8:00 a.m. and 5:00 p.m. daily. 	KSAIL Management	1,000,000
IMPACT ON LAND SCAPING AND AESTHETICS			
SITE PREPARATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Conduct vegetation clearance on a phased basis. • Re-vegetate cleared areas as soon as possible. • Retain vegetation screens to reduce the visual effect of this stage of the development. • Ensure that local building materials and muted colours are used to reduce the visual impacts of the development and the landscaping to blend with the local environment. 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that land scarping is incorporated within its designs are regularly maintained. 	KSAIL Management	50,000 monthly
IMPACT ON BIOLOGICAL IMPACTS (FLORA AND FAUNA)			
SITE PREPARATION AND CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Determine access roads which are to be used by machinery used in the construction and site clearance phase of the development to avoid the unnecessary trampling of vegetation that will be maintained within the development • Reduce edge effect and habitat loss by physically delimit the remaining vegetation by some means of fencing which will reduce the impact of secondary opportunistic clearance in the area as a result of increased accessibility created by the development; • Incorporate as much local plants found within the area 	KSAIL Management & contractor	As Per Bill of Quantities

	<ul style="list-style-type: none"> The developer should incorporate trees that are used by bird species for foraging to attract bird species to the area. 		
ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
OPERATION PHASE	<ul style="list-style-type: none"> Reduce Clearance in the area as a result of increased accessibility created by the development; Develop and implement a comprehensive Nutrient Management Programme for the maintenance of the lawns. Use slow release fertilizers throughout the irrigation. 	KSAIL Management	200,000
IMPACT ON SOCIO-ECONOMIC MITIGATION MEASURES			
Community Cohesion			
OPERATION PHASE	<ul style="list-style-type: none"> The developer should develop a Corporate Social Responsibility Programme which could provide assistance to the community such as free medical camps and support for education programmes. 	KSAIL Management	500,000 annually
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> This should avoid any feelings of resentment and will ensure that the community derives the most benefits from the development. As far as possible purchase supplies to be used in the construction should be sourced from nearby suppliers. Identify a specific area on the project site for vending type activities ensuring that there are garbage receptacles throughout the project site. 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> As far as possible purchase goods and supplies from suppliers within the area. The Local Planning Authority must play an important role in ensuring that the development slated for the area is monitored and implemented in an orderly and sustainable manner. 	KSAIL Management	400,000
IMPACT ON INFRASTRUCTURAL AND ROAD NETWORK			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> The developer must improve the road network which provides access to the project area. This should be accompanied by an upgrade in the drainage along this road network. Ideally the road improvement works should take place prior to the infrastructural works at the development site. These road improvements must be scheduled between 9:00 a.m. and 4:00 p.m. daily, so as not to disrupt traffic in the area and to abate the increase in ambient noise levels in the community. 	KSAIL Management & contractor	As Per Bill of Quantities

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that roads are regularly maintained • Establishing an inclusive Grievances Redress and the proposed plant Feedback Mechanism for purposes of capturing, negotiating and streamlining social and environmental impacts that may arise over time in the life of the bio-fertilizer plant. Stepping up a more transparent and inclusive CSR strategy. • Establish an explicit communication and decision making strategy. • Instituting a satisfactory Reallocation Plan for the primary schools, if deemed appropriate during the bio-fertilizer factory's operations phase. • Establishing a NEMA coordinated continuous monitoring and evaluation framework for management of the Plant. • Establishing a strategy for continuous engagements between KSAIL and a competent technical support agency for RECP improvements of the KSAIL family of factories, including the proposed bio-fertilizer factory 	KSAIL Management & contractor	4,000,000
IMPACT ON UTILITIES AND ELECTRICITY			
OPERATION PHASE	<ul style="list-style-type: none"> • Install energy saving lights • Ensure that a back-up generator is installed for use in periods of power outages. • Ensure that the plant is designed in such a manner that there is reduction in the energy use associated with the operation of air conditioning units; and • Train employees in the benefits of energy conservation. 	KSAIL Management	5,000,000
IMPACT ON WATER AVAILABILITY			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> • Ensure that there is adequate water available to supply the increase in demand that the construction activities will pose. 	KSAIL Management & contractor a	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that there is an upgrade to the water supply in the area prior to the operation of the plant. Water consumption during this phase can be reduced with the installation of water conservation fixtures in buildings and maximizing of recycled water in the irrigation activities. 	KSAIL Management	500,000

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
IMPACT ON SOLID WASTE			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> The developer should seek to hire a private licensed solid waste collection company. All the refuse generated should be properly transported and disposed of at the nearest licensed solid waste facility. Ensure that vending during these phases of the development is localized. Provide garbage receptacles around the project site. 	KSAIL Management & contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> The developer should install a mechanism to manage solid waste generated. All containers which were previously used to store pesticides and other chemicals should be bored with holes to ensure that these containers are not reused. 	KSAIL Management	1,000,000
IMPACT ON SEWAGE EFFLUENT			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> Ensure that toilets are provided for use by employees during these phases of the development. A reasonable ratio would be one (1) toilet per eight (8) workers. 	KSAIL Management contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> The developer should ensure that all sewage treatment lines or septic tanks are maintained regularly and that, all effluent released is within or below the standards for effluent as stipulated by the NEMA, Water Quality Regulations, 2006. 	KSAIL Management	2,000,000
IMPACT ON SOCIAL SERVICES			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> Provide a First Aid Kit on site for any minor injuries that may occur on site Inform and make arrangements with the nearest Health Clinic to accommodate any major injuries that may occur in these phases of the project 	KSAIL Management	As Per Bill of Quantities

ANTICIPATED IMPACTS	POSSIBLE MITIGATION MEASURES	RESPONSIBILITY	ASSOCIATED COSTS (KSH)
IMPACT ON EMERGENCY SERVICES			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> Burning should not be employed on the site preparation activities. Bund areas where flammable substances will be stored. These bunds must be designed to hold approximately 1 ½ times the amount of the substances that will be stored Place warning signs in areas where flammable substances will be stored 	KSAIL Management	As Per Bill of Quantities
IMPACT ON SECURITY			
SITE PREPARATION AND CONSTRUCTION PHASES	<ul style="list-style-type: none"> It is recommended that persons from the nearby communities be employed to work on the construction site. This will avoid any feelings of resentment that may be felt from locals and may reduce the level of crime and violence during these phases of the development. 	KSAIL Management and contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> Ensure that buildings are properly secured; and Ensure that there is adequate security on site at all times 	KSAIL Management	1,000,000
	<ul style="list-style-type: none"> The proponent may wish to implement a transportation system for workers, in the event that problems with access to transportation by workers become evident 	KSAIL Management	

OCCUPATIONAL HEALTH AND SAFETY MITIGATION MEASURES		RESPONSIBILITY	COSTS IN KSHS
Hazards			
SITE PREPARATION, CONSTRUCTION AND OPERATION PHASES	<ul style="list-style-type: none"> • Provide all employees with safety and protective gear • Including hard hats, safety goggles, dust masks, gloves and safety shoes. Employees will be required to wear these at all times on the project site. • Designate the roles and responsibilities of employees, which will enable a clear chain of command during a fire or explosion and allows persons to be aware of their responsibilities in the event of such occurrences. • Ensure that all machinery used on the site is properly maintained and inspected before use. • Install several suitable, approved fire extinguishers at accessible, conspicuous and unobstructed points throughout the development area. • Place a fully equipped first aid kit on the project site. • Place conspicuous warning signs where hazardous or flammable substances will be stored. • Place information signs around the project site which list the numbers of the person responsible for handling emergencies on the site, i.e. Kisumu Fire Department, Keep an emergency log to document any occurrences of fires and explosions as well as to record any damage to the property and human injuries. This log must also contain emergency contact information for all employees. 	KSAIL Management and contractor	As Per Bill of Quantities

ACCIDENTS AND GENERAL HUMAN HEALTH			
SITE PREPARATION, CONSTRUCTION PHASE	<ul style="list-style-type: none"> • Provide all employees with safety and protective gear including hard hats, safety goggles, dust masks, gloves and safety shoes. Employees will be required to wear these at all times on the project site. Designate the roles and responsibilities of employees, which will enable a clear chain of command in the event of an accident and allows persons to be aware of their responsibilities in the event of such occurrences. • Place a fully equipped first aid kit on the project site. • Ensure that a crew member is trained in basic first aid practices. • Place information/warning signs around the project site, which indicates where hazardous and flammable material will be stored. • Signs must also be placed around the construction site displaying the numbers of the person responsible for handling emergencies on the site, • Keep an emergency log to document any occurrences of any accidents that may occur on the site. • Ensure that all machinery operating at the project is regularly serviced and maintained. • Ensure that persons operating equipment's are trained 	KSAIL Management and contractor	As Per Bill of Quantities
OPERATION PHASE	<ul style="list-style-type: none"> • Ensure that only the required amounts of chemicals to be used in the short-term will be stored at the maintenance facility; • Ensure that chemicals are stored in a safe and secure environment, and that only authorized persons will be allowed in these storage areas. These areas should be properly signed to indicate that hazardous chemicals are stored in this area; • Develop and implement a Health and Safety Training Manual for the employees. 	KSAIL Management	2,000,000

CHAPTER TEN

10.0 PROJECT DECOMMISSIONING

10.1 Decommissioning Phase

Decommissioning in this project will occur twice. First, after a successful completion of the proposed project development for temporary structures erected at the project site for the contractor and second after the entire project ceases.

During these phases, all equipment and fixtures that were required during the construction and operational phase will be dismantled and removed from the site. It is mandatory that the proponent ensures safe dismantling of all the facilities and equipment's.

10.1.1 Removal of Waste

Waste from the facility during construction and usage will be carted away and disposed of by a licensed NEMA waste handler. Waste generated during this phase may include:

- i) Masonry works/building works, (cement bags, broken building blocks, etc.
- ii) Roofing (iron sheets, timber/ metal pieces, etc.)
- iii) Plumbing (pipe fittings and off cuts, etc.)
- iv) Electrical works (residual cables and connectors, damaged electrical fittings, etc.)
- v) Wastes generated from dismantling of fixtures and equipment.
- vi) Wastes generated from wrappers and packaging material
- vii) Domestic garbage

10.1.2 Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the open earth sites will be restored through replenishment of the topsoil and re-vegetation where appropriate.

10.2 Impacts during Decommissioning Phase

If at the end of the project life span the facilities are to be demolished, then decommissioning stage will have to address issues related to environmental impacts of demolishing old buildings and the manufacturing plant.

10.3 Handling Hazardous and Regulated Materials

In addressing these issues, deconstruction of the old buildings and manufacturing machinery is usually undertaken. The deconstruction process is the opposite of the construction process; the last thing to go on is the first thing to come off. Deconstruction is the manual dismantling of a building so that materials can be salvaged for reuse. Deconstruction can range from the soft stripping of non-structural elements such as cabinets and plumbing to the full structural disassembly of the buildings. Of necessity, most deconstruction projects employ all three options viz reuse, recycling and disposal. However, reuse is often made the priority. .

Preservation should be the first choice when deciding what to do with old buildings. With increased mechanization, however, recycling and disposal of construction and development debris has become more appealing than dismantling for reuse. Current building methods and materials such as use of composite materials, laminates and adhesives also favor recycling or disposal alternatives.

Table 10.1 provides a summary of the bio fertilizer decommissioning plan

Table 10.1: Summary of the Decommissioning Plan for the Proposed Kibos Fertilizers Ltd.

Issues	Potential impacts	Significance	Mitigation measures	Implementation period	Responsibility
a) Generation of wastes <ul style="list-style-type: none"> • Generation of solid, liquid and hazardous wastes 	- Pollution of surface / ground water and air - Disposal costs	Significant, negative & short term	<ul style="list-style-type: none"> • Re-use and re-cycle demolition wastes • limit pollution from liquid waste by providing pre-treatment systems prior to safe disposal • Contract a NEMA licensed vendor to manage the waste. • Donate to charity office equipment or sale to public • Dispose in approved sites • Contact NEMA licensed waste managers to handle and dispose hazardous wastes • Improve security of the demolition zones • Plant trees, restoration programmes after demolition • Compensation programs for sacked workers absorb staff in other areas. 	During entire Decommissioning period	Contractor and KSAIL management
b) Occupational health and safety concerns <ul style="list-style-type: none"> • Dust • Falling objects, • Noisy machinery, Gaping holes and electrical risks among others. c) Security concerns	Potential health effects and injuries	Significant, negative & short term	<ul style="list-style-type: none"> • Provide relevant PPEs for works during the entire demolition exercise. 	During entire Decommissioning period	Contractor and KSAIL management

Issues	Potential impacts	Significance	Mitigation measures	Implementation period	Responsibility
<ul style="list-style-type: none"> Increased insecurity due to the influx of people who would want to salvage some usable materials and parts. d) Loss of aesthetic value of land e) Loss of benefits associated with the Bio fertilizer plant 	Cases of theft and personal harm	Significant, negative & short term	<ul style="list-style-type: none"> Enhance security systems by working closely with the local administration and the police 	During entire Decommissioning period	Contractor and KSAIL management
f) Soil erosion	Vegetation and Soil loses	Significant, negative & short term	<ul style="list-style-type: none"> Ensure that the site is rehabilitated by vegetation and restored. 	After decommissioning	Contractor and KSAIL management
g) Social Economic and Cultural Impacts	Loss of jobs and alteration of cultural norms modified by the bio-fertilizer operations i.e religion and some cultural believes	Significant, negative & short term	<ul style="list-style-type: none"> Re-deploy works to other KSAIL group companies. Sustain social systems such as religion etc. within the area. 	During the decommissioning process and after	Contractor and KSAIL management

CHAPTER ELEVEN

11.0 CONCLUSION

This EIA Study report has clearly brought out the fact that there have been significant challenges for the KSAIL group of companies with regard to the management of various streams of waste. The company has been trying to manage them by coming up with a circular economy that establishes downstream industries to add value to up-stream wastes. KSAIL has been able to manage the bagasse waste by using it strategically to generate electricity and steam for its projects, and to manufacture paper which will significantly reduce the destruction of forests in the country by using bagasse waste which is abundant in the country, for the production of paper and packaging material.

In the same vein, KSAIL has used the molasses waste to produce ethanol and technical alcohol. The company has proposed to use the filter mud and boiler ash wastes from the sugar plant, coupled with DSW from the distillery, to produce organic fertilizer for sale in the country. Fertilizer will be of great importance to Kenya as a Nation as it imports all its fertilizer needs. The proposed bio-fertilizer plant will produce organic fertilizer from waste which has hitherto been a challenge to manage due to its adverse effect on the environment. The bio-fertilizer plant will instead, ensure this waste is made useful to the environment; it will increase food safety in the country at a cheaper rate; meanwhile providing for import substitution, saving foreign exchange and working towards the fulfilment of the 15% contribution of manufacturing pillar in the Big Four Agenda.

Based on a succinct analysis of the views of the stakeholders and the expert observations, the proposed project will not compromise the well-being of the environmental condition as it is set to utilize the problematic waste currently generated by the group sister companies as raw material for the production of the bio-fertilizer and therefore, will in fact create employment for the Kenyan population and provide clean environment. Due to its uniqueness, it will also provide technical knowledge and mop up DSW which is a big challenge to other distilleries in the country and to the environment.

From the perspective of the public views and opinions gathered during the EIA Study, the analysis has revealed that establishment of the bio-fertilizer plant in its intrinsic right does not present fundamental social and environmental threats. Instead, the substance of the public views and opinions obtained that command the directions for mitigation measures are premised on the histories of relations between the existing KSAIL family of factories and its ecosystem.

11.1 RECOMMENDATION

Much of the concerns raised from the consultations centred on the need for the operations and management of the bio-fertilizer plant to be in tandem with local community requirements for controlled effluent discharge into the River Kibos in conformity with NEMA and WRA standards; health issues arising from the particulates; and co-decision making and sharing of proceeds from investments by the KSAIL. Most of these potential negative impacts have been mitigated in the EMP generated which the management needs to adhere to.

To this end, the following considerations have informed the development and structure of the proposed EMP for the bio-fertilizer plant.

- a) Establishing an inclusive Grievances Redress and a proposed plant Feedback Mechanism for purposes of capturing, negotiating and streamlining social and environmental impacts that may arise over time in the life of the bio-fertilizer plant. Stepping up a more transparent and inclusive CSR strategy.
- b) Establish an explicit communication and decision making strategy.
- c) Establishing a strategy for continuous engagements between KSAIL and a competent technical support agency for RECP improvements of the KSAIL family of factories, including the proposed bio-fertilizer factory.

We therefore, recommend that NEMA speedily grant a license to this proposed project for purposes of mitigating the pollution risk of DSW, filter mud and boiler ash. The project's purpose apart from using the waste material to generate income through establishing a downstream industry, will not only contribute to the 15% contribution to the manufacturing pillar of the Big Four Agenda, it will generate jobs; provide for import substitution of fertilizer for the Nation of Kenya and provide home-grown organic fertilizer at a cheaper rate. It will save the country foreign exchange, and will also mitigate against the pollution challenges that the company has been grappling with.

In fact, this project is a solution to all the factories producing alcohol and which are struggling with DSW such as London Distillers, Spectre International, Agro-Chemical and Food Company, etc. The project will also source for more filter mud and boiler ash from sugar factories in the region, thereby assisting not only Kisumu County with pollution control but the whole region will be served, making this a major project in terms of employment creation, taxes flowing both to the County Governments and National Treasury.

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13.0 APPENDICES