

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

Proposed Abattoir at Nomotio LIC Farm, Maralal, Samburu County



PROPONENT

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CERTIFICATION

OikosVeritas Services was commissioned by the County Government of Samburu through Department of Agriculture, Livestock and Fisheries to undertake Environmental and Social Impact Assessment for the proposed abattoir at Nomotio LIC Farm, Samburu Central Sub-county, Samburu County. This Report has been prepared in accordance with the Environmental Management and Coordination Act no. 8 of 1999 and The Environmental (Impact Assessment and Audit) Regulations, 2003 for submission to the National Environmental Management Authority (NEMA). OikosVeritas Services submits this Environmental and Social Impact Assessment Study Report, to NEMA Kenya. To the best of our knowledge, all the information provided in this report is true and correct.

**Proponent: Department of Agriculture, Livestock and Fisheries
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30/05/2018

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28/05/2018

ACRONYMS AND ABBREVIATIONS

ABR:	Anaerobic baffled reactor
AD:	Anaerobic Digester
AF:	Anaerobic Filter
AL:	Anaerobic Lagoon
AS:	Activated Sludge
ASAL:	Arid and Semi Arid Lands
ASDSP:	Agricultural Sector Development Support Programme
BAT:	Best Available Techniques
BOD:	Biochemical Oxygen Demand
BRC:	British Retail Consortium
CAL:	Covered Anaerobic Lagoon
CH₄:	Methane
CIDP:	County Integrated Development Plans
Cl:	Chloride
CLPO:	County Livestock Production Officer
CLTS:	Community Led Total Sanitation
CO₂:	Carbon Dioxide
COD:	Chemical Oxygen Demand
CW:	Constructed Wetlands
DAF:	Dissolved Air Flotation
DO:	Dissolved Oxygen
DOHS:	Directorate of Occupation Health and Safety
EA:	Environmental Audit
EC:	Electrocoagulation
EMCA:	Environmental Management and Coordination Act
EMP:	Environmental Management Plan
ESIA:	Environmental and Social Impact Assessment
FAO:	Food and Agriculture Organization
GFSI:	Global Food Safety Initiative
GPS:	Global Positioning System
H₂O₂:	Hydrogen Peroxide
HRT:	Hydraulic Retention Time
IPCC:	Inter-Governmental Panel on Climate Change
IPD:	Integrated Pest and Disease
IUCN:	International Union for Conservation of Nature
KAA:	Kenya Airports Authority
KCAA:	Kenya Civil Aviation Authority
KEBS:	Kenya Bureau of Standards

KeNHA:	Kenya National Highways Authority
KNBS:	Kenya National Bureau of Statistics
KWS:	Kenya Wildlife Services
LIC:	Livestock Improvement Centre
LWK:	Live Animal Weight in Kilograms
MF:	Microfiltration
NEMA:	National Environment Management Authority
NF:	Nanofiltration
NOx:	Nitrogen Oxide
OC:	Percentage Organic Carbon
OM:	Organic Matter
PPE&C:	Personal Protective Equipment & Clothing
RO:	Reverse Osmosis
SCG:	Samburu County Government
SQF:	Safe Quality Food
ST:	Septic Tanks
SWW:	Slaughterhouse Wastewater
TDS:	Total Dissolved Solids
TN:	Total Nitrate
TP:	Total Phosphate
TSS:	Total Suspended Solid
UASB:	Up-flow anaerobic sludge blanket
UF:	Ultrafiltration
UV:	Ultraviolet
VS:	Volatile Solids Portion
WRMA:	Water Resources Management Authority
WSB:	Water Service Board
WSP:	Water Service Providers
WSRB:	Water Services Regulatory Board

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TABLE OF CONTENTS

CERTIFICATION	ii
ACRONYMS AND ABBREVIATIONS.....	iii
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vi
List of Tables	xi
List of Figures.....	xii
List of Annexes.....	xiii
EXECUTIVE SUMMARY	xiv
CHAPTER 1: INTRODUCTION	1
1.1. Overview.....	1
1.2. The Nomotio Abattoir	2
1.3. Project Objectives.....	2
1.4. Scope of ESIA Study	2
1.5. Approach and Methodology	3
1.5.1. Review of secondary data	3
1.5.2. Public consultations.....	4
1.5.3. Baseline environmental survey	5
1.5.4. Assessment/mapping of potential vulnerable ecosystems to pollution	6
1.5.5. Assessment and analysis of utilities demands (water and energy)	7
1.5.6. Evaluation of project alternatives.....	7
1.5.7. Assessing significance of impacts	8
1.5.8. Preparation of environmental management plan (EMP)	8
1.6. Purpose of the Report.....	8
CHAPTER 2: DESCRIPTION OF PROPOSED PROJECT.....	9
2.1. Background.....	9
2.2. Description	9
2.2.1. Facility design and components	10
2.2.2. Production, processing and dispatch facilities	11
2.2.2.1. Production facility	11
2.2.2.2. Slaughterhouse hall section	12
2.2.3. Meat processing facility.....	14
2.2.4. Meat dispatch facility.....	15
2.2.5. Accessories and service facilities.....	15
2.2.5.1. Blood collection.....	15
2.2.5.2. Hide and skin store	17

2.2.5.3. Gut and tripe room.....	17
2.2.5.4. Red offal room	17
2.2.5.5. Rendering plant	17
2.2.5.6. Inedible area.....	17
2.2.5.7. Equipment wash.....	17
2.2.5.8. Veterinary office and laboratory	17
2.2.5.9. Vehicle washing	18
2.2.5.10. Water supply and storage	18
2.2.5.11. Stormwater and drainage	18
2.2.5.12. Electric and power supply system	18
2.2.5.13. Back-generator.....	18
2.2.6. Effluent disposal and other by products facilities.....	18
2.2.6.1. Solid waste disposal	18
2.2.6.2. Manure bay	19
2.2.6.3. Wastewater and treatment	19
2.2.7. Other facilities	20
2.2.7.1. Facilities for personnel.....	20
2.3. Operational layout of the facilities	22
2.4. Project justification.....	23
2.5. Construction period and materials	23
2.6. Project cost	23
CHAPTER 3: POLICY, LEGAL AND REGULATORY FRAMEWORK	24
3.1. Legal Framework	24
3.1.1. The Constitution of Kenya, 2010	24
3.1.2. Environmental Management and Coordination (Amendment Act, 387, 2015.....	24
3.1.3. The Public Health Act- Laws of Kenya, Chapter 242	25
3.1.4. Meat Control Act Cap 356.....	26
3.1.5. Kenya Meat Commission Act Cap 263 – Revised 2012	26
3.1.6. Pest Control and Products Act, Cap 346	26
3.1.7. Food, drugs and chemical substances Act Cap 254)	27
3.1.8. Animal Diseases Act, Cap 364	27
3.1.9. Hides, Skins and Leather Trade Act, Cap 359	27
3.1.10. Kenya Stock Traders Licensing Act, Cap 498 – Revised 1993.....	27
3.1.11. Stock and Produce Theft Act, Cap 355	28
3.1.12. The Water Act No. 8 of 2002.....	28
3.1.13. The Physical Planning Act Cap 286.....	29
3.1.14. Occupational Health and Safety Act, 2007	29
3.1.15. Energy Act, 2006	30
3.1.16. The County Government Act	30

3.1.17. Penal Code (Cap 63).....	30
3.2. National Regulations and Guidelines	31
3.2.1. Environmental (Impact Assessment and Audit) Regulations, 2003	31
3.2.2. EMC Noise Prevention and Control Rules 2009	31
3.2.3. EMCA (Waste Management) Regulation, 2006	31
3.2.4. EMC (Water Quality) Regulations, 2006	32
3.2.5. EMC (Air Quality Standards) Regulations, 2008	32
3.2.6. The Conservation of Biological Diversity Regulations 2006	33
3.2.7. Medical examination Rules, 2005	33
3.2.8. Fire Risk Reduction Rules, 2007	33
3.2.9. Building Code 2009	34
3.3. Best practices in meat processing and handling.....	34
3.3.1. Global food safety initiative schemes.....	34
3.3.2. Overview of best practices in meat processing meat handling.....	35
3.3.2.1. Equipment.....	35
3.3.2.2. Treatment of livestock before slaughter and its impact on meat quality	35
3.3.2.3. Stunning and bleeding of slaughter animals	35
3.3.2.4. Scalding and de-hairing	35
3.3.2.5. Skinning of cattle and small ruminants	35
3.3.2.6. Evisceration	36
3.3.2.6. Splitting, washing and dressing of carcasses	36
3.3.2.7. Refrigeration	36
3.3.3. Carcass handling	37
3.3.3.1. Refrigerated meat	37
3.3.3.2. Transport of meat with refrigeration	37
3.3.3.3. Carcass and meat handling and marketing without refrigeration.....	38
3.3.3.4. Storage and transport without refrigeration.....	38
CHAPTER 4: BASELINE INFORMATION	39
4.1. Environmental and ecological baseline.....	39
4.1.1. Project location.....	39
4.1.2. Physical environment – topography, geology and soils.....	40
4.1.3. Topography and drainage.....	41
4.1.4. Ecological conditions	43
4.1.5. Climatic conditions.....	43
4.1.6. Biological environment (flora and fauna)	44
4.1.7. Environment and climate change	45
4.2. Socio-economic baseline	45
4.2.1. Administrative and Political Units.....	45
4.2.2. Demography.....	46

4.2.3. Education and Literacy	47
4.2.4. Housing	47
4.2.5. Energy Sources	48
4.2.6. Water resources and sanitation	48
4.3 Economic setting.....	50
4.3.1. Land and land use.....	50
4.3.2. Crop and livestock production.....	50
4.3.3. Labour Force	52
4.3.4. Mining Activities.....	52
4.3.5. Trade and Commerce.....	53
4.3.6. Tourism.....	54
4.3.7. Health Services	54
4.4 Infrastructure and access	54
4.4.1. Road transport	54
4.4.2. Airstrips	55
4.4.3. Posts and telecommunication networks.....	55
4.4.4. Security and public safety	55
CHAPTER 5: PUBLIC PARTICIPATION	57
5.1. Introduction	57
5.2. Methodology.....	57
5.2.1. Key Informant Interviews.....	58
5.2.2. Questionnaire administration	58
5.2.3. Issues and concerns raised.....	58
CHAPTER 6: ALTERNATIVES TO THE PROJECT.....	65
6.1. Description of alternative locations	65
6.2. Alternative designs and processes	66
6.3. No project/"ZERO" alternative	68
6.4. Analysis of alternative construction materials and technology.....	69
6.5. Waste management alternatives	70
6.6. Incremental alternatives	72
CHAPTER 7: ENVIRONMENTAL AND SOCIAL IMPACTS	73
7.1. Steps of impact assessment.....	73
7.2. Construction phase	78
7.3. Operation phase	82
7.4. Decommissioning Phase	90
CHAPTER 8: ENVIRONMENTAL MANAGEMENT PLAN (EMP).....	92

8.1. Approach and strategies for EMP implementation	92
8.2. Monitoring and compliance assessment	94
8.3. Management review and liaison	95
8.4. Proposed project and the EMP context	95
8.4.1. Construction Phase	95
8.4.2. Operation phase EMP	96
8.4.3. Decommissioning Phase EMP	96
CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS	106
9.1. Conclusions	106
9.2. Recommendations.....	106
REFERENCES	109
ANNEXES	112

List of Tables

TABLE 1: EXPECTED LIFESPAN FOR DIFFERENT MEAT TYPES UNDER REFRIGERATION	37
TABLE 2: COORDINATES AND ALTITUDES RECORDED AROUND THE PROPOSED ABATTOIR SITE	41
TABLE 3: ADMINISTRATIVE UNITS OF SAMBURU COUNTY	46
TABLE 4: POLITICAL UNITS OF SAMBURU COUNTY	46
TABLE 5: POPULATION PROJECTIONS BY URBAN AREAS AND THEIR PROJECTIONS IN SAMBURU COUNTY	47
TABLE 6: BASELINE WATER/SOIL QUALITY PARAMETERS WATER SOURCES NEAR THE PROPOSED ABATTOIR	49
TABLE 7: SUMMARY OF STAKEHOLDERS' EXPECTATIONS, CONCERNS AND MITIGATION MEASURES	60
TABLE 8: DESCRIPTION OF ANALYSIS OF LOCATION ALTERNATIVES FOR THE PROPOSED ABATTOIR	65
TABLE 9: DESCRIPTION OF ANALYSIS (DESIGN/PROCESSES) ALTERNATIVES FOR THE PROPOSED ABATTOIR	67
TABLE 10: DESCRIPTION OF ANALYSIS FOR MATERIALS/TECHNOLOGY FOR THE PROPOSED ABATTOIR	69
TABLE 11: DESCRIPTION OF SOLID WASTE MANAGEMENT ALTERNATIVES FOR THE PROPOSED ABATTOIR	70
TABLE 12: DESCRIPTION OF LIQUID WASTE MANAGEMENT ALTERNATIVES FOR THE PROPOSED ABATTOIR ..	71
TABLE 13: SUMMARY OF ENVIRONMENTAL/SOCIAL IMPACTS AND MITIGATION MEASURES	74
TABLE 14: BREAKDOWN OF WATER CONSUMPTION IN AN ABATTOIR	84
TABLE 15: WATER USE UNDER DIFFERENT PROCESSING SCENARIOS FOR THE PROPOSED ABATTOIR	84
TABLE 16: SLAUGHTERED LIVESTOCK SPECIES AND PRODUCTS/BY PRODUCT QUINTILES OF AN ABATTOIR ..	86
TABLE 17: IDENTIFIED POTENTIAL ODOUR SOURCES FOR THE PROPOSED ABATTOIR	87
TABLE 18: APPROACHES TO MANAGE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED ABATTOIR ..	92
TABLE 19: PROPOSED ORGANIZATIONAL STRUCTURE AND STAFF IN IMPLEMENTATION OF EMP	93
TABLE 20: ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED ABATTOIR	97

List of Figures

FIGURE 1: FLOWCHART OF INPUT, PROCESS AND OUTPUTS FROM THE PROPOSED ABATTOIR	10
FIGURE 2: FLOW CHART OF THE MEAT PROCESSING AT THE PROPOSED ABATTOIR.....	15
FIGURE 3: FLOWCHART OF BLOOD PROCESSING TO BLOOD MEAL AND BLOOD PLASMA.....	16
FIGURE 4: FLOWCHART OF A RENDERING PROCESS FOR THE PROPOSED ABATTOIR.....	19
FIGURE 5: PROPOSED WASTEWATER TREATMENT PROCESS AT THE ABATTOIR	20
FIGURE 6: LAYOUT OF PRODUCTION FACILITY AND PROCESS FOR THE PROPOSED ABATTOIR	22
FIGURE 7: FACILITIES LAYOUT FOR THE PROPOSED ABATTOIR.....	22
FIGURE 8: LOCATION OF NOMOTIO FROM MARALAL TOWN, SAMBURU COUNTY.....	39
FIGURE 9: DRAINAGE SYSTEM OF THE PROPOSED ABATTOIR LOCATION.....	42
FIGURE 10: CLIMOGRAPH OF MARALAL AND SURROUNDING AREAS INCLUDING NOMOTIO LIC FARM	44
FIGURE 11: TRENDS IN LIVESTOCK NUMBERS IN SAMBURU COUNTY, 2014 – 2017	51
FIGURE 12: LINK ROADS NETWORKS AND THE PROPOSED ABATTOIR LOCATION, SAMBURU COUNTY	55

List of Annexes

ANNEX 1. Land ownership documents for the proposed site

Annex 2. Architectural design and drawings of the proposed abattoir

Annex 3: Minutes of the public meeting held on 10th April 2018 with the members of the public and village council of Lkurroto sub-location, Maralal Town Location, Kirisia Division, Samburu County

Annex 4: Public participation – participants list and filled public consultation forms

Annex 5: Checklist of bird species recorded at the proposed abattoir site

Annex 6: Laboratory Analysis Reports

Annex 7: NEMA practicing license of the firm of experts

Annex 8: NEMA practicing license of Lead ESIA Expert

EXECUTIVE SUMMARY

The County Government of Samburu through the Department of Agriculture, Livestock & Fisheries in collaboration with European Union and the national Ministry of Devolution & Planning plans to construct a modern abattoir in Nomotio Area on the Livestock Improvement Centre (LIC) Farm. The proposed abattoir shall be of its kind in the County, and shall process meat from different livestock species for local, regional and international markets, and meet the national and international standards. The facility will have the capacity to process at least 250 (50 cattle and 200 goats/sheep) animal units per week on a five (5) day work week schedule. The overall objective of the project is to establish a modern abattoir to process meat products for local and international markets. Directly linked to the overall objective are specific objectives that include: to promote sustainable livestock production; to process competitively Samburu branded high quality and disease-free meat and meat products for local consumption and external markets; to promote value addition of livestock by-products specifically bones, blood, hides and skins, and to enhance capacity of key value chain actors in the livestock sub-sector. The ESIA took into consideration all environmental and social impacts of the proposed abattoir project works, identify the main environmental and social aspects in order to optimize the project from the environmental and social point of views, and avoid, minimize, reduce or off-set negative impacts while enhancing positive impacts. The ESIA further aimed at developing a cost-effective Environmental Management Plan (EMP) for the lifetime of the project.

Approach and methodology

We applied an approach and methodology in undertaking the study that covered all phases of the project: pre-construction, construction and operation. In addition to this phased approach, we examined the possible maintenance plans and decommissioning of the project, and came up with cost effective environmental management plans for the same. We undertook environmental screening and scoping to avoid unnecessary data, and applied various approaches in collecting data and information for assessing the impacts of the proposed project. The data collection was carried out through public consultative processes, desktop studies and literature review, field observations/visits and collection of samples for laboratory analysis in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003. Legal and regulation guidelines that apply, and are relevant to the establishment and operations of the proposed abattoir were reviewed, and these covered both national and international aspects.

The design

The proposed design follows the “Guidelines on Slaughterhouses and Meat Hygiene for Developing Countries” WHO publication VPH 83.56 (Mann et al 1983), with modifications to take account of the likely mix of stock in Samburu County. The proposed design is meant to cater for the slaughter of major livestock species in Samburu and surrounding counties, viz. cattle, sheep and goats. It shall have different structures/buildings including: livestock receiving area, lairage / holding pen, slaughterhouse, perimeter fencing, guard house, office of the meat inspector, personnel amenities, water supply and storage system, drainage system and wastewater treatment facility as the major structures.

Baseline information

The proposed site is located a few kilometres from water dams supplying Maralal Town in a fairly hilly area undulating with breaks in slopes. The proposed has characteristic loam soil with under layer rock basement. The proposed abattoir will be located at a site downstream from Nomotio Dam, hence chances for contamination of the Maralal main water source is minimal. However, Muramur and Silangiro Dams located further downstream could be vulnerable from wastewater pollution from the proposed abattoir if the wastewater is not properly managed. The proposed site for the abattoir construction is dominated by *Acacia tortilis* with interspersed with grasslands used mainly for livestock grazing. No species of conservation concern was recorded from the proposed site during the study.

Public consultations

From stakeholders consultations, it was clear that majority of respondents were receptive of the proposed project but insisted that full implementation of environmental management plan be undertaken and as much as possible the communities need to be engaged in all environmental management and decision-making aspects.

Analysis of project alternatives

The alternative selected for location was based on economic, engineering and topographic justifications. The design alternative as selected based the need to minimize environmental impacts including, noise, odour and aspect; optimum capital and running costs and land area requirements. The waste management alternative selected emphasized on the need to minimize waste generated from the facility through most practical and feasible options including recycling of both liquid and solid wastes generated in all phases of the project. Among the most feasible options selected for solid wastes were combined recycling processes including biogas production, composting and rendering. For liquid wastes the selected alternative was biological processes including lagoons with anaerobic and aerobic

processes. The no project alternative was not selected due to lack of significant negative effects on either biophysical or the socio-cultural environment.

Environmental and social impacts - Anticipated impacts and mitigation measures

The major positive impacts of the proposed project were mainly the economic and social benefits that can be acquired at the county and national levels. On the other hand, the major adverse impacts arise from generation of solid wastes, wastewater and air pollutants. Cost-effective and environmentally sustainable techniques that can mitigate the adverse impacts and enhance the positive effects were proposed.

Summary of anticipated impacts and proposed mitigations measures

Project phase	Potential impact	Mitigation measures
Construction	Flora and fauna	<ul style="list-style-type: none"> • Limit clearing/soil disturbance around construction sites. • Limit/control movement of machineries during construction. • Undertake selective vegetation clearing that allows regeneration. • Re-vegetate disturbed areas at the construction site. • Undertake routine monitoring/clearance of invasive species. • Restoration plans should incorporate measures to improve the ecological status of the site. • Give provisions for wildlife corridors and buffer zones.
	Landscape integrity and land use pattern	<ul style="list-style-type: none"> • Undertake dumping of excavated material at selected and designated sites. • Minimize movement of vehicles/construction machineries outside the premise of the project site. • Incorporate existing habitat features into site design. • Create habitats to compensate for habitat losses and to improve ecological potential for the site.
	Water quality and demand	<ul style="list-style-type: none"> • Optimize water use and monitor consumption during construction. • Install construction water storage facilities at the site. • Minimize disposal wastewater disposal at the construction site
	Noise and vibrations	<ul style="list-style-type: none"> • Provide PPE to construction workers and persons visiting the site. • Ensure the machineries do not exceed acceptable noise limits. • Inform local residents when construction activities are likely to generate excessive noise. • Truck drivers to switch off engines during offloading materials & avoid unnecessary hooting.
	Soil erosion	<ul style="list-style-type: none"> • Allow minimal vegetation clearing and disturbance at the site.

Project phase	Potential impact	Mitigation measures
		<ul style="list-style-type: none"> Re-vegetate all cleared areas during construction with indigenous vegetation species. Undertake proper planning of site clearing of natural vegetation during the construction works. Encourage re-use of excavated materials for back-filling and landscaping activities. Install proper and functional wastewater and storm water drainage channels.
	Air quality	<ul style="list-style-type: none"> Sprinkle water on fresh construction soil to minimize dust emissions. Provide personnel with Personal Protective Equipment & Clothing (PPE&C) such as dust masks. Palliate stockpiles of earth generated with water regularly to suppress evolution of particles. Maintain equipment and machinery in good condition to minimise unnecessary emissions. No burning of materials should be permitted at the project site. Limit traffic movement within the earmarked project areas.
	Occupational health and safety	<ul style="list-style-type: none"> Ensure all equipments are inspected before use for appropriate safeguards. Ensure controlled working hours and that employees do not extend working hours unnecessarily. Ensure appropriate road safety signages are strategically placed in and round the construction site. Erect speed breaks where human and vehicular traffic have high interactions.
	Solid wastes	<ul style="list-style-type: none"> Encourage wastes segregation at source into different wastes categories before disposal. Contract licensed waste management firm for disposal of large quantities of solid wastes. Domestic solid wastes to be temporarily stored in refuse bins before disposal by licensed contractor. Concrete, asphalt and other waste aggregate should be stored and reused. All reusable materials should be reused to minimize on quantity of solid waste generated.
	Liquid wastes	<ul style="list-style-type: none"> Provide workers with appropriate and adequate sanitary facilities i.e. exhaustible mobile toilets. Effluent from mobile toilets should be disposed by a registered NEMA waste handler. Wastewater from concrete//aggregates to be disposed into sedimentation pools & reuse clean water. Designate specific areas for washing of cement trucks/equipments away from a water body. Ensure no oil spills during machineries' fuelling with all vehicles re-fuelled at designated stations.
Operation	Increased pressure on water resources	<ul style="list-style-type: none"> Investigate options for water efficient measures to reduce pressure on existing water resources. Undertake water treatment of potable standard for reuse in production processes

Project phase	Potential impact	Mitigation measures
		<ul style="list-style-type: none"> • Incorporate relevant and practical wastewater reuse options into the operational procedures • Ensure compliance with Water Resources Management Rules, 2007 on groundwater abstraction. • Undertake regular groundwater monitoring, especially of boreholes supplying water to the abattoir
	Increased storm water	<ul style="list-style-type: none"> • Undertake regular surface water monitoring in the downstream • Ensure storm water drainage system is in good functional condition • Develop and implement contingencies for groundwater and downstream wetlands
	Wastewater effluents	<ul style="list-style-type: none"> • Apply best available technologies and adopt cleaner production techniques • Collect all blood for processing of animal feeds, fertilizers or pharmaceutical products. • Install grease traps in the drains to remove solidified fat from the abattoir wastewater. • Install a functional biological treatment (aerobic/anaerobic processes) for wastewater treatment • Apply for waste discharge permits from NEMA • Undertake annual environmental audits and submit findings to NEMA
	Solid wastes	<ul style="list-style-type: none"> • Hide and skin should be removed from site daily after slaughter operations. • Install a functional incinerator to destroy condemned animals/meat • Contract NEMA licensed waste handlers for disposal of various solid wastes; • Sludge and coagulated blood should be de-watered to solid contents before disposal • Condemned carcasses to be stored in chilled room and disposed by licensed waste handlers • Install a functional rendering plant for processing solid by products to useful products • Consider alternative energy (biogas) generation from wastes to supplement energy needs • Undertake aerobic composting of manure and secure composting pits from rain and scavengers • Undertake annual environmental audits and submit report to NEMA
	Air emissions	<ul style="list-style-type: none"> • Design and construct an efficient wastewater treatment system in accordance with best practice s • De-sludge anaerobic treatment ponds every 5 years • Plant indigenous trees around the site to help sequester carbon • Cover the composting area to control insects and scavenging birds • If biogas is installed, ensure the design encourages burning via flares

Project phase	Potential impact	Mitigation measures
		<ul style="list-style-type: none"> • Install a functional rendering system with an air cooled condenser and deodorizing capacity • Manure management practices should focus on dry systems to reduce methane gas emissions. • Design of facility chimneys, generators and boilers should comply with the air control standard. • Provide water hose points for floor cleansing of lairages, unloading/holding areas to reduce odour. • Provide chutes for direct dumping of manure into the collection skips to reduce odour.
	Spread of invasive species, insects, vermin and pests	<ul style="list-style-type: none"> • Undertake regular invasive species monitoring/implement remedial measures. • Clear/remove invasive plant species immediately they are sighted • Undertake prudent and efficient solid/liquid waste management to keep away scavenging birds. • Set vermin baits at the facility • Develop/implement Integrated Pest and Disease (IPD) focusing on pest monitoring/pesticides use.
	Noise	<ul style="list-style-type: none"> • Develop and implement a noise management plan • Install acoustic enclosures and silencers in the main plant. • Install efficient and super silent power generators • Ensure livestock yards are supplied with adequate water/pasture to minimize noise from animals
	Increased pressure on energy resources	<ul style="list-style-type: none"> • Reduce boiler start-up and shutdown frequencies by programming the operation • Construct impermeable secondary tanker for collecting and reuse of oil spills and prevent leakages • Undertake training and reminding workers to switch off lights when leaving the premises • Install solar and biogas energy systems to supplement electricity/energy demands
	Socio-economics, community health and amenity impacts	<ul style="list-style-type: none"> • Install good fencing and other site security to prevent trespass and vandalism. • Form environmental management committee with locals to address all emerging issues/complaints • Undertake annual environmental audits and submit reports to NEMA
	Flora and fauna	<ul style="list-style-type: none"> • Monitor invasive plant species at the project area and uproot unwanted germinating plants • Plant soil-erosion preventing grass species (i.e. <i>Sporobolus pyramidalis</i>, <i>Cynodon dactylon</i>, <i>Heteropogon tortulus</i> and <i>Bothriochloa insculpta</i> at bare or sloppy grounds at the site • Do not plant exotic plant species at the project site • Unnecessary vehicular disturbances such as hooting should be discouraged at the vicinity of site. • Use of floodlights on site should be restricted where necessary • Engage KWS in problem animal control

Project phase	Potential impact	Mitigation measures
	Occupational health and safety hazards	<ul style="list-style-type: none"> Register the workplace with Director, Directorate of Occupational Health and Safety (DOHS). Provide PPE to staff and personnel at the site. Ensure compliance with Occupational Safety & Health Act (Part XI) regulations on construction activities. Undertake regular occupational health and safety audits and submit reports to DOHS Provide first aid kit at the facility
Decommission	Noise pollution	<ul style="list-style-type: none"> Schedule noisy activities during the day time period; Use silencers on machines where possible. Ensure machinery is well maintained to reduce noise emitted.
	Air/dust pollution	<ul style="list-style-type: none"> Practice dust management techniques, including watering down dust; Set up dust barriers/ screens at strategic locations Provide and enforce the appropriate use of PPE against dust for staff
	Liquid wastes	<ul style="list-style-type: none"> Ensure prudent use of water to reduce liquid waste volumes. Adhere to EMCA 2006 water quality regulations. Adhere to WRMA 2007 guidelines for effluent discharge into surface water resources. Undertake proper demolition of wastewater structures to prevent ground water pollution by content
	Solid wastes	<ul style="list-style-type: none"> Undertake disposal of solid waste in compliance with EMCA 2006 waste management regulations; Segregate wastes to encourage reuse and recycling Contracted NEMA licensed waste collector to collect and dispose wastes
	Social impacts	<ul style="list-style-type: none"> Provide earlier notice to all affected parties concerning the development. Dismissal procedures should be compliant with the Employment Act, 2007. Notify residents in advance on planned decommissioning of the abattoir and its structures
	Occupational health and safety hazards	<ul style="list-style-type: none"> Contractor to register the workplace with Directorate of Occupational Health and Safety (DOHS). Provide PPE to staff and personnel at the site. Ensure compliance with Occupational Safety & Health Act (Part XI) regulations on construction activities. The Contractor should provide a standard First Aid Kit on site. Ensure all materials in use have no negative effects on environment and health.

Environmental management plan

The EMP covered information on the management and/or mitigation measures that will be taken into consideration to address impacts in respect of the three project phases:

construction, operation and decommissioning, and will be under the coordination of the Department of Agriculture, Livestock and Fisheries, Samburu County.

Conclusions and recommendations

Conclusions

The proposed abattoir will be the first of its kind multiplier investment in the livestock sector in Samburu County. It is economically feasible in regard to opening up the County for more enhanced livestock production and marketing in Kenya. The proposed abattoir will have all modern slaughtering and meat processing facility so that no by products or left over are taken outside. The abattoir will include modern rendering plant for the treatment of in edible offal, fat, bones and other by products. The abattoir will further install a modern technology oriented Effluent treatment plant for the treatment of waste water generated from the process of slaughtering, meat processing and rendering and utilization of other by products. Although development of this magnitude may have potential negative environmental and social implications, this study has provided appropriate mitigation measures for all potential negative impacts, and it is hoped that the proponent will strictly adhere to the implementation of proposed mitigation measures including full implementation of environmental management plan. During the preparation of this report for the development of the proposed abattoir project it was observed and established that most of the negative impacts on the environment are rated low and short term thus can be abated through the proposed mitigation measures. The positive impacts are highly rated and will benefit all stakeholders, Samburu County and the country at large. The project proponents should aim to prudently implement the Environmental Management Plan.

Recommendations

While there is a general acceptability of the abattoir by the local community, interference with water points, increased exposure to environmental risks such as odour and general safety are among concerns of the local communities, the following recommendations were made:

- (i) Integrate suitable mitigation measures as outlined in this report in the designs for all sections of the project abattoir for implementation during construction and operation of the abattoir.
- (ii) Form an environmental and management committee with full representation of the local communities for purposes of addressing any emerging environmental challenges from the project. As a procedure, the proponent will be expected to consult the communities and other stakeholders, particularly property owners, to the extent possible on planning the works, especially where other aspects of social interest are concerned;

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- (iii)** Engage the services of a NEMA licensed waste handling firm in regard to waste considerations during all the phases of the abattoir so as to ensure safety from waste released and also for management issues among other concerns;
 - (iv)** Institute effective communication, education and awareness towards the project beneficiaries for enhanced acceptability and social harmony. This is particularly important for all sub-counties within Samburu County with Samburu Central Sub-county prioritized.
 - (v)** Implement the environmental management plan throughout the project implementation with assistance of appropriate experts and in conjunction with relevant line ministries at county and national levels.
 - (vi)** Institute regular environmental audits and monitoring to assess the levels of compliance in the implementation of EMP, and submit reports to NEMA. During such audits, occupational health and safety audits shall also be undertaken and reports submitted to DOSH.
 - (vii)** The Proponent is to incorporate relevant and practical wastewater reuse options into the operational procedures to limit the potential cumulative impacts that this project may have on the water supply, especially in Samburu Central Sub-county and Maralal Township in particular. Additional water efficiency measures should be developed in consultation with Water Resources Management Authority (WRMA) and Samburu Water and Sanitation Company, and in keeping with the principles of Ecologically Sustainable Development.
 - (viii)** Prior to commencement of works, the Proponent is to establish a network of bores within the site boundaries in order to conduct a site specific hydro-geological assessment. This will inform development by the proponent of a conceptual model to enable assessment of the potential impacts to groundwater and surrounding receptors. During operation, the bores will then serve as monitoring bores. Groundwater monitoring (establishing bores and collecting data), including its frequency, should be in accordance with WRMA guidelines.
 - (ix)** Prior to commencement of works, an erosion and sediment control plan (ESCP) is to be developed and implemented. The plan should detail control measures for construction and operational phases.
 - (x)** The design plans for wastewater management system including oxidation ponds and storm water system should be provided to Public Health Department for approval prior to works commencing.
 - (xi)** The proposed composting area shall be covered, to the satisfaction of the Public Health Department, to prevent the composting material being exposed to rainfall.

The floor surface of the composting area is to be a concrete hardstand to prevent leaching into the soil substrate.

- (xii)** Develop an odour management plan before the commencement of the operations and ensure its full implementation during the lifespan of the project.

This report has been prepared in accordance with the EIA/EA Regulations, 2003 and Environmental Management and Coordination Act Cap 387, 1999 amended 2015.

CHAPTER 1: INTRODUCTION

1.1. Overview

Livestock production and marketing is a major economic activity in many developed and developing countries. A large proportion of the poor globally keep livestock, and estimates indicate that to some extent, almost one billion of the world's extremely poor people depend on livestock for their livelihoods (FAO, 2008; LID, 1999; Upton, 2004; Delgado et al., 1999; FAO, 2006). In Kenya, over 70% of land surface area is categorized as ASAL with livestock sector constituting an important engine of growth and poverty reduction. Growth in livestock production systems and marketing to enhance income generation can thus, make a direct contribution to the overall objective of eradicating poverty (World Bank, 2008a).

Samburu County falls in an ecological region categorized as arid and semi-arid, and is renowned for its livestock production and marketing. However, the pastoral production systems in the county is facing challenges by emerging socio-economic development trends, climate change and land use patterns. Furthermore, the county lacks multiplier infrastructures such as abattoirs to enhance economic returns for a sector which is the backbone for the county's economy. The need to for an investment in a modern and state of the art abattoir has become necessary.

It is in this regard that the County Government of Samburu through the Department of Agriculture, Livestock & Fisheries in collaboration with European Union and the national Ministry of Devolution & Planning plans to construct a modern abattoir in Nomotio Area on the Livestock Improvement Centre (LIC) Farm adjacent to Meloni Cooperative Tannery. The proposed abattoir shall be of its kind in the County, and shall process meat from different livestock species for local, regional and international markets. The abattoir shall also be used by long-distance livestock traders to process meat carcasses and transport to other areas instead of transporting live animals as the case currently. The main goal of the proposed investment is to improve economy of Samburu County through increased household incomes, provide a good avenue for farmers to sell their livestock at competitive prices, create direct and indirect job opportunities and enhance the County's progress in agro-processing sector.

The Legal Notice No. 101 of 2003 (EIA/EA Regulations, 2003) requires the Proponent (County Government of Samburu) to prepare EIA Study Report for approval by National Environment Management Authority (NEMA) prior to commencement of such projects. The County Government of Samburu engaged OikosVeritas Services Limited – a NEMA registered ESIA/EA firm of experts to undertake detailed environmental and social impact assessment study for the proposed abattoir. The study covered all phases of the project:

pre-construction, construction and operational phases. In each of the phases, the impacts of the project shall be examined, analyzed and documented.

1.2. The Nomotio Abattoir

The abattoir is designed to meet both national and international standards. It will occupy a plinth area of approximately 300 square metres, and will cost approximately KES 100m to build. The facility will have the capacity to process at least 250 (50 cattle and 200 goats/sheep) animal units per week on a 5 day work week schedule. It shall have different structures/buildings including: livestock receiving area, lairage / holding pen, slaughterhouse, perimeter fencing, guard house, office of the meat inspector, personnel amenities, water supply and storage system, drainage system and wastewater treatment facility as the major structures.

1.3. Project Objectives

The overall objective of the project is to establish a modern abattoir to process meat products for local and international markets. Directly linked to the overall objective are specific objectives that include:

- To promote sustainable livestock production
- To process competitively Samburu branded high quality and disease-free meat and meat products for local consumption and external markets
- To promote value addition of livestock by-products specifically bones, blood, hides and skins
- To enhance capacity of key value chain actors in the livestock sub-sector.

1.4. Scope of ESIA Study

The project qualifies for full ESIA study in compliance with the applicable laws and regulations in Kenya, concerning health, safety and environmental standards. The ESIA took into consideration all environmental and social impacts of the proposed abattoir project works, identify the main environmental and social aspects in order to optimize the project from the environmental and social point of views, and avoid, minimize, reduce or off-set negative impacts while enhancing positive impacts. The ESIA further aimed at developing a cost-effective Environmental Management Plan (EMP) for the lifetime of the project. Overall, the ESIA incorporated the following key aspects:-

- To describe the baseline condition of the proposed location
- To give a concise description of the national environmental legislative and regulatory framework.
- To describe the technology, procedures and processes to be used, in the implementation of the project.

- To describe the project and layout plan including the location, size of land, leases and project site and architectural designs for the overall project;
- To describe the potentially affected environment. Geological, hydrology, climate, and vegetation types, biological environment and demographic patterns and attitudes towards proposed project including any historical/archaeological importance of the area.
- To assess the environmental effects of the project including the social and cultural effects, direct/indirect, cumulative/irreversible, and short/long-term effects anticipated.
- To recommend a specific environmentally sound and affordable waste management systems.
- To analyse alternatives including project site, design and technologies.
- To develop an environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- To provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- To propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.

1.5. Approach and Methodology

We applied an approach and methodology in undertaking the study that covered all phases of the project: pre-construction, construction and operation. In addition to this phased approach, we examined the possible maintenance plans and decommissioning of the project, and came up with cost effective environmental management plans for the same. We undertook environmental screening and scoping to avoid unnecessary data, and applied various approaches in collecting data and information for assessing the impacts of the proposed project. The data collection was carried out through public consultative processes, desktop studies and literature review, field observations/visits and collection of samples for laboratory analysis in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003. The following techniques shall be used:

1.5.1. Review of secondary data

A wide range of environmental and socio-economic data was sought from different sources to describe the baseline physical and environmental conditions at the project area and

socio-economics. The main sources for the secondary data were County Integrated Development Plans (CIDP), Kenya National Bureau of Statistics (KNBS), research and technical report, and different sector plans and literature held by the County and national agencies.

1.5.2. Public consultations

We identified key stakeholders, met and discussed about the proposed project as part of its public consultative process. The identification of stakeholders for consultative process was based on a combination of social, cultural, gender, political and sectoral and statutory considerations. Details of such consultative meetings are captured in this report showing the persons met, date and venue of such meetings and key issues and outcomes of the meetings. In our public consultation process, we attempted to the extent possible to keep the consultative issues within the premise of the study without extending to the wider and broader context aspects. Key informant interviews were conducted during public stakeholder consultation in order to obtain the views and concerns of the interested parties regarding to the proposed project. A semi structured interview checklist was used to capture the responses of the stakeholders. Among the key stakeholders engaged in the public consultation process included:

- Local community elders
- Residents living near the proposed project site
- Local administration (Area chief)
- Area administrator and village council
- Butcheries/restaurants/hotels and other business operators in Maralal
- Kenya Livestock Marketing Council representative
- County Physical Planning Officers
- County Public Health Officers
- County Veterinary Officers
- Kenya National Bureau of Statistics (Samburu County)
- Agricultural Sector Development Support Programme
- Water services providers
- Non-governmental organizations (World Vision)
- County Commissioner, Samburu County

The participants' views enabled prediction of possible impacts (positive/negative) impacts to the natural and human environments. The questionnaires, public meetings attendance lists and meeting minutes are appended on the report.

1.5.3. Baseline environmental survey

Baseline environmental survey was undertaken in order to understand the prevailing conditions and to predict the likely changes once the proposed project is operationalized. During the baseline surveys, we determined the limits of the study area - defined to encompass all anticipated direct/indirect project impacts. We described and analysed the physical, biological and human conditions, relevant environmental and social issues within the area including any changes anticipated before project implementation. We assessed the interrelations between the environmental and social components and the value that the local populations attach to these components to allow us capture the environmental and social dimensions representing particular interests. Our assessment of flora and fauna was all inclusive in the area but particular attention was given to rare, threatened, sensitive or vulnerable habitats such as wetlands and conservation areas near the proposed project site.

(i) *Flora survey*

Field activities entailed walking and driving within the proposed site within a radius of 5km and making stops at various points to sample vegetation (structure, species composition and general vegetation type). At each of the points sampled, GPS coordinates were noted with focus being on natural or near natural habitats. The species identification was cross-checked using identification guides and other relevant literature.

(ii) *Fauna Survey*

Observations were done within a radius of 5km of the project site, and faunal species present - sighted or heard identified and recorded. Additionally, indications of their sightings/presence were scored as 4 (sighted); 3 (evidence of presence); 2 (reported present); 1 (expected based on habitat availability), and 0 (listed on species' list database for the area). The locations of the survey observations were selected with the consideration of pristine natural conditions and site accessibility to cover the representative areas of all natural habitats as far as practicable within the 5km radius. Avifauna species survey involved identification of species present in each natural habitat type through direct observation (using binoculars) and calls. All observations/recordings were undertaken whole day, especially in the periods corresponding with peak activities for most bird species. To maximize efficiency, relevant literature including recent surveys conducted in the area was used to provide additional information for the assessment. All the observation records and secondary data were reviewed under IUCN species conservation status criteria and relevant national guidelines. Terrestrial mammal surveys were conducted during daytime. In addition to direct count on any observed terrestrial mammals, all traits such as dung, feeding signs, footprints, burrows and dens associated with mammal activities per section was recorded and scored.

1.5.4. Assessment/mapping of potential vulnerable ecosystems to pollution

Abattoirs produce large amounts of slaughterhouse wastewater (SWW) due to the slaughtering of animals and birds and cleaning of the slaughterhouse facilities and meat processing. Actual SWW sources may contain faeces, urine, blood, lint, fat, carcasses, and non-digested food from slaughtered animals, production leftovers, and cleaning of the facilities. We assessed the entire area and mapped potential and vulnerable habitats/ecosystems (i.e. water resources, areas prone to water logging/flooding/erosion) likely to be affected by potential soil and water pollution agents from the proposed project. Our assessment involved taking samples (soil and water) for laboratory analysis. This process was critical as it helped to determine baseline conditions upon which all future environmental audits would be based.

(i) *Water sampling and analysis*

Water samples were collected randomly in different locations within the 5km radius of the proposed project site. The focus was on streams/rivers, ground water wells/water pans and other surface water in the vicinity of proposed site. In-situ water quality analysis was undertaken for all physiochemical parameters at each sampling site following standard analytical method (APHA/AWWA/WEF, 2005), and focused on the following parameters: pH, temperature, total dissolve solids (TDS), chloride (Cl), dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total solids, total suspended solids (TSS). Nutrient analyses were conducted in NEMA accredited laboratory, and focused majorly on eutrophication elements – nitrates, nitrite, ammonia, silicates, phosphorus, total phosphorus (TP) and total nitrogen (TN).

(ii) *Soil sampling and analysis*

Soil sampling was done according to the methods of Zaku (2006). A total of twenty five (25) composite samples were collected from five (5) different locations. The locations were within the 5km radius targeting vulnerable sites for potential pollution from the proposed abattoir. Three composite samples each were collected from the sampling locations at a depth of 0 to 15cm. The samples were placed in sterile polythene bags and transported to the laboratory for processing (Rabah & Ibrahim 2010). Preliminary routine laboratory practices of air drying, crushing and sieving were done. Soil pH was determined using 1:1 soil to distilled water, and measured with a glass electrode pH meter (Bates, 1954). Percentage organic carbon (OC) and organic matter (OM) were determined using Walkley-Black method (Walkley & Black, 1934). Total nitrogen (N) was determined using micro Kjeldhal digestion distillation method (Bremner & Mulvaney, 1982). Available phosphorus (P) was determined using Bray-1

method (Bray & Kurtz, 1945), while sodium (Na) and potassium (K) was measured using flame photometer.

1.5.5. Assessment and analysis of utilities demands (water and energy)

Abattoir requires enormous amounts of water and adequate/reliable supply of energy/electricity. Water and energy consumption associated with refrigeration and heating water are therefore major environmental issues for a slaughterhouse. Apart from determining the potential sources of water, we also proposed effective techniques to maximize on water available sources. Although proportions of water used can vary, a typical water consumption depends on the livestock species, we used FAO (2004) standards on water requirements for standard abattoir to estimate the amount of water required for optimal slaughter operation of the abattoir. Additionally, we quantified other water uses such as vehicle washing, knife sterilization, scald tanks, cooling water, floor and equipment cleaning, meat sprays and rinses, personal hygiene and extras (evaporation, spillage etc). We estimated the water demand/use as follows:

$$WD = \sum [(n\alpha^w + n\beta^w + n\chi^w + n\delta^w + n\phi^w + n\gamma^w + n\lambda^w + n\mu^w + \varepsilon^w)]$$

Where: TWD = Total water demand

$n\alpha^w$ = Number of livestock by species – water used mainly in lairage

$n\beta^w$ = Vehicle washing

$n\chi^w$ = Knife sterilization

$n\delta^w$ = Scald tank

$n\phi^w$ = Cooling water

$n\gamma^w$ = Floor and equipment cleaning

$n\lambda^w$ = Meat sprays and rinses

$n\mu^w$ = Personal hygiene water

ε^w = Error (water lost through evaporation, spillage, watering livestock etc)

On energy, we estimated and categorized sources of energy for use at the abattoir including determination of alternative sources of energy. The total energy demand estimated as a function of all energy uses such as lighting, powering the machineries, heating, freezers, etc. In doing this, we also identified sources and cost effective techniques for use of energy.

1.5.6. Evaluation of project alternatives

As part of the ESIA study, we identified, assessed and evaluated the various feasible alternatives of the project, including the "the No Project Option". We presented comparisons of the potential alternatives on the basis of technical, economic, environmental

and social criteria, as well as based on public views and concerns. In addition, analysis of alternatives addressed amongst others; proposed location of the slaughterhouse project, technology to be used, design considerations, its operations and aligned these to potential environmental and social impacts and the feasibility of mitigating the impacts. For each of the alternatives assessed, their environmental and social impacts were quantified including their economic values where feasible.

1.5.7. Assessing significance of impacts

The first stage of impact assessment involved the identification of environmental activities, aspects and impacts. The significance of the impacts assessed was rated for each variable numerically. The purpose of the rating was to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact were then summed up.

1.5.8. Preparation of environmental management plan (EMP)

We prepared overall and specific environmental management plans (EMP) for all identified impacts of the project. The EMP outlined the followings:

- (i) Exact project activities, their impacts, proposed mitigation measures, the institutional arrangements required for effective implementation of the proposed mitigation measures as well as monitoring of the implementation of the mitigation measures was developed. We described the measures aimed at ensuring that the proposed mitigation are effectively implemented during all phases of the project including budgetary provisions.
- (ii) The EMP summary summed up all the costs associated with environmental mitigations as well as costs associated with monitoring which constituted part of project financing.

1.6. Purpose of the Report

This report has been prepared in accordance with the EIA/EA Regulations, 2003 and environmental management and coordination act Cap 387. It presents detailed account of the project including legal/regulatory frameworks, identified impacts and the proposed mitigation measures, views and opinions from stakeholders regarding the project, analysis of alternatives and environmental management plan (EMP) among other key elements.

CHAPTER 2: DESCRIPTION OF PROPOSED PROJECT

The proposed project is owned by the County Government of Samburu through the Department of Agriculture, Livestock and Fisheries, and is financed by the County Government, the European Union and the National Ministry of Devolution and Planning. The proposed project is of its kind in Samburu County, and is envisaged to become a modern abattoir processing meat products for local, national and international markets. Additionally, it is meant to minimize movement of live animals by traders as has been the case over the years. The abattoir will offer the needed opportunity to process carcasses and transport to different areas using vehicles – a much cheaper and effective method.

2.1. Background

Samburu County is renowned for its livestock production and marketing, and is one of the leading counties in the sector. Despite its livestock productivity and marketing potentials, the County is yet to fully exploit the existing and emerging opportunities. The County lacks multiplier infrastructure in the livestock such as modern abattoir and better and modern road infrastructure, among others. The support from the European Union for the construction of a modern abattoir in the County is therefore timely, and is coming at a time when the County's main focus is on establishment of agro-processing industries to not only spur economic growth but also to modernize the livestock sector. The soon to be completed tarmacking of highway, C77 (Rumuruti–Maralal) will be a major boost for the proposed project, as it will ensure efficient transportation of processed meat to other parts of the Country apart from opening up the County for investments in different sectors.

2.2. Description

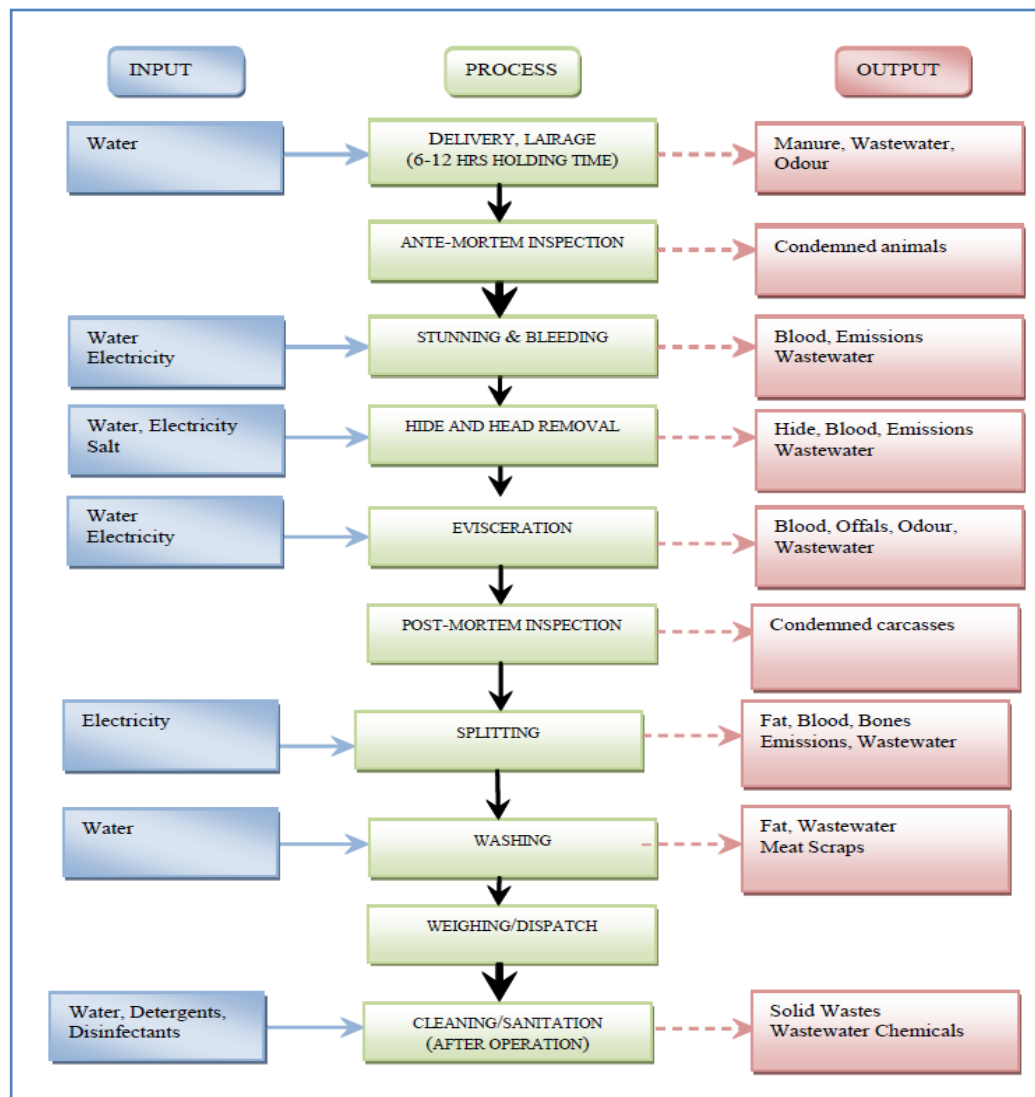
The proposed project will be established at the Nomotio LIC Farm – about five kilometres from Maralal town on the south eastern side. There are three main activities currently being undertaken at the LIC farm. These include: livestock improvement, fodder production and storage and tannery works to be operation soon. The County Government has already allocated five (5) acres of land for the project within the farm, and effected the change of user in compliance with the physical planning Act. The surrounding of the farm is dominated by human settlements whose main activities are livestock keeping and crop farming – although in a smaller scale. The proposed project site can be accessed through Maralal – Baragoi Highway, branching near Maralal High School towards the LIC farm, and Maralal – Rumuruti Highway (C77) branching next to Samburu Teachers' College then southwards to Maralal Mixed High School then westwards to LIC farm. This road shall be the main road for accessing the abattoir, and is earmarked for converted to a bitumen standard road. Overall, the proposed abattoir site is within a well defined land-use area that allows connectivity

between different transport modes to Maralal Town using vehicles and boda-boda (motorbike), private vehicles, and bicycles.

2.2.1. Facility design and components

The proposed design follows the “Guidelines on Slaughterhouses and Meat Hygiene for Developing Countries” WHO publication VPH 83.56, with modifications to take account of the likely mix of stock in Samburu County. Details of architectural drawings are provided in Annex 2 of this report. The proposed design is meant to cater for the slaughter of major livestock species in Samburu and surrounding counties, viz. cattle, sheep and goats. Figure 1 shows a flowchart of the slaughtering process in the production facility of the proposed abattoir. Daily throughputs of approximately 50 large stocks (e.g. cattle) or 200 small stocks (sheep and goats) or a combination thereof represent a practical maximum for the proposed design.

Figure 1: Flowchart of input, process and outputs from the proposed abattoir



The following key facilities that characterize a modern abattoir have been included in the design:

2.2.2. Production, processing and dispatch facilities

2.2.2.1. Production facility

Livestock yard section

Transportation of animals over long distances travelling on foot or overcrowding in transportation and exposure to extreme weather shall be avoided for all animals earmarked for the proposed abattoir. A livestock holding yard meant for animals earmarked for the slaughter is proposed in the design. This shall be the first facility to receive the animals. The facility has been designed with loading and offloading rumps for ease of operation, and has adequate livestock trucks parking. The animals shall be rested in this facility for 2-3 days, and provided with adequate fodder and water. Ante-mortem inspections shall be carried out in this section for purposes of clearing the animals for slaughter. Overcrowding of the animals shall be avoided in this facility, and animals not passed for slaughter removed. The stockyard has been designed to have enough open area for vehicle turn and is located opposite to the side from where processed product meat is dispatched. It has been designed to have water and feeding facilities for both small and large stocks. A separate pen with watering and feeding arrangements for (i) animals suspected to be suffering from contagious and infectious diseases and fractious animals. All suspected animals are sent to isolation pen directly from stockyard.

Lairage section

This facility has been incorporated in the design and is meant to keep cleared animals from the stock yard for two to three days stock for slaughter. The facility has a reception area and after passing through reception area the animals reach to the lairage where these are rested before slaughter. The rest is given to restore their normal physiological condition. Usually animals travel long distances to reach abattoir and if not rested properly the quality of meat is adversely affected. The facility is equipped with all resources/structures to make the animals feel animal comfortable, and is protected from heat, cold and rain. It has been designed with adequate space for both large and small stocks to be slaughtered. Lairage is provided with abundant water and feed, and is constructed in such a manner as to separately keep animals depending upon their type and class. Again, the facility has a separate isolation pen for suspected fractious animals as in case of stockyard. The lairage area has been design as per the specifications of daily outputs as follows: Cattle (1.7m²/head and sheep/goat (0.4m²/head).

Condemned/quarantine animals yard section

This facility has been designed to be beside the livestock yard/lairage. Following ante-mortem inspection, all condemned or quarantined animals should be taken to this facility and removed from the precincts of the abattoir for remedial actions or emergency slaughter.

2.2.2.2. Slaughterhouse hall section

From lairage, animals are transferred to slaughter hall, situated at a distance of 10 meter from lairage. In the slaughterhall, separate provisions for slaughtering, dressing and processing of small and large stock have been provided. The slaughter hall has several sections including:

- **Drive/races:** Firstly, the animals reach to holding pen and then they are driven to stunning pen through drive/races. Drive is curved path with single file accommodation and stop gate. Animal are continuously guided by a person to stunning pen.
- **Stunning pen:** This is an area where animals are made unconscious before killing. It has been designed to take into account the type of stunning procedures to be followed.
- **Bleeding area:** Immediately after stunning, the animals are bled to death. This area possesses a good gradient for collection of blood, and is located in such a manner as to avoid blood splashing to other animals being slaughtered or on the carcass being skinned. Blood drain and collection have been properly designed with drain channel diameter of 150mm. The bleeding trough for large animals have been designed with diameter of 1.5m wide while for small stock, the diameter has been set at 1.2m. These are enclosed on both sides, and have smooth impervious surfaces of stainless steel.
- **Carcass dressing area:** This is an area where a number of operations are carried out such as removal of hide and skin, head removal, evisceration, splitting, trimming and final wash etc. Dressing of carcasses is done on floor. Adequate means for immediate disposal of hides or skins have been provided. In addition to this, provisions have been made for immediate disposal of legs, horns, hooves etc. Adequate number of hand wash basins with sterilizers and hot and cold water outlets has been provided in this area as well as sufficient space for the de-boning, removal and thorough washing of heads. A moving top evisceration table with cold water sprays to remove blood and extraneous material, and synchronized with the eviscerating rail has been provided.

- **Inspection area:** Before evisceration the carcass are examined carefully for any pathological lesions. This section acts as a clearing area before carcasses are ready for sending to the next section. All visceral organs and the whole eviscerated carcass are re-examined carefully. It is then decided whether the carcass is sent to chilling section or condemned meat room or detention room. This section has been provided with adequate space for examination of viscera of various types of animals slaughtered. Hand wading, tool sterilization, floor washing and facilities for separation and disposal of condemned material are provided in this area.
- **Carcass washing area:** This is a separately drained area or an area of sufficient size slopped to a floor drain provided for washing of the approved carcasses with a jet of water.

Cold storage section

If the meat is to be consumed immediately after dressing i.e., in hot condition, the carcasses shall be sent immediately for sale and cooking. Otherwise in all other cases carcass are chilled soon after the post-mortem inspection. Chilling temperature for carcass should not exceed 70°C while for offal it should be below 40°C. The carcass is held in chilling room for atleast three days. All blast freezers and holding freezers are maintained at temperature of -25°C or lower and -18°C or lower respectively. Chill doors have been designed to be sliding or single or double-hinged. Internal finishing is made of durable, impervious and with good insulation and floor drainage. An area in the cooler has been provided for the chilling and storage of detained carcasses and parts. This area is segregated from the remainder of the cooler and is equipped with seal and lock.

Cutting and deboning room section

This is a section where meat cutting and removal of bones are undertaken. Once the carcass is firmly set in chilling room, deboning (separation of meat from bone) becomes easier and cut into pieces. The operation in this section is performed in controlled temperature (10-12°C) by skilled and efficient worker. An adequate number of knife sanitizers are provided at strategic locations and the area has good illumination.

Packaging and despatch section

Adjacent to cutting and deboning room there is packaging room where the meat chunks are packaged and after freezing they are kept under frozen condition (-40°C) before despatch. The despatch area has adequate space to allow for orderly and efficient loading of meat into transport vehicle. At the time of loading, docking system is practiced whereby there is no air movement into the despatch area or vehicle.

Condemned meat room section

This area is directly connected with inspection area. It has adequate space, refrigeration and drainage along with supply of durable and lockable container and weighing facilities essential to arrange for sorting and holding of materials unfit for human consumption prior to despatch. This room is provided with only one door located outside the building, and with a lock.

Detained meat room section

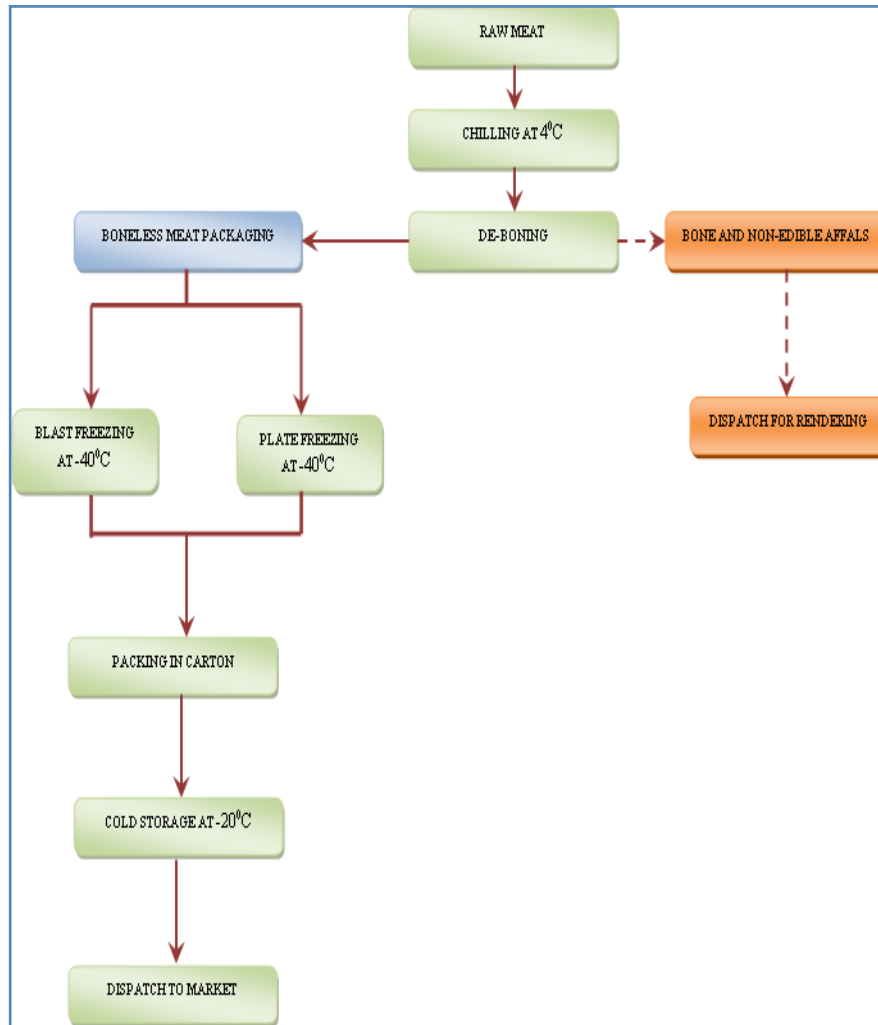
This area has sufficient facilities provided for the isolation of the meat requiring further examination as sometime the inspector/veterinarian may be neither in a position to discard the carcass nor to pass it to chilling section. In such cases a detailed report from quality control laboratory and viscera examination section is needed. Detained meat room is located adjacent to the main slaughter hall inspection point and is also connected with condemned meat room as well as chilling section since after clearance of pending decision, carcass is accordingly sent.

Quality control laboratory section

This area is meant for detailed examination of specimen from carcass and their respective viscera. Microbiological and other relevant tests are conducted here. The area is well equipped for detailed examination of the carcass and the organs because the final decision of acceptance or rejection of the meat and the offals depends on the report of quality control laboratory. This area is directly connected with the slaughter hall.

2.2.3. Meat processing facility

This facility in the design is meant for processing meat including packaging, and is linked to the production facility. Figure 2 shows the flowchart of the meat processing at the proposed abattoir. Carcasses from the production section are processed into pieces that can be packaged and sold to customers as packed meat products. Basically, the process involves de-boning – meat is separated from the bones then packaged. Once the meat is de boned, it is inspected and sent to packing section. After packing in small parts, that are then put in trays and again taken to the freezer/chillers section awaiting supply to the market. This section is connected to clean and warm water supply.

Figure 2: Flow chart of the meat processing at the proposed abattoir

2.2.4. Meat dispatch facility

This is a facility in the design where the products from both production and processing facilities leave the abattoir for the market. This facility is designed with good packing space able to accommodate cold storage vehicles. It is well supplied with water for purposes of cleaning meat transportation containers.

2.2.5. Accessories and service facilities

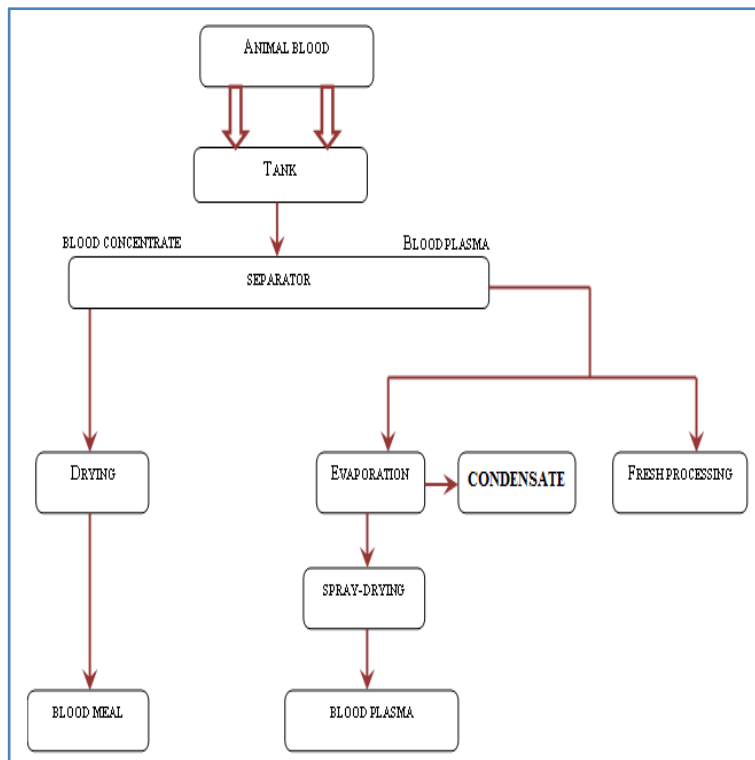
Besides these main components, the proposed abattoir has the following accessories' sections:

2.2.5.1. Blood collection

This is an underground to the bleeding area, and divided into two-edible blood collection section and inedible one. Blood has got nutritional as well as commercial importance and it

cannot be allowed in waste as in traditional slaughter system. A provision has been made in the design to ensure that blood is not diverted into liquid waste effluent system as blood can quickly clog up the screens and disposal trenches. Special blood collection pits have been included in the design adjacent to the bleed area in the production unit for purposes of collecting blood for recycling – blood is a good source of protein and can also be used in the manufacture of pharmaceutical products. The pits are well secured from rain and insects. Consistent processing of animal blood into blood plasma or blood meal is a possible way of increasing the profitability of the proposed abattoir. Obtaining blood plasma in particular opens up lucrative opportunities because this product is very much in demand from a wide variety of industries due to the valuable constituents it contains. Blood plasma is used as an additive in the food sector as well as in the pharmaceutical and pet food industries. Blood is composed of cellular and liquid components. Plasma remains when the corpuscles are removed from liquid blood. To prevent the blood from clotting, an anticoagulant is added when the blood is collected from the arteries of slaughtered animals. Calcium-binding substances such as citrates are suitable for this purpose. Clotting is unable to start as a result of thrombin formation being inhibited. Figure 3 shows the flow process for blood processing.

Figure 3: Flowchart of blood processing to blood meal and blood plasma



2.2.5.2. Hide and skin store

Along with other by products, hide and skin need to be stored before despatch. A provision has been made in the design for temporary storage before transportation to the nearby tannery. It is expected that the tannery will be able to handle all hides and skins by products from the abattoir.

2.2.5.3. Gut and tripe room

This is a separate room and hanging space provided for emptying and cleaning of stomach and intestine, and has a separate exit. This area has been designed with provisions for the preparation of casing, tripe and edible fat.

2.2.5.4. Red offal room

The design has provision for red offals. Many of visceral organs have commercial as well as food value. Among the red offals include liver, lungs, heart, kidney etc. These are organs which should be trimmed and then placed in a chill or freezing room depending on ultimate system of disposal. This room has been designed with provision for edible and inedible sections red viscera for further processing. This section is located separately from the slaughter floor but with two connecting doorways with self closing doors.

2.2.5.5. Rendering plant

This section deals with extraction of fat from carcass parts, condemned carcass/diseased one by applying high temperature processing. The materials left after fat extraction can be used for animal feed-fertilizer. The whole section of rendering plant is divided into edible fat section and inedible fat section – see details in the solid wastes section.

2.2.5.6. Inedible area

All materials unfit for human consumption with exception of hides and skins are kept in the section away from edible areas called inedible area.

2.2.5.7. Equipment wash

A provision for equipment wash section has been included in the design. This has been designed to avoid buggies, bins and washing of equipment at improper places. The equipment wash section has one-way system of passing in equipment. The section ensures the entry of dirty equipment's entry from one side and exit of only clean equipment's from other side.

2.2.5.8. Veterinary office and laboratory

This section has essential facilities and equipment's to carry out inspection work.

2.2.5.9. Vehicle washing

Separate sections for cleaning of meat transport and animal transport vehicles have been provided for in the design.

2.2.5.10. Water supply and storage

Two water sources for use at the proposed project are identified as borehole water pumped from a borehole located about two kilometres away from the proposed project site, and rainwater to be harvested from the roofs. The project will have an installed water storage tanks of over 600 cubic metres capacity constructed at the site.

2.2.5.11. Stormwater and drainage

Provisions have been made in the design for storm water drainage system to dispose excess water from the roofs and paved areas. The design of the storm water drainage system is guided by the general topography in the area, and the layout design.

2.2.5.12. Electric and power supply system

Three sources of power are envisaged for the proposed abattoir. These are solar, biogas and mains electricity from the national grid. While the mains supply is expected to run the heavy machinery, solar and biogas shall support the routine power needs such as lighting and water heating. Provision for installation of solar and biogas systems have been included in the design.

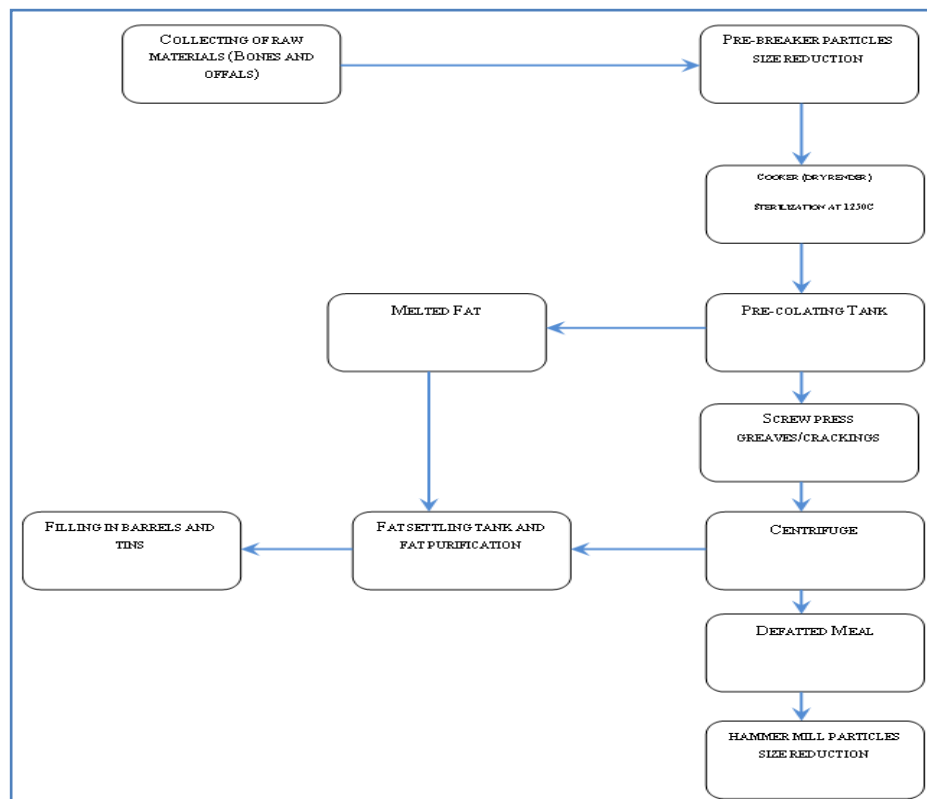
2.2.5.13. Back-generator

A back-up generator location has been included in the design. This is meant to help run the heavy machinery in cases of power outages from the mains supply.

2.2.6. Effluent disposal and other by products facilities

2.2.6.1. Solid waste disposal

The abattoir has been designed to allow a continuous rendering process. Figure 4 shows a flowchart of a rendering process for the proposed abattoir. A temporary solid waste collection section has been proposed where all solid wastes from the abattoir including bones, hoofs, heads, etc will be collected. The raw material i.e. solid waste from the various processes is collected in this section for purposes of recycling. A provision has been made for dung/ruminant contents collection area separate from other solid wastes within the facility which will again be disposed or processed offsite.

Figure 4: Flowchart of a rendering process for the proposed abattoir

2.2.6.2. Manure bay

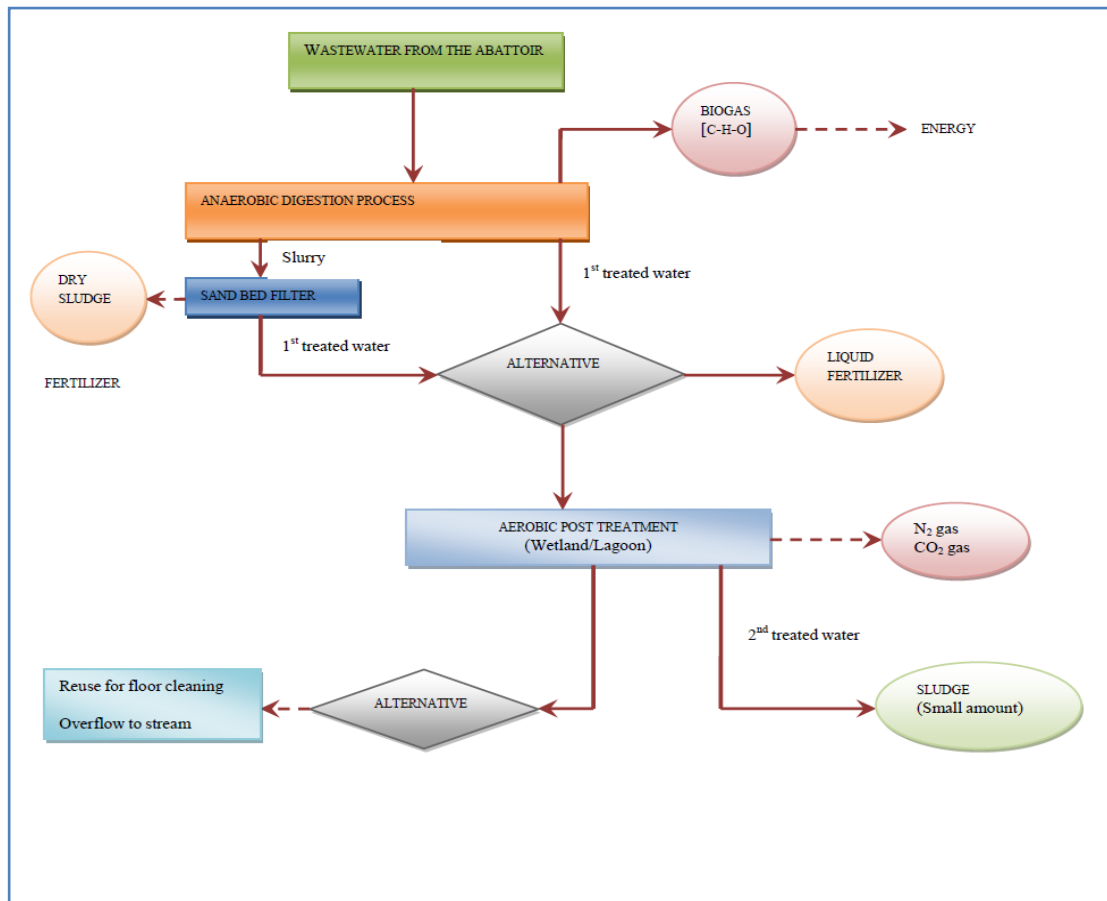
A large amount of dung from lairage, emptying of rumen and intestine is expected once the abattoir starts operation. This section has been provided for to deal with huge mass of manure to avoid problem of flies etc. Floors and walls of this area are impervious, easily washable, properly drained and can be easily disinfected. The floor has been designed lower than other floors in the slaughterhouse.

2.2.6.3. Wastewater and treatment

This facility has been designed to cater for all waste water expected from the facility. The main waste water sources have been identified as: floor washing, carcasses washing, cleaning of offals (intestine etc), equipment washing, tools cleaning, cutting & packing table washing, from laboratory, boiler blow down, cooling tower discharge (once in a month) and domestic (toilets, canteen etc.). The facility will have a waste water treatment system/plan with a capacity of over 300 cubic metres keeping in view the effluent quantity generation and further the existing proposed tannery near the proposed project site. This design considers safety margin in addition to estimated flow for peak production period. The proposed treatment system will combine both anaerobic and aerobic systems (Hejnfelt & Angelidaki 2009). The combined effluent generated from the proposed abattoir is expected to be non-toxic in nature and biodegradable in nature. An expected volume of over 100,000

litres of liquid wastes in expected from the facility at maximum operation capacity – 50 cattle and 200 goats per day. Considering the nature and quantity of combined effluent the proposed effluent treatment plant (ETP) will be designed for over 100,000 litres with the treatment pattern adopting activated sludge process (ASP) along with physico-chemical treatment (PCT). Figure 5 shows the flow diagram of the proposed wastewater treatment process before discharge to the environment.

Figure 5: Proposed wastewater treatment process at the abattoir



2.2.7. Other facilities

The other facilities in the design include facilities for personnel such as: offices, staff vehicle parking yards, security fencing and roads. Provisions for three gates have been incorporate in the sign. These are livestock entrance to stockyard, staff and meat dispatch gates.

2.2.7.1. Facilities for personnel

These are mainly facilities to cater for staff sanitation. These facilities have been designed in a manner that allows for sufficient distance away from slaughter walls. The facilities for personnel have been designed to incorporate the followings:

-
- **Lockers:** Each and every individual should be provided a separate shelf with key and lock facility where they can keep their valuables. Cloak room should be provided at the staff entrance gate.
 - **Toilet/urinals:** Provision has been made for separate toilet/urinals for male and female. The numbers of toilets/urinals are sufficient according to strength of workers, i.e 4 to 6 toilets/urinals sufficient for 100 workers. Exhausts in each toilet are provided for in a properly guided direction.
 - **Shower:** Separate showers for male and female workers and sufficient number have been provided for in the design, i.e. one for every 15 employees.
 - **Dressing room:** Adjacent to bath room are the dressing rooms where the wet clothing could be put off. Soiled clothing should be separately kept in containers for washing every day. In dressing room there are mirrors and any type of hard cosmetics are prohibited.
 - **Apron, caps, mask and gloves:** Every individual should be provided a sterilized apron, cap and mask. All individual are expected to wear cap in such a manner that the chances of hair fall could be minimized. Mask is meant to prevent any contamination from worker's mouth or nose. Gloves are provided to workers of specialized section to prevent contact of meat with bare hand.
 - **Gumboots/shoes:** Gum boots for abattoir workers and shoes for clean area workers should be provided. Foot dip with disinfectants for foot wears at entrance and exit is provided for in the design.
 - **Wash basin:** Adequate wash basins or elongated washing troughs with individual taps have been provided for in the design, i.e. one for every 15 employees. Only soap solutions with less strong odour shall be used.
 - **Canteen:** A provision has been made for staff canteen. This is supposed to cater for the welfare of staff, especially if the working in shift is introduced during the proposed abattoir operation.
 - **Meeting hall:** A provision for meeting hall has been incorporated in the design. This is meant for purposes of discussion of activities going on and any type of disputes or complaint etc.

2.3. Operational layout of the facilities

The overall typical arrangement/layout for the proposed abattoir is as shown in Figures 6 and 7. The facility will be sited in an area of about 5 acres, to typically contain all the facilities are described in the design. Although there are points to consider in selecting a site, in practice, compromises are inevitable especially for the Nomotio LIC Farm abattoir.

Figure 6: Layout of production facility and process for the proposed abattoir

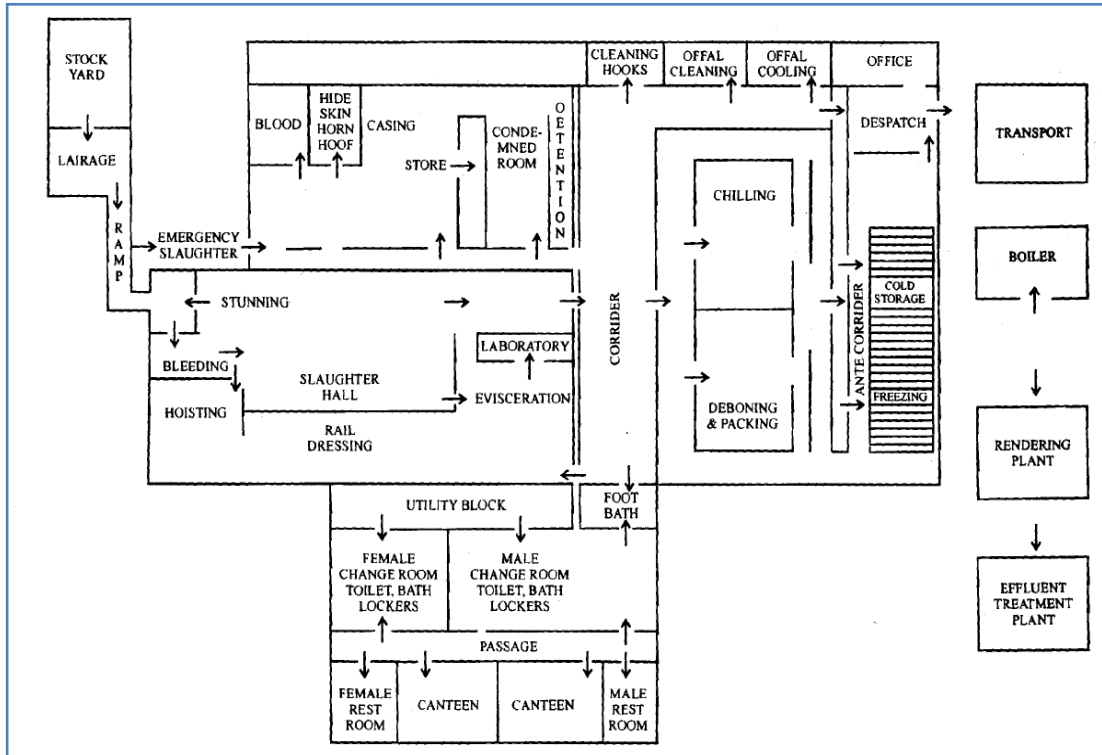
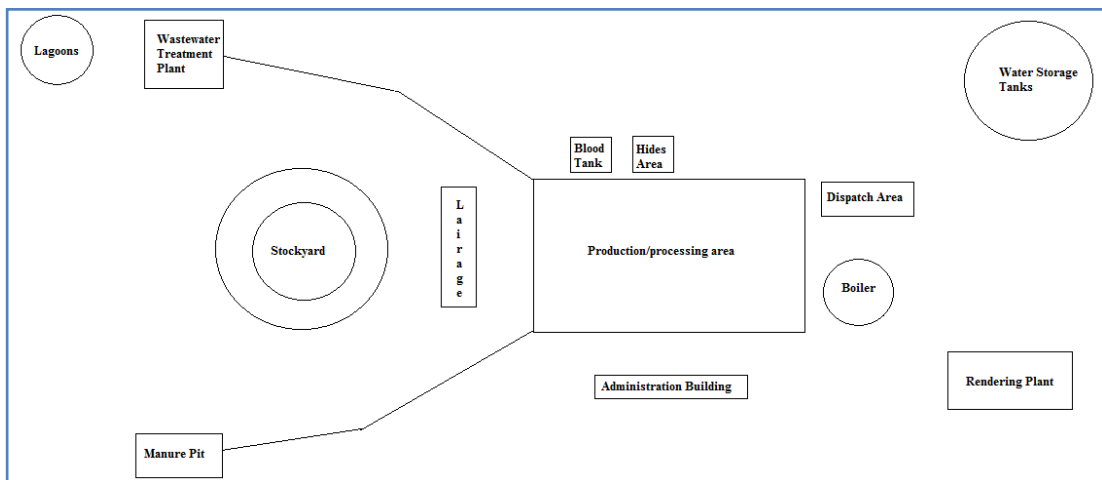


Figure 7: Facilities layout for the proposed abattoir



2.4. Project justification

The broad aim of this proposed Nomotio abattoir project is to enhance and promote livestock production and marketing in Samburu County. The project has laid emphasis on the establishment of a modern abattoir meeting both national and international standards for meat processing (i.e. World Bank 2007) to encourage locals and neighbouring counties' residents and traders to use the facility as a major source of meat products. The project is also aimed at supporting livestock traders to process carcasses for long distance markets that can then be transported using refrigerated trucks. Overall, the proposed project will spur economic growth in Samburu County through provision of market for livestock sale to farmers within the County.

2.5. Construction period and materials

The proposed abattoir is expected to be constructed over a period of between 9 and 12 months. Most of the materials for major construction works will be sourced from within the Samburu County.

2.6. Project cost

The proposed project will cost approximately KES 100 millions with the major cost items being: land preparation, construction materials, structural/mechanical/electrical engineering works, equipment, labour costs and contingencies.

CHAPTER 3: POLICY, LEGAL AND REGULATORY FRAMEWORK

This Chapter gives an overview of legal and regulation guidelines that apply, and are relevant to the establishment and operations of the proposed abattoir. The guidelines cover both the national and international aspects. For each legal and regulatory guideline, the levels of compliance by the proponent based on ESIA study findings are recommended. This has been done to ensure that adequate measures are taken by the proponent to conform to the existing laws, and regulations, and international best practices for abattoirs.

3.1. Legal Framework

Kenya has several provisions under the Constitution as well as various Acts that protect the environment and human health. Among the legal provisions that apply to the proposed project establishment and operation include:

3.1.1. The Constitution of Kenya, 2010

The Constitution of Kenya 2010 recognizes the environment as part of the country's heritage, and which must be safeguarded for future generations. It provides for the right to a clean and healthy environment for every person. Articles 42 and 69 obligate the state to enact legislation to protect that right and establish systems for environmental impact assessment, environmental audit and monitoring of the environment in Article 69.

Comment: The proponent (the Samburu County Government) shall cooperate and work with other national state organs and agencies to undertake investment projects and programmes that take cognisance of the need to protect and conserve the environment by commissioning environmental impacts assessment studies before any projects/programmes are undertaken. Each year the proponent shall also undertake environmental audit to conform to the provisions of Articles 42 and 69 of the Constitution of Kenya that underscore the need for proper environmental management and monitoring.

3.1.2. Environmental Management and Coordination (Amendment Act, 387, 2015

EMCA, 1999 and its 2015 Amendment is the main framework law on environmental management in Kenya. The Act provides a legal and institutional framework for the protection and conservation of the environment (in line with Article 42 of the constitution), as well as providing the necessary mechanism to monitor that, which include environmental impact assessment, environmental auditing and monitoring as prescribed by Article 69 of the Constitution. The Act has further provisions for environmental audits to ensure conformity with the environmental standards for all activities that have direct and indirect impacts on environment. The Act is relevant for the establishment and environmental

governance of the proposed facility. In particular, the EIA and EA have to be undertaken before commencement of the project, and regular environmental audits will have to be undertaken during the abattoir operations.

Comment/recommendations: The proponent by engaging a registered NEMA licensed firm of experts, OikosVeritas Services to undertake the ESIA study for the proposed facility has conformed to the requirements of EMCA Act. In addition, the proponent shall undertake regular annual environmental audits and submits reports to NEMA (in compliance with sections 68 and 69 of the Act). These audits shall examine and assess the environmental performance based on key parameters with direct and indirect impacts to the environment considering the nature of the project operations. NEMA may require relevant bodies/agencies such as the ministry of health, lands and planning, county governments and other key stakeholders to comments on such reports.

3.1.3. The Public Health Act- Laws of Kenya, Chapter 242

This Act stipulates among others that food must be prepared and stored in establishments approved for the purpose using clean and pathogen free equipment and containers, food products be processed or cooked to destroy pathogenic microorganisms, food products must be processed, handled, packed, stored and transported or shipped hygienically and all necessary precautions taken to prevent recontamination, food stores must be free of vermin such as rodents, flies and cockroaches, food handlers must be free of communicable diseases and must undergo regular medical check-ups, materials and articles in contact with foodstuffs e.g. packaging materials or containers must be non-toxic and innocuous, food products must not contain any harmful additives or foreign substances including microbial toxins or chemical residues in concentrations injurious to health, and foodstuffs or food ingredients must be transported and stored separately from poisonous substances such as pesticides, fertilizers. Section 116 requires that local Authorities take all lawful necessary and reasonable practicable measures to maintain their jurisdiction clean to prevent occurrence of nuisance or condition liable to injuries or dangerous to human health. The Public Health Act makes it an offence for a property owner or project developer to allow nuisance or any other condition liable to be injurious or dangerous to health to prevail in his property.

Comment/recommendations: The proponent shall adhere to all the requirements of the Act as provided. This shall include amongst others: (i) ensuring site hygiene at all times in the three phases of the project; (ii) provision of clean sanitary facilities and clean drinking water supply to staff and customers at the facility; (iii) removal of wastes and general cleanliness at the facility to ensure that the operational activities are not a nuisance to the public and the workers; (iv) and institute measures to minimize air pollution.

3.1.4. Meat Control Act Cap 356

The Meat Control Act aims to promote the supply of safe meat for both local and export markets, and requires that: each export slaughterhouse be equipped with adequate sanitary facilities, inspection and maintenance of sanitary conditions be conducted regularly, carcasses and parts judged unfit for human consumption be disposed not later than 24 hours after inspection, re-inspection of all products be done at the time they leave an export slaughterhouse, export meat must be free from food additives and injurious substances prohibited by the receiving country and appropriate export stamps, certificates and records must be maintained.

Comment/recommendations: The proposed abattoir is envisaged to be a modern abattoir to serve both local and international markets. The proponent shall undertake all measures required under this Act to ensure compliance with all its provisions.

3.1.5. Kenya Meat Commission Act Cap 263 – Revised 2012

This Act establishes a commission to purchase cattle and small stock, and to acquire, establish and operate abattoirs, meat works, cold storage concerns and refrigerating works for the purpose of slaughtering cattle and small stock, processing by-products, preparing hides and chilling, freezing, canning and storing beef, mutton, poultry and other meat foods for export or for consumption within Kenya, and to confer certain exclusive rights upon the Commission, and for connected purposes.

Comment/recommendations: The proponent shall work in collaboration with Kenya Meat Commission under this Act for enhanced synergies, especially with regards to products marketing both at national and international markets.

3.1.6. Pest Control and Products Act, Cap 346

This Act stipulates that appropriate pesticides must be used to control pests in food crops and food animals as well as appropriate withdrawal periods allowed to prevent accumulation of pesticide residues. The use of pest control products has a bearing on the animal products, and there is need to ensure proper and controlled use, especially for livestock earmarked for slaughterhouse.

Comment/recommendations: Working in collaboration with neighbouring county governments, the proponent shall advocate for control in use of pesticides for livestock earmarked for the slaughterhouse. Additionally, the proponent shall set a holding ground near the proposed facility for purposes of monitoring the health status of livestock to be slaughtered.

3.1.7. Food, drugs and chemical substances Act Cap 254)

The Act stipulates that appropriate drugs and antibiotics must be used to treat animal diseases and withdrawal periods allowed to prevent accumulation of drug residues in animals.

Comment/recommendations: The proposed facility is earmarked to produce food products (meat). The proponent to ensure that the operation of the facility do not contravene the stipulations of Act.

3.1.8. Animal Diseases Act, Cap 364

This Act stipulates that food animals be raised in a well-ventilated, well lit and appropriately spaced housing or environments, animals be relieved of pain from diseases and pests through appropriate treatment and husbandry practices, animals must be fed on innocuous materials or feeds that are free of poisonous substances, substances having hormonal effects should not be used in food animals and animals be given enough potable drinking water.

Comment/recommendations: The proponent shall engage livestock producers and other key actors to ensure adherence to this Act. For instance, working with the livestock marketing associations, the proponent shall ensure that only disease-free animals are delivered to the facility.

3.1.9. Hides, Skins and Leather Trade Act, Cap 359

This act provides for the coordination and control of the trade and development of the HSL industry. It requires one to be licensed to buy hides, skins or leather for the purposes of resale, tanning, and manufacturing of goods in Kenya or for export. The Act also gives guidelines on export and import of HSL. Through its provisions, this Act enables the estimation of actual domestic beef production capacity or volume of imports from the number of hides traded.

Comment/recommendations: Hides and skins are among the by-products expected once the facility becomes operational. The proponent has already established a modern hides and skins storage facility near the proposed project site. In compliance with the provisions of this Act, the proponent shall ensure adherence to the guidelines as stipulated.

3.1.10. Kenya Stock Traders Licensing Act, Cap 498 – Revised 1993

The Stock Traders Licensing Act, CAP 498 implies that 'No persons shall carry on the trade or business of a stock trader without a license, whether as a principal, partner or agent. The exceptions are farmers who buy, sell or barter stock in the course of their business as farmers and residents in special areas set apart for the use of the tribe to which they belong. The Act empowers County Commissioners to issue stock trader licenses, while the police, administrative, veterinary officers or inspectors are empowered to inspect the license on

demand. This Act provides the Veterinary Director with the following powers: declare areas infected, issue provisions affecting infected areas (isolation, disinfections and movement of animals), search for infected animals; prohibit importation of animals, slaughter and disposal of forfeited animals and carcass of infected animals, search and detain suspects; indemnity and payment of compensation; and prescribe fees for drugs and vaccines, prohibit use of vaccines or drugs. The Act also incorporates the subsidiary legislation of the animal disease rules related to: importation of animals; movement of animals; and infected Areas. The legislation also covers the examination of imported animals, certificates required for imported animals, tests to be carried out, quarantine procedures and the requirements of other certificates if necessary.

Comment/recommendations: The compliance with the provisions of this Act shall ensure delivery of quality and disease free animals to the proposed facility. The proponent shall enhance the capacity of animal health inspection, prohibit and control unnecessary importation of livestock into the County and implement all necessary quarantine procedures. To enhance implementation of this Act, the proponent shall work in collaboration with neighbouring counties to ensure compliance over a wider area.

3.1.11. Stock and Produce Theft Act, Cap 355

This act provides for penalties imposed for the theft of stock or produce and to make persons liable to account for the possession of stock or produce in certain cases.

Comment/recommendations: The proponent to ensure that the operation of the facility do not contravene the stipulations of Act. No stolen animals shall be accepted at the facility.

3.1.12. The Water Act No. 8 of 2002

The Water Act was gazetted in October 2002 as the Water Act, 2002 and went into effect in 2003 when effective implementation of its provisions commenced. The legal framework under the Water Act 2002 provides the guidelines in line with the existing policy changes, four key institutions with separate functions and decentralized decision making systems. These are Water Service Boards (WSBs); Water Service Providers (WSPs); Water Resources Management Authority (WRMA) and Water Services Regulatory Board (WSRB). In furtherance to the Water Act 2002, the relevant Ministry and Water resources Management Authority (WRMA) in collaboration with other stakeholders prepared a set of Regulations Gazetted under the Legal Notice No. 171 of 28th September 2007 to give guidelines on water permit acquisition and adherence to conditions attached and also enforcement of the user fee charges.

Comment/recommendations: The proponent shall undertake regular monitoring of waste water from the proposed facility and undertake regular recording of water use to help understand the variations that may be caused by misuse to prompt action - a

measure that ensures efficient use of water.

3.1.13. The Physical Planning Act Cap 286

Physical Planning Act is a fundamental Act of Parliament that provides for preparation of local-physical development plans giving the local authority power to prohibit or control development activities in their jurisdictions by checking on the content of the plans, process of preparation and ultimate approval. Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority. In principle, the Planning Act ensures that all developments and other changes to land are vetted and approved as to ensure order, harmony, health and economy of the different uses on any land. The Act also promotes public participation in the preparation of plans and requires that in preparation of plans proper considerations be given to the potential for economic and social development.

Comment/recommendations: The proponent shall adhere to all the requirements of the Act as provided including applying and complying with the change of user guidelines through the relevant physical planning authorities.

3.1.14. Occupational Health and Safety Act, 2007

This Act was enacted to give general and specific guidelines on management of Occupational Health and Safety in work places. Section 23 establishes the office of the Directorate of Occupational Safety and Health Services. The office of the Director is charged with the responsibility of coordinating the operations of the Occupational Health and Safety Department. In section 27, the Act establishes the National Council for Occupational Safety and Health. The Act outlines several measures that need to be in place for the management of the Occupational Health and Safety, these measures include: (i) formulation and implementation of an occupational health and safety policy; (ii) establishment of the safety and health committees where there are at least 20 employees in an establishment. The Director may direct establishment of a committee at any other workplace; (iii) reporting of accidents to the Director of Safety and Occupational Health; and (iv) a proponent is bound by the Act by virtue of being an employer, and it is imperative that the Act be applied to safeguard the Safety and Health of workers at all the phases of projects. This is especially so in matters related to working with mobile / moving parts equipment and other implements used in the construction sites. The Act requires the proponent to: (i) comply with general duties with respect to health and safety in the workplace. Such duties include undertaking S&H risk assessments, S&H audits, notification of accidents, injuries and dangerous occurrences, etc.; (ii) register the facility with the DOSHS; (iii) maintain cleanliness in the facility, avoid overcrowding and provide ventilation; (iv) ensure safe operation of

machinery and including all prime movers and transmission equipment; and (v) provide a General Register for recording amongst other things all incidents, accidents and Occupational injuries.

Comment/recommendations: The proponent shall ensure strict adherence to the provisions of the Act and all the accompanying regulatory requirements. Cleanliness and tidiness of the facility to be maintained to the highest acceptable standards. This will ensure that the welfare and hygiene of staff is taken care of. A first aider and first aid box need to be supplied and stocked adequately.

3.1.15. Energy Act, 2006

The Energy Act 2006 was enacted in 2006 and received Presidential assent on 30th December 2006. It is an Act of Parliament to amend and consolidate the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes. The Energy Act upon commencement repealed the Electric Power Act, 1997 as well as the Petroleum Act, Chapter 116 of the Laws of Kenya.

Comment/recommendations: The proponent shall install energy saving devices and invest in renewable energy sources (solar and wind) abundant in the area to supplement the energy demand at the facility. Additionally, the proponent shall institute regular monitoring of energy use to identify areas in which unnecessary usage can be reduced. The facility also needs to be supplied with a standby generator.

3.1.16. The County Government Act

The County Government of Samburu has By-Laws consistent with the County Government Act and provides for the necessary easements for the facility.

Comment/recommendations: Ensure strict adherence and compliance status with conditions for approval issued by various Samburu County Government departments including ensuring that all the necessary licenses and permits to operate are up to date.

3.1.17. Penal Code (Cap 63)

The Chapter on "Offences against Health and Conveniences" contained in the Penal Code strictly prohibits the release of foul air into the environment which affects health of other persons. Any person, who voluntarily violates the atmosphere at any place to make it noxious to human health in general dwellings or business premises in the neighbourhoods or those passing along public way, commits an offence.

Comment/recommendations: The proponent to ensure that the operation of the facility do not contravene the stipulations of Act.

3.2. National Regulations and Guidelines

3.2.1. *Environmental (Impact Assessment and Audit) Regulations, 2003*

These reiterate EMCA on the need for concluding and approval of an environmental impact assessment project report before project undertaking, and undertaking regular environmental audits to confirm the levels of compliance with the environmental management guidelines. A comprehensive ESIA and EA promotes safe and healthy environment in the operations of facilities such as the proposed abattoir as it offers opportunity to institute measures to mitigate potential environment threats.

Comment/recommendations: The proponent has engaged the services of licensed ESIA firm of experts to undertake ESIA study. The proponent shall also undertake to engage experts to undertake annual EA and use audit findings to strengthen environmental management systems for the proposed facility.

3.2.2. *EMC Noise Prevention and Control Rules 2009*

Legal Notice No. 61 as effected in November 2009 is meant to regulate noise and vibrations across the spectrum of various activities. The regulations give the noise limits applicable at different times of the day and has provisioned for issuance of licences and permits for noise levels exceeding the stated standards. For regulation of noise at workplaces, these regulations have given reference to the Factories and other places of Work Act regulations on noise at workplaces. The Rules requires the proponent and the management to: (i) develop, rollout and implement a written hearing conservation program if the noise generated from their operations exceeds the permissible levels stipulated in the Rules; (ii) ensure that any equipment brought to a site in Kenya for use shall be designed or have built in noise reduction devices that do not exceed 90 dB (A); and (iii) medically examine those employees that may be exposed to continuous noise levels of 85 dB (A). The facility has minimal noise, except from the surrounding facilities.

Comment/recommendations: Supply employees with appropriate noise prevention gears to be used in incidences of noise levels exceeding 90dB (A). The contractors will also strive to maintain the noise-generating equipment to the best service conditions during the construction phase of the project. During the operation phase, all efforts should be made to minimize noise from animals meant for slaughter.

3.2.3. *EMCA (Waste Management) Regulation, 2006*

The Waste Management Regulations (2006) are contained in the Kenya Gazette No. 69, Legal Notice No. 121. The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. The Regulations requires the project to among others: (i) segregate waste (hazardous and non-hazardous) by type and

then disposes them in an environmentally acceptable manner; (ii) use only licensed Waste Carriers for collection of wastes; (iii) avoid littering during waste transportation; (iv) install anti-pollution technology for treatment of waste, and (v) label hazardous waste containers in accordance with section 24 of the Regulations. Generally, the regulations place emphasis on waste minimization, cleaner production and segregation of waste at source.

Comment/recommendations: The proponent shall set a functional waste management system and disposal procedures for wastes generated from the facility. This should among other involve segregation of wastes (hazardous and non-hazardous) in all phases of the project, and engage the services of licensed waste handlers.

3.2.4. EMC (Water Quality) Regulations, 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006. These regulations apply to water used for a variety of purposes, including water used for domestic purposes, industrial, purposes, agricultural purposes etc. They protect lakes, rivers, streams, springs, wells and other water sources whereby contravening the regulations is an offence that attracts a fine not exceeding five hundred thousand shillings. The Regulations set the standards for diverse waters namely: - water for domestic use, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. The rules further stipulate the quality standards for water to be disposed either directly into nature or through the sewage network. These Regulations outline: Quality standards for sources of domestic water; Quality monitoring for sources of domestic water; Standards for effluent discharge into the environment; Monitoring guide for discharge into the environment; Standards for effluent discharge into public sewers; Monitoring for discharge of treated effluent into the environment. LN 120 requires that a Discharge Permit be obtained for all water disposed into the environment from any premises. The Regulation requires the proponent (Samburu County Government) to refrain from any activity which might cause water pollution, not to discharge any liquid, gaseous or solid into water resource as to cause pollution.

Comment/recommendations: The proponent is expected to install waste water pre-treatment facility at the proposed project site for purposes of treating waste water before discharge to the environment. Additionally, the proponent shall install water saving devices to ensure efficient use of water during all the phases of the project and apply for waste water discharge permits.

3.2.5. EMC (Air Quality Standards) Regulations, 2008

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required stipulated under the

provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits). These Regulations prohibit the project management from: (i) acting in a way that directly or indirectly cause or may cause air pollution to exceed levels set out in the second schedule to the regulations; (ii) allowing particulates emissions into the atmosphere from any source not listed in the sixth schedule of the regulations; (iii) causing ambient air quality in controlled areas (listed in schedule thirteen) to exceed those stipulated under second schedule, and (iv) allowing emission of particulate matter above the limits stipulated in second schedule.

Comment/recommendations: Abattoirs can be a major source of air pollution. The proponent is expected to carry out regular air quality measurement and take necessary remedial actions as per the air quality mitigation measures and management plan as outlined in this report.

3.2.6. The Conservation of Biological Diversity Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes Conservation of threatened species, inventory and monitoring of biodiversity and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

Comment/recommendations: Although no threatened or endangered species were observed at the proposed project site, some species of birds and insects were recorded at the site. The proponent needs to ensure that the site is maintained as pristine as possible to ensure that the fauna and flora in the surrounds of the site thrive.

3.2.7. Medical examination Rules, 2005

This legislation requires the proponent to mandatorily undertake medical evaluations of workers especially those who handle food or food products. The workers are expected to undergo medical evaluations by a registered medical health practitioner duly registered by the DOSHS.

Comment/recommendations: The proponent shall institute and implement regular medical examinations for its staff at the facility.

3.2.8. Fire Risk Reduction Rules, 2007

The Rules requires the proponent to: (i) ensure that all flammable materials are stored in appropriately designed receptacles; (ii) ensure that electrical equipment is installed in accordance with the respective hazardous area classification system. It also requires that all electrical equipment is inspected after every six (6) months by a competent person and records of such inspections be kept; (v) clearly delineate fire escape exits; (vi) appoint firefighting team and ensure they undergo a training course in firefighting provided by a

DOSHS approved institution; (vii) mandatorily undertake fire drills at least once in a year; (viii) properly mark assembly points; (ix) display “No Smoking” signs wherever flammable vapours may be present; (x) install fire detection systems in their premises which must be connected to audible and visual flashing devices and be maintained regularly to ensure their integrity at all times; (xi) install and maintain firefighting systems in workplaces; (xii) mount fire extinguishers at least 60cm above ground while each fire hose reel must be located within a radius of 30m; (xiii) colour code all their pipelines according to the product being conveyed by them; (xiv) have adequate fire water storage capacity. As a minimum this regulation requires the facility to have at least 10m³ of dedicated fire water storage capacity; (xv) develop, rollout and implement a comprehensive written Fire Safety Policy, and (xvi) undertake annual fire safety audits.

Comment/recommendations: The proponent to develop and implement EHS policy for the facility, and provide adequate fire fighting equipment at the facility.

3.2.9. Building Code 2009

Building Code 2009 provides detailed account on designs for different structures. Most relevant to abattoir is Section 17.1 (a) of the building code which states that any building used as a stable, garage, cowshed, dairy, kennel, butchery, abattoir or any vehicle washing area or other similar area that requires regular cleansing which produces waste water or soil water shall be connected to a drain which shall serve such building or area, and such area shall be paved with an approved impervious material, and be graded to a gully which shall be fitted with a removable grating and be connected to an approved silt trap, grease trap, petrol and oil interceptor or two or more of the foregoing.

Comment/recommendations: The architectural design for the proposed abattoir has been made and conforms to the Building Code 2009 in many ways. All sanitation and drainage systems have been designed according to the building code.

3.3. Best practices in meat processing and handling

3.3.1. Global food safety initiative schemes

While operation and maintenance is mandatory for registered abattoir facilities in Kenya, there is a growing trend for food processors in general to also be required by their customers to implement, obtain and maintain certification of a Global Food Safety Initiative (GFSI) – benchmarked scheme. Current benchmarked schemes include SQF (Safe Quality Food), BRC (British Retail Consortium) and numerous others. Some international customers may require a processor to implement a specific GFSI scheme, although they are all supposed to be considered equivalent in delivering food safety, quality and legality. Certification is obtained through scheme holder - endorsed third party certification bodies.

3.3.2. Overview of best practices in meat processing meat handling

3.3.2.1. Equipment

Slaughtering equipment, particularly for smaller-scale operations, need not be elaborate and expensive. The amount of equipment will depend on the slaughtering procedures employed. If possible, all equipment should be made of stainless steel or plastic, be rust resistant and easily cleaned and sanitized. Equipment which does not get in contact with the meat (e.g. overhead rails, working platforms, knocking pen) is usually made of galvanized steel.

3.3.2.2. Treatment of livestock before slaughter and its impact on meat quality

Stress in its many forms, e.g. deprivation of water or food, rough handling, exhaustion due to transporting over long distances, mixing of animals reared separately resulting in fighting, is unacceptable from an animal welfare viewpoint and should also be avoided because of its deleterious effects on meat quality. From loading on the farm to the stunning pen animals must be treated kindly, and the lorries, lairages and equipment for livestock handling must be designed to facilitate humane treatment.

3.3.2.3. Stunning and bleeding of slaughter animals

Most countries have legislation requiring that animals are rendered unconscious (stunned) by a humane method prior to bleeding. Exceptions are made for religions which require that ritual slaughter without prior stunning is practised, provided the slaughter method is humane. Stunning also makes sticking (throat-slitting) less hazardous for the operator. The animal must be unconscious long enough for sticking to be carried out, and for brain death to result from the lack of blood supply.

3.3.2.4. Scalding and de-hairing

Scalding in water at around 60°C for about six minutes loosens the hair in the follicle. Too low a temperature and the hair will not be loosened and too high a temperature and the skin will be cooked and the hair difficult to remove. To check the effectiveness of the scald, rub the skin with the thumb to see if hair comes away easily. Some machines have the thermostatic controls and timers. To reduce contamination, scalding water should be changed frequently.

3.3.2.5. Skinning of cattle and small ruminants

The outer side of the hide must never touch the skinned surface of the carcass. Operators must not touch the skinned surface with the hand that was in contact with the skin. After bleeding, while the animal is still hanging from the shackling chain, the horns are removed and the head is skinned. The head is detached by cutting through the neck muscles and the

occipital joint. Skin and remove the legs at the carpal (foreleg) and tarsal (hind leg) joints. The forelegs should not be skinned or removed before the carcass is lowered on to the dressing cradle or the cut surfaces will be contaminated. The hooves may be left attached to the hide.

3.3.2.6. Evisceration

For all species care must be taken in all operations not to puncture the viscera. All viscera must be identified with the carcass until the veterinary inspection has been passed. After inspection the viscera should be chilled on racks etc. for better air circulation. In the combined horizontal/ vertical system this is done with the animal resting on the cradle. The carcass is then raised to the half-hoist position and when hide removal is complete the abdominal cavity is cut carefully along the middle line. The carcass is then fully hoisted to hang clear of the floor so that the viscera fall out under their own weight. They are separated into thoracic viscera, paunch and intestines for inspection and cleaning. If any of the stomachs or intestines are to be saved for human consumption, ties are made at the oesophagus/stomach, stomach/duodenum boundaries, the oesophagus and rectum having been tied off during hide removal. This prevents cross-contamination between the paunch and the intestines.

3.3.2.6. Splitting, washing and dressing of carcasses

Work facing the back of the carcass. Split the carcass down the backbone (chine) with a saw or cleaver from the pelvis to the neck. Sawing gives a better result but bone dust must be removed. If a cleaver is used, it may be necessary to saw through the rump and loin in older animals. The saw and cleaver should be sterilized in hot (82°C) water between carcasses. Power saws increase productivity.

3.3.2.7. Refrigeration

Carcasses should go into the cooler as soon as possible and should be as dry as possible. The object of refrigeration is to retard bacterial growth and extend the shelf-life. Chilling meat post-mortem from 40°C down to 0°C and keeping it cold will give a shelf-life of up to three weeks, provided high standards of hygiene were observed during slaughter and dressing. Carcasses must be placed in the cooler immediately after weighing. They must hang on rails and never touch the floor. After several hours the outside of a carcass will feel cool to the touch, but the important temperature is that deep inside the carcass. This must be measured with a probe thermometer (not glass), and used as a guide to the efficiency of the cooling.

3.3.3. Carcass handling

3.3.3.1. Refrigerated meat

Chilled meat must be kept cold until it is sold or cooked. If the cold chain is broken, condensation forms and microbes grow rapidly. The same rules about not overloading, leaving space for air circulation, opening doors as little as possible and observing the highest hygiene standards when handling the meat apply. An ideal storage temperature for fresh meat is just above its freezing point, which is about - 1°C (- 3°C for bacon because of the presence of salt). The expected storage life according to International Institute of Refrigeration for various types of meat held at these temperatures are as shown in Table 1.

Table 1: Expected lifespan for different meat types under refrigeration

Type of meat	Expected storage life at - 1°C
Beef	up to 3 weeks (4–5 with strict hygiene)
Veal	1–3 weeks
Lamb	10–15 days
Edible offal	7 days

Under commercial conditions, meat temperatures are rarely kept at - 1°C to 0°C, so actual storage times are less than expected. The times would also be reduced if RH were greater than 90 percent. Meat should be placed in the refrigerator immediately following receipt. Any parts which show signs of mould growth or bacterial slime should be trimmed off and destroyed. Hands must be thoroughly washed after handling such trimmings and knives must be sterilized in boiling water. The refrigerator should be thoroughly cleaned after finding such meat and should also be cleaned on a regular basis. Carcasses, quarters and large primals should not be cut into smaller portions before it is necessary as this will expose a greater surface area for bacteria to grow. Freshly cut surfaces are moist and provide a better medium for bacterial growth than the desiccated outer surfaces of cuts that have been stored for some time. An accurate thermometer should be placed in the refrigerator and checked regularly. The temperature should remain within a narrow range (0° to + 1°C).

3.3.3.2. Transport of meat with refrigeration

Vehicles for transporting meat and carcasses should be considered as an extension of the refrigerated storage. The object must be to maintain the meat temperature at or near 0°C. Meat should be chilled to 0°C before loading. Meat should hang on rails, not on the floor. If stockinettes are put on carcasses they must be clean. Meat trucks should not carry anything other than meat. The refrigeration is usually produced by injecting liquid nitrogen or carbon dioxide (CO₂) into the compartment or by blowing air over CO₂ chunks (dry ice). The temperature in these vans can be set and controlled to minimize the temperature rise and to avoid condensation on the meat surface. Insulated vans without refrigeration may be refrigerated by adding dry ice. While this is a reasonably good alternative to the

refrigerated truck it does not allow the temperature to be controlled. Uninsulated vans and open trucks should not be considered as suitable transport for meat, particularly in hot climates. In addition to the temperature abuse, condensation will occur when the meat goes back into refrigeration and in open trucks the meat is exposed to attack from insects. Loading and unloading should be done quickly. If there are any unavoidable delays then dry-ice blocks should be placed in the partly filled van.

3.3.3.3. Carcass and meat handling and marketing without refrigeration

Where refrigeration is unavailable either owing to financial or technical reasons (e.g. no power supply), the shelf-life of meat is reduced to days or hours, not weeks. Slaughter and dressing must be near the point of sale and it must be quick and clean. If carcasses and meat are kept in well-insulated rooms, the temperature can be reduced with dry-ice blocks, if these are available. Since it is easier to chill boneless cuts rather than whole carcasses, hot-boning should be considered. Stock must be handled carefully to avoid producing high-pH meat which will spoil more quickly. Rooms used for slaughter and handling meat must be clean and well ventilated, but out of direct sunlight, dust-free and vermin free (rodents and insects). Hot water (82°C) must be available to clean all equipment and surfaces and personnel must work very hygienically. Receive all blood into sealed containers and have separate skips on wheels for hooves, skins, green offal and trimmings.

3.3.3.4. Storage and transport without refrigeration

Meat should be put on sale within a day of slaughter. If it has to be held it should be hung in a clean, well-lit hall with good ventilation. Insects, rodents and birds must be kept out, dust must not blow in. Trays of offal should be on shelves, not on the floor. Barrows for wheeling carcasses and quarters are better than carrying on shoulders, as they can be cleaned frequently. All staff must wear clean clothing and observe strict personal hygiene. Transport of non-refrigerated meat is very hazardous. If meat is to be put in stockinettes and sacks these must be very clean. Meat should be on rails in the truck or wagon, and it is not advisable to carry it more than a day's journey before sale.

CHAPTER 4: BASELINE INFORMATION

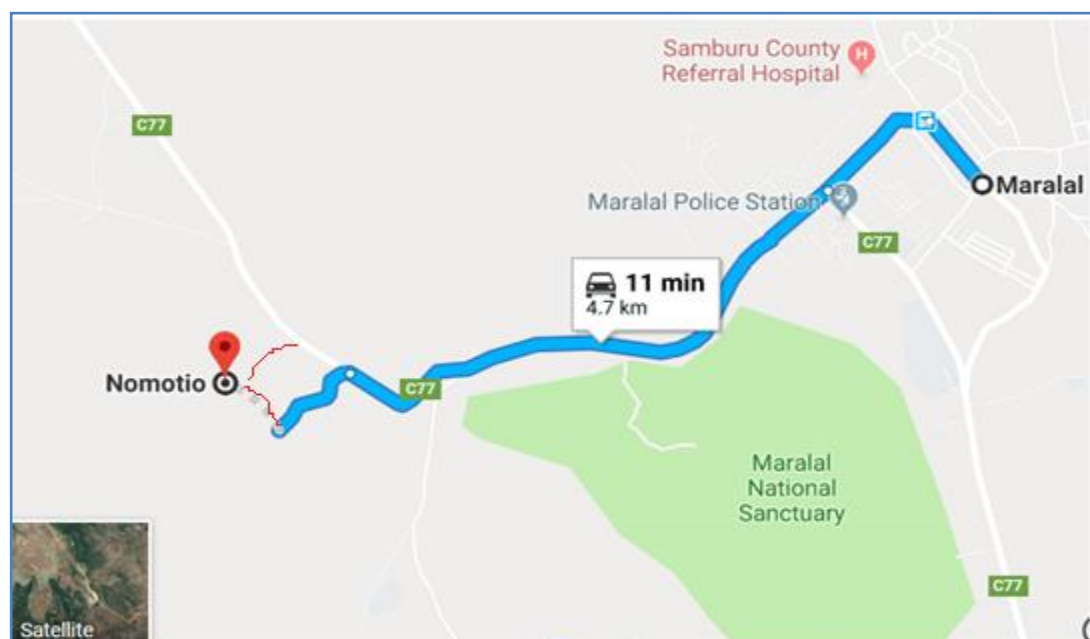
This chapter addresses the Environmental, Social and Economic profile and baseline information for Nomotio area, Samburu Central Sub-county, Samburu County. The proposed project will be on Nomotio LIC Farm - a community managed livestock improvement centre, and is expected to bring changes that are more positive to this agricultural land. Currently Samburu County does not have a modern and state of the art abattoir to serve the increasing demand for quality meat products for which the county is renowned. Additionally, the abattoir will support livestock trade as traders will use the facility to process carcasses for long-distance markets instead of moving livestock as has been the case over the years. Overall, the proposed investment shall be of its kind in the area, and in the entire Samburu County.

4.1. Environmental and ecological baseline

4.1.1. Project location

The proposed abattoir will be established at Nomotio (1°03'10"N, 36°41'14"E) and at an altitude of 1937m. Nomotio area is approximately 4.7km to the west of Maralal Town (Figure 8). The facility will be established in a government owned livestock improvement centre, and near the existing Meloni Cooperative Tannery – about 1 km to the western side of the existing tannery structure. Details of land ownership documents are provided in Annex 1 of this report.

Figure 8: Location of Nomotio from Maralal Town, Samburu County



4.1.2. Physical environment – topography, geology and soils

Samburu County consists of several highlands, plateaus and lowlands including the famous Suguta Valley. High-level plateaus built by repeated floods of lava from the Rift Valley dominate the eastern part of the Suguta Valley with Kirisia rising to 2,500m above sea level being the highest point of the plateau. The soils are mostly well-drained phaezems although some parts are covered by shallow lithosols including areas around Suguta Marmar where the risk of flooding is classified as medium. The geology and soils of Nomotio area is underlain by the basement system rocks (pre-cambrian) mostly dominated by metamorphic sediments. The rocks are generally granular in texture and intermediate in composition. The farm is located a few kilometres from water dams supplying Maralal Town in a fairly hilly area undulating with breaks in slopes. The proposed has characteristic loam soil with under layer rock basement.

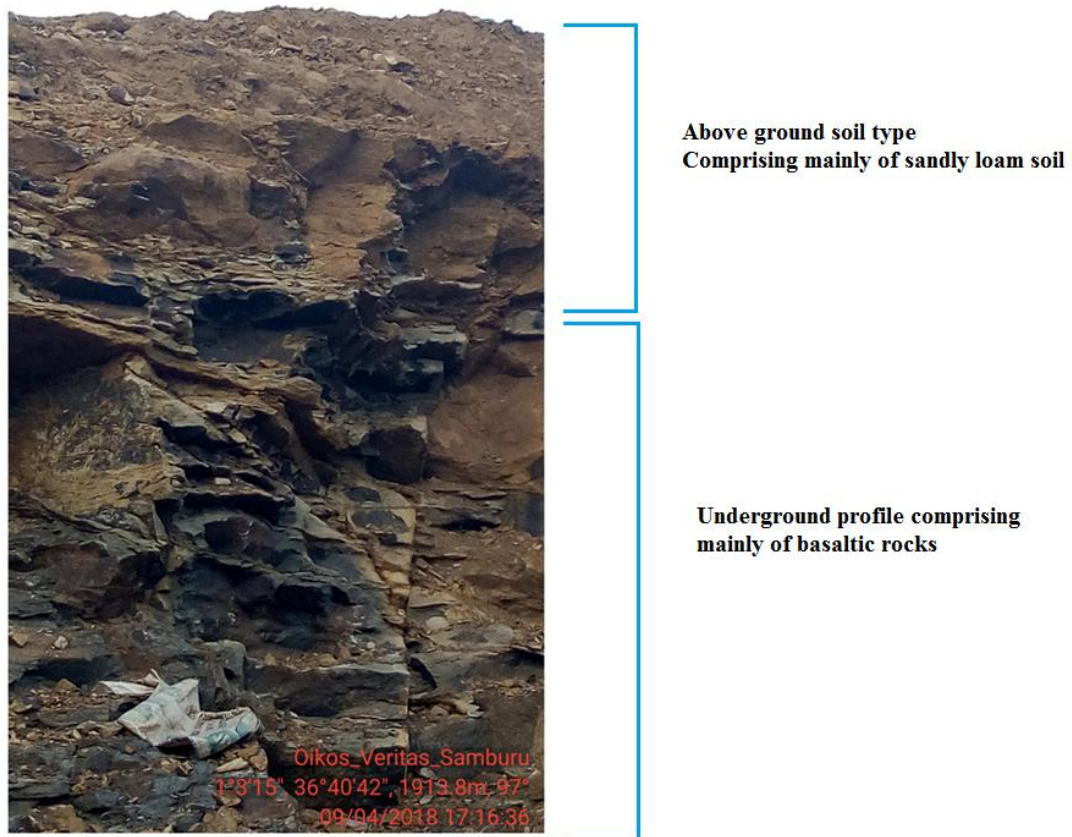


Plate 0-1: Characteristic soil layers at the proposed site for the abattoir

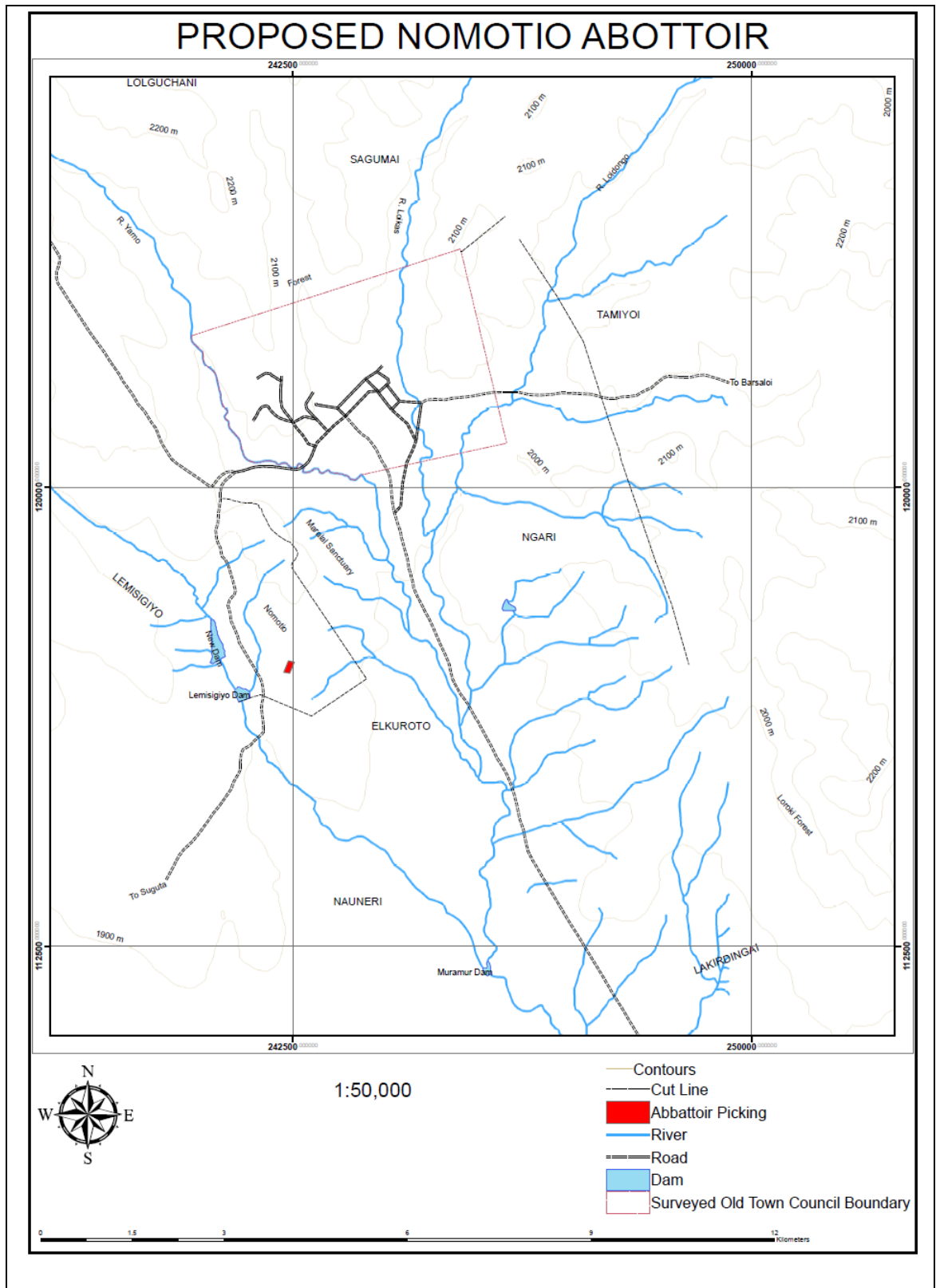
4.1.3. Topography and drainage

Most rivers in Samburu County tend to be seasonal and only flow during short periods after rain. At many places surface water is stored behind dams and in pans. However, storage capacities reduce over time due to siltation caused by erosion and evaporation. The chemical quality of the surface water is/generally good, but bacteriological contamination is common in some dams. Figure 9 shows the drainage system of the proposed abattoir location. Nomotio and Laikas Rivers are the major rivers near the proposed site. The proposed abattoir will be located at a site downstream from Nomotio Dam, hence chances for contamination of the Maralal main water source is minimal. However, Muramur and Silangiro Dams located further downstream could be vulnerable from wastewater pollution from the proposed abattoir if the wastewater is not properly managed. Table 2 shows the coordinate points with the respective altitudes recorded in and around the proposed abattoir.

Table 2: Coordinates and altitudes recorded around the proposed abattoir site

Name	Coordinates	Altitude (m)	Average Altitude (m)
Proposed abattoir/tannery	1°03'10"N, 36°41'13"E	1932.5	1937
	1°03'11"N, 36°41'13"E	1941.6	
	1°03'10"N, 36°41'14"E	1947.9	
	1°03'10"N, 36°41'15"E	1928.9	
	1°03'09"N, 36°41'16"E	1928.6	
	1°03'10"N, 36°41'18"E	1939.6	
	1°03'10"N, 36°41'19"E	1944.0	
	1°03'09"N, 36°41'27"E	1913.6	
	1°03'12"N, 36°41'17"E	1936.6	
	1°03'15"N, 36°41'19"E	1939.4	
	1°03'15"N, 36°41'31"E	1933.2	
	1°03'18"N, 36°41'13"E	1945.6	
	1°03'10"N, 36°41'14"E	1946.2	
Abandoned site	1°03'10"N, 36°41'14"E	1968	1968
Road	1°04'03"N, 36°40'41"E	1970.0	1970
Nomotio Dams	1°03'11"N, 36°40'37"E	1925.0	1934
	1°03'27"N, 36°40'37"E	1931.0	
	1°03'27"N, 36°40'36"E	1934.7	
	1°03'26"N, 36°40'35"E	1939.9	
	1°03'26"N, 36°40'38"E	1939.3	
	1°03'28"N, 36°40'41"E	1934.8	
Maralal Mixed Sec. School	1°02'57"N, 36°41'21"E	1948.0	1952
	1°02'58"N, 36°41'20"E	1953.0	
	1°02'55"N, 36°41'22" E	1956.0	

Figure 9: Drainage system of the proposed abattoir location



4.1.4. Ecological conditions

Samburu County is divided into five ecological zones. Details about the zones are provided in the Spatial Plan chapter of this document. The five ecological zones and their descriptions are as follows: (i) *tropical alpine zone* (altitude: 1,980m-2,040m; annual average rainfall: 600mm-800mm; temperatures: 21°C-25°C); (ii) *Upper highland zone* (altitude: 2,150m-2,600m, average rainfall: 900mm-1,000mm, temperatures: 15°C-19°C); (iii) *Lower highland zone* (altitude: 1,800m - 1,980m, annual average rainfall: 750mm. temperature: 14°C-17°C); (iv) *Lower midland zone* (altitudes: below 1,300m, average annual rainfall: 720mm, mean temperatures: 22°C-27°C); and (v) *Lowland zone* (altitudes: 600m-1,450m, mean annual rainfall: 700mm, temperatures: 30°C-33°C). The proposed site for the abattoir construction is dominated by *Acacia tortilis* with interspersed with grasslands used mainly for livestock grazing.

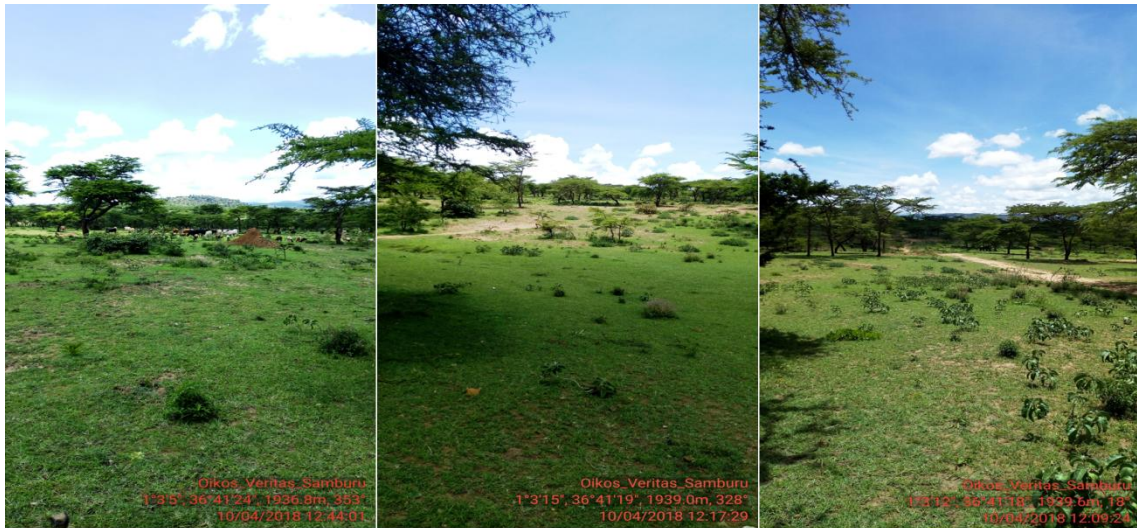
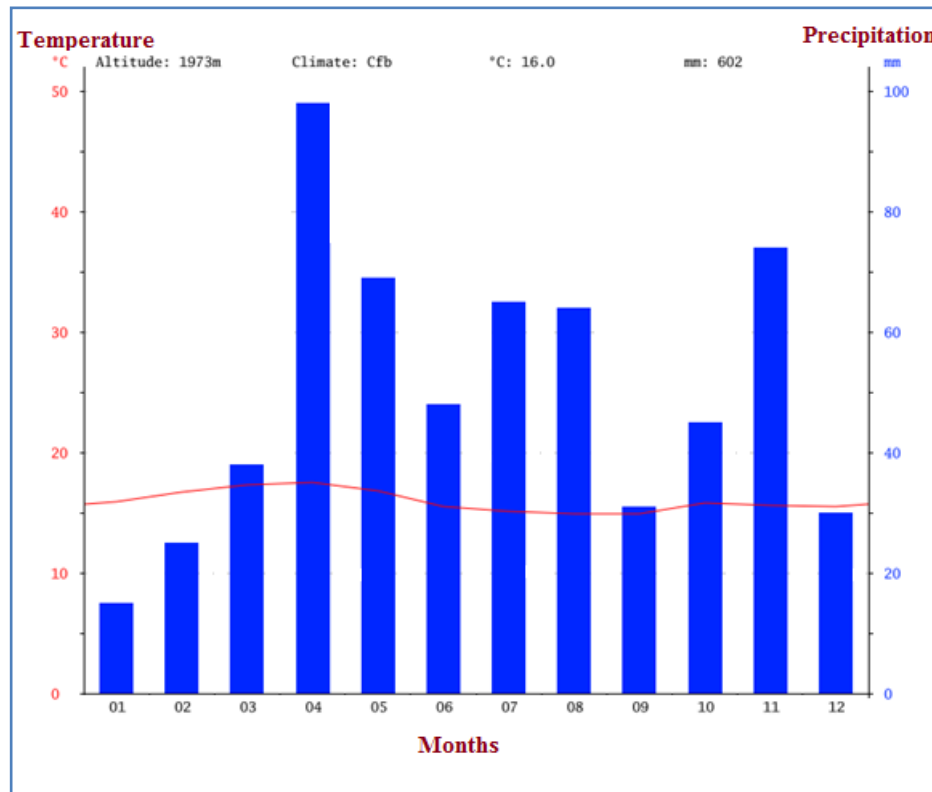


Plate 0-2: Characteristic flora found at the proposed abattoir site (*Acacia tortilis* interspersed in open grassland is the dominant plant species)

4.1.5. Climatic conditions

Samburu County is within arid and semi-arid area of Kenya. Rainfall is erratic and varies significantly both in temporal and spatial scales (Figure 10). The County experiences both short and long rains with driest months in January and February. The long rains are in the months of March, April and May. Apart from South Horr and Wamba areas, short rains occur during the months of July and August, sometimes extending into September. Nomotio area just like Maralal has warm and temperate climate with temperatures generally in the range of between 24°C and 33°C. The month of January experiences the highest temperature of 33°C and the month of July is the coldest month with 24°C.

Figure 10: Climograph of Maralal and surrounding areas including Nomotio LIC farm

(Source: <https://en.climate-data.org/location/11139/>)

4.1.6. Biological environment (flora and fauna)

Samburu County has a total of 3,250 km² of gazetted forests translating to a 15% forest cover. The forests consist of mainly of indigenous forests uniformly distributed across the county. Different tree species exist in these forests, with the dominant species being *Acacia*, especially in the lowlands of Samburu North and Samburu East as well as sections of Samburu Central. The highland tree species include: cedar, podo, cape chestnut and *Olea africana* amongst others. Samburu County is endowed with a variety of wildlife, and the County boasts the largest number of game wildlife outside protected area systems in Kenya. Some of the wild animals found in the County include; giraffes, the endangered Grevy's zebra, lions, elephants, buffalos, birds and different species of small wild game. Full list of bird species recorded at the proposed abattoir site is provided in Annex 5. The proposed site is dominated by *Acacia tortilis* interspersed with grasslands used for livestock grazing by LIC farm and the local communities. Different bird, arthropod and burrowing rodents are known to occur at the proposed site but none is listed in the IUCN threat categories.

4.1.7. Environment and climate change

Over 90 percent of Samburu County is ASAL. Given that over 80 percent of the population of the county relies on land to support livelihoods, activities such as charcoal burning, overstocking and crop cultivation in the catchment areas and wetlands has contributed greatly to the destruction of the environment. These practices coupled with low environmental education, weak enforcement of legislations, poor community participation as well as weak institutions at local level has contributed heavily to environmental degradation in the County. Samburu County has not been spared impacts of the vagaries of climate change and environmental degradation. The County has witnessed repeated droughts, occasional floods and reduced vegetation cover and diminishing surface water volumes overtime. These have greatly affected crop farming and livestock rearing leading to the current poverty situation in the County.

4.2. Socio-economic baseline

The socio-economic baseline of the project area is discussed in terms of social characteristics, economic setting, health setting, infrastructure and security and public safety. Samburu County lies within the arid and semi-arid parts of Kenya in the northern part of the Great Rift Valley. It covers an area of 21,022.1 square kilometres and borders the counties of Turkana to the northwest, Baringo to the southwest, Marsabit to the northeast, Isiolo to the East and Laikipia to the South. The County is marked by latitudes 0°30' and 2° 45' north of the equator and longitudes 36°15' and 38° 10' east of the Prime Meridian. Maralal town is the current county headquarters.

4.2.1. Administrative and Political Units

Samburu County is divided into three administrative sub-counties namely Samburu Central, Samburu East and Samburu North. These are further sub-divided into 7 divisions, 39 locations and 108 sub-locations as shown in Table 3. Politically, the county comprises three constituencies namely Samburu West, Samburu North and Samburu East which are further sub-divided into 15 county wards as presented in Table 4. The proposed project site is marked by 37N 02424 UTM 01168 and is located in Lkuroto Sub-location, Maralal Urban Location, Kirsia Division in Samburu Central Sub-county of Samburu County.

Table 3: Administrative Units of Samburu County

Sub-county	Division	Area (sq. Km)	No. of locations	No. of sub-locations
Samburu Central	Lorroki	1,399.3	6	17
	Kirisia	1,237.7	5	18
	Malasso	1,300.3	3	11
Samburu East	Wamba	4,670.8	8	19
	Waso	5,378.9	4	10
Samburu North	Baragoi	4,024.4	7	17
	Nyiro	3,010.7	6	16
Total		21,022.1	39	108

Source: Samburu County Commissioner's Office

Table 4: Political Units of Samburu County

Constituency	No. of County Wards	Ward Name	Area in Sq. Km.
Samburu West	5	Lodokejek	864.6
		Suguta Marmar	859
		Maralal	524.9
		Loosuk	690.8
		Porro	998
Samburu North	6	El-barta	722.4
		Nachola	1,979
		Ndoto	1,476.9
		Nyiro	1,489.1
		Angata Nanyokie	529.6
		Baawa	838.1
Samburu East	4	Waso	5,088.9
		Wamba West	999.4
		Wamba East	1,567.5
		Wamba North	2,393.9
Total	15		21,022.1

Source: Independent Electoral and Boundaries Commission

4.2.2. Demography

According to the 2009 Population and Housing Census, the population of Samburu County was 223,947. Given a population growth rate of 4.45 percent per annum, as opposed to the national growth rate of 3 percent, the County population is projected to increase to 292,484 by 2015 and 319,708 by 2017. These changes represent about 25% population rise between 2012 and 2017. The population density is expected to rise to 14 and 15 persons per Km² by 2015 and 2017 respectively. Samburu West constituency had the highest population density of 21 persons per Km². Samburu north and Samburu East had 14 and 6 persons per Km² respectively. According to urban areas and cities Act 2011 only Maralal town qualifies as an urban centre in the County. Generally, the major urban centres (Table 5) are experiencing rapid population growth.

Table 5: Population projections by urban areas and their projections in Samburu County

Urban Centre	Population Projections								
	2009 Census			2015			2017		
	M	F	T	M	F	T	M	F	T
Maralal	6,175	6,256	12,431	8,065	8,171	16,236	8,815	8,931	17,746
Suguta Marmar	1,989	2,184	4,173	2,598	2,852	5,450	2,840	3,118	5,958
Kisima	1,997	2,556	4,553	2,608	3,338	5,946	2,851	3,649	6,500
Wamba	3,144	3,103	6,247	4,106	4,053	8,159	4,488	4,430	8,918
Archer's Post	3,226	3,049	6,275	4,213	3,982	8,195	4,605	4,353	8,958
Baragoi	2,307	2,387	4,694	3,013	3,118	6,131	3,293	3,408	6,701

Source: KNBS, 2013

4.2.3. Education and Literacy

According to the Samburu County Annual Development Plan, 2018 – 2019, the county has 529 ECD schools with a total enrolment of 42,938 pupils attended to by only 470 ECD teachers (a ratio of 1:91). In 2013, the county had a total of 149 primary schools with a total pupil enrolment of 45,000 and 949 teachers (a ratio of 1:49). In the same period, there were 19 secondary schools with a total enrolment of 4,422 students and 185 teachers (a ratio of 1:23). Due to the low population density resulting from the vastness of the county and insecurity, schools tend to have few pupils per class which is a major contributor to the low teacher pupil ratio. There are few active youth polytechnics in the county. However, there are efforts by both levels of Governments to revive the dormant institutions at this level. Approximately 64 percent of the population is unable to read and write. There are few institutions of higher learning in the county. Notable higher learning institutions in the county include Laikipia University (Maralal Campus), Samburu Teachers Training College, Kenya Medical Training College and several other commercial colleges. The project area is served by Lkurroto Integrated Primary and Maralal Day Mixed Secondary Schools.



Plate 0-3: Schools next to the proposed project site

4.2.4. Housing

In Samburu County, decent housing is found in the towns of Maralal, Wamba and Baragoi with several government quarters housing civil servants albeit inadequate. On the other

hand, individual settlements are poorly planned and informal settlements are beginning to emerge in the town centres. Aside from urban centres where there are permanent houses, the rest of the county is dotted with *Manyattas*.

4.2.5. Energy Sources

The main source of energy for domestic use by households in the county is firewood for cooking and kerosene for lighting. There are 11 trading centres connected with electricity while 20 others have no connection. Lack of reliable electricity has is a major constraint in the growth of the centres. Continued use of firewood poses both health and environmental concerns and has contributed to forest degradation.

4.2.6. Water resources and sanitation

Samburu County is classified as a water deficit region with the main sources of water for domestic and livestock use being water pans, dams and shallow wells. Others include protected and unprotected springs, drilled boreholes and roof catchments. Water in Maralal town is supplied and managed by the Samburu Water and Sanitation Company (SWSC) in collaboration with the department of Water. Currently, there are about 25,000 households connected with piped and potable water. The average distance to the nearest watering point is approximately 3 kilometres in rural areas but it becomes much shorter in most urban and market centres to about 0.5 kilometres.

The main sources of water for domestic and livestock use are from water pans, dams and shallow wells. Others water sources are protected and unprotected springs, boreholes and roof catchments. Most water sources in the County are not protected hence contaminated. Borehole yields are on average 1.4-2.5m³/hr in Basement and 4m³/hr in volcanic rocks. Groundwater quality of major water sources near the proposed abattoir (Table 6) is generally good, though saline at some places in the Basement. Surface water is available in small quantities only. The only major perennial river is the Ewaso Ngiro at the southern border. Springs are found in the mountain ranges. Rainfall is low in the plains (200-500 mm/year), but higher in the mountains (700-1000 mm/year). The proposed abattoir is about 2km away downstream of the two dams supplying water to Maralal Town and the surrounding communities. However, the Nomotio dam is at higher altitude (1939m) compared to the proposed abattoir site.

Table 6: Baseline summary water/soil quality parameters water sources near the proposed abattoir**Water quality**

Parameter	Max. Allowable (mg/L)	Mean Results per Site					
		Nomotio D-1 (µg/L)	Nomotio D-2 (µg/L)	Ronyonyi BH (µg/L)	Muramur D-1 (µg/L)	Muramur D-2 (µg/L)	Nontoto Riv. (µg/L)
Dissolved Oxygen	50	6.12	5.58	5.41	5.35	6.25	6.06
Conductivity	6s	131.43	139.54	375.48	272.30	277.60	271.30
Total dissolved solids	1200	94.41	97.11	276.90	185.90	183.95	182.00
Salinity	1	0.70	0.70	0.21	0.14	0.19	0.13
pH	6.5-8.5	7.91	7.55	8.09	8.24	7.98	7.92
Oxygen reduc.potential	30	123.15	124.54	76.18	79.30	95.10	85.30
Nitrate	10	94.62	44.03	3.73	80.15	80.15	79.61
Nitrite	3	31.91	72.52	54.64	87.97	87.97	85.86
Ammonia	0.5	105.90	112.80	4.00	88.40	88.40	80.74
Silicate	8	21.79	20.91	44.59	18.26	18.26	16.35
Soluble reactive phosp.	1	97.71	82.00	40.57	344.86	344.86	245.63
Total phosphorus	1	222.00	234.86	56.29	687.71	687.71	647.24
Total nitrogen	1	1222.36	2580.55	1840.55	2024.18	2024.18	2001.12

Remarks: The water quality parameters are within the NEMA set limits.

Soil Analysis

Parameter	Max. Allowable (mg/Kg)	Mean Results per Site				
		Site-1 (µg/kg)	Site-2 (µg/kg)	Site-3 (µg/kg)	Site-4 (µg/kg)	Site-5 (µg/kg)
pH	6.5-8.5	7.74	7.28	6.96	7.35	7.85
Nitrate	10	96.32	46.09	4.68	78.22	72.31
Nitrite	3	41.21	66.57	64.71	80.77	82.66
Ammonia	0.5	115.9	113.7	6	81.4	84.74
Silicate	30	23.72	21.41	54.69	18.776	18.45
Soluble reactive phosphorus	1	92.71	80.2	39.52	347.22	255.23
Total phosphorus	1	224.1	244.66	55.39	686.91	657.24
Total nitrogen	1	1202.4	2589.5	1846.5	2027.2	2031.2
Cadmium	0.01	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	0.05	<0.1	<0.1	<0.1	<0.1	<0.1
Iron	0.05	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc	1.8	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	0.05	<0.1	<0.1	<0.1	<0.1	<0.1

Remarks: The soil analyses showed fluctuations of different strengths for all parameters, but these fluctuations were not significant, and were within the limits set by NEMA.



Plate 0-4: Nomotio Dam – the main water supply dam for Maralal Town

4.3 Economic setting

4.3.1. Land and land use

Land ownership in Samburu falls into four categories namely; trust, communal, Government and Private. Communal land is managed by the communities while private land encompasses group ranches. The bulk of the land is not registered - a situation that affect their full potentials for use and exploitation. The primary land use practices are pastoralism and wildlife conservation. These practices account for over 90 percent of the total land holding in the county. Farming is also undertaken in favorable areas like Poro in Kirisia Division, Baragoi and South Horr and Tuum in Nyiro Division. Gazetted forests occupy 15% of the County land area. The forests provide habitat and foliage for both wildlife and livestock. Only 5% of the population in the County possesses land title deeds. Majority of land is communally owned under group ranches. This limits access to loans and other investment opportunities which are guaranteed by land title deeds. The proposed abattoir site is with the government owned LIC farm.

4.3.2. Crop and livestock production

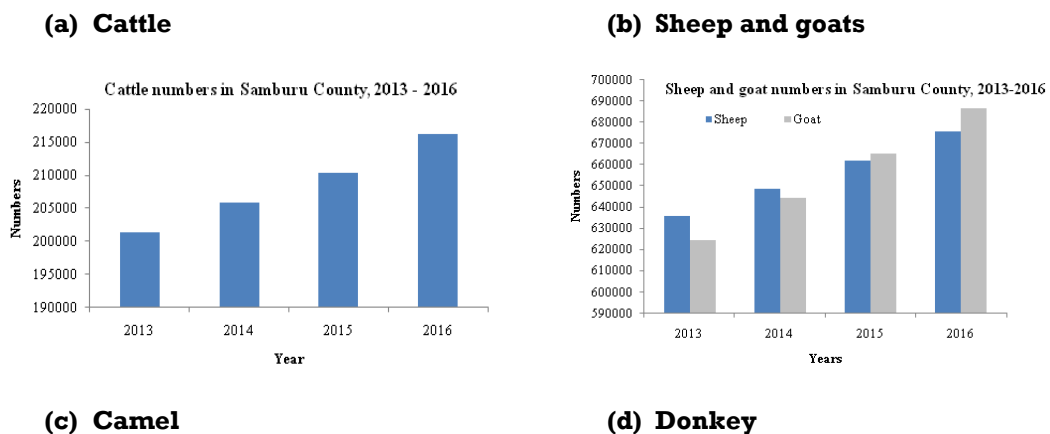
The main crops grown in the County include maize, beans, wheat, barley and millet. These crops are grown in the highland areas of Poro in Kirisia Division. This is due to its fertile soils and adequate rainfall sufficient for rain fed agriculture. Already, a national government funded irrigation scheme is underway at Tuum which is expected to boost food production in the area. The main livestock found in the county are the indigenous cows, goats, sheep, camels, and donkeys comprising of indigenous, exotic species and crossbreeds depending on livestock species. The main cattle breeds are the Zebu and the Boran while those of goats

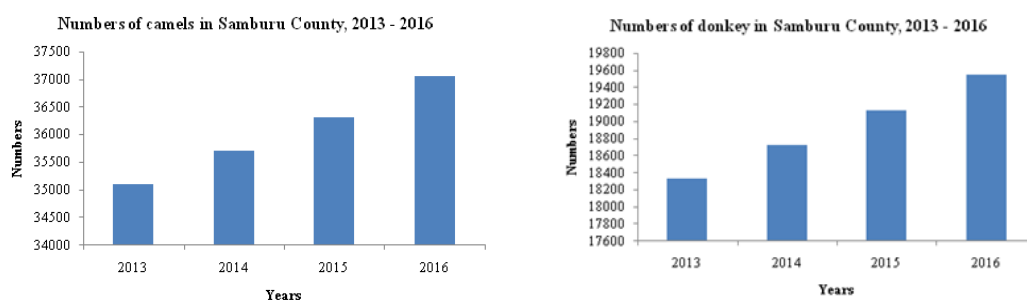
include: the Small East African goat which is widely spread across the County, and the Gala goat. Milk and meat are the main livestock products in the county. Persistent drought has over the years remained a challenge to livestock keeping, and has led to fluctuations of different strengths in livestock numbers of different species (Figure 11 a,b,c & d). However, interventions through livestock off take programmes by the government in collaboration with development partners have assisted in mitigating the adverse effects of climate change. The residents living near the proposed abattoir site are mainly pastoralists but also undertake crop farming.



Plate 0-5: Livestock grazing at the proposed site

Figure 11: Trends in livestock numbers in Samburu County, 2014 – 2017





Source: Samburu County Department of Livestock

4.3.3. Labour Force

The total labour force, that is, the population aged between 15 and 64 years in the county is projected to have increased to 135,811 in 2017. This age group has a critical role to play in the socio-economic development of the county hence training them on appropriate skills will significantly shape the future of the county.

4.3.4. Mining Activities

Quarrying and sand harvesting are the major ongoing mining activities in the county. Quarrying is undertaken in Lolmolog and Soito areas of Baragoi division in Samburu North Sub-county. Sand harvesting activities are practised in dry riverbeds neighbouring the main urban centres of Wamba, Maralal and Baragoi. The county is endowed with various mineral deposits although their economic potential has not been ascertained nor have they been exploited for commercial purposes. Soda and salt exist in Suguta Valley near Lake Logipi, graphite is found in South Horr, chronicle talc, columbium and titanium are found around Baragoi and Stillimanite is found near Kiengok Hill. Also, there are scattered deposits of various precious stones including aquamarine, ruby, blue sapphire; garnet and amethyst particularly around Barsaloi, South Horr. The extent and amounts of these deposits are yet to be determined.



Plate 0-6: Quarrying activities

4.3.5. Trade and Commerce

Commercial activities involving exchange of goods and services are carried out mainly in the major towns of Maralal, Baragoi, Wamba, and Suguta Marmar among other centres. There are several traders in the towns selling a wide range of products including foodstuff, clothes, beverages and household goods among other products. Although livestock rearing is the main economic activity of the project area, the off take of livestock is low. Many pastoralists are reluctant to sell their stock since the numbers of livestock is a measure of wealth and status among the local community. Currently, the main markets for livestock include Rumuruti in Laikipia County, Suguta Marmar and Wamba both found in Samburu County. However, there are a number of constraints to effective market flow of livestock from the project area including:

- Lack of stable terminal markets;
- Poor roads;
- Difficulties associated with long hours of livestock trekking;
- Frequent quarantine restrictions;
- Lack of reliable market information;
- Scarcity of handling facilities; and
- Poor terms of trade for pastoral procedures.

Owing to the above constraints, the livestock farmers are beginning to join cooperative societies including: Raapa, Maralal Livestock Traders, Aramatak, Angata-Nanyukie Livestock Traders and Lekuru Cooperative Societies among others to help them market their livestock.

4.3.6. Tourism

Samburu County is endowed with a number of natural sceneries like plateaus, escarpments, valleys and wildlife which could be tapped to promote tourism industry in the county. Currently, Samburu National Reserve hosts various lodges and game sites which are mainly in Samburu East and is the greatest revenue earner to the county. The locals have indigenous knowledge and cultural artefacts that could be tapped to promote cultural tourism. The annual camel derby tourist promotion event in the county has over the years attracted both local and foreign tourists leading to income generation to the county. The county also boasts of hosting the largest number of wildlife outside the game reserve. These are found at various conservancies. Some of the wildlife found in the county include; giraffes, the endangered bevy zebra, lions, elephants, and buffalos in addition to the small wildlife.

4.3.7. Health Services

The county has three hospitals, which include a County hospital in Maralal, a Sub-county hospital in Baragoi and a Mission hospital in Wamba. The total number of doctors in the entire county is eight distributed in these hospitals. This gives a doctor patient ratio of 1: 31,991. The distance to the nearest health facility is 20 kilometres thus restricting accessibility of health care services in the county. The five most prevalent diseases in the county are respiratory diseases (35.7 percent), malaria (28.9 percent), pneumonia (12.4), skin diseases (6.2 percent), and typhoid (2.2 percent) as per KDHS 2008. Immunization coverage in the county is 79.6 percent for measles and 61 percent for trachoma. This has been increasing although still slightly lower comparable with the national figure of 80 percent. Improved health seeking behaviour amongst pastoralist communities and the increased provision of outreach services are the contributing factors to this rate of immunization.

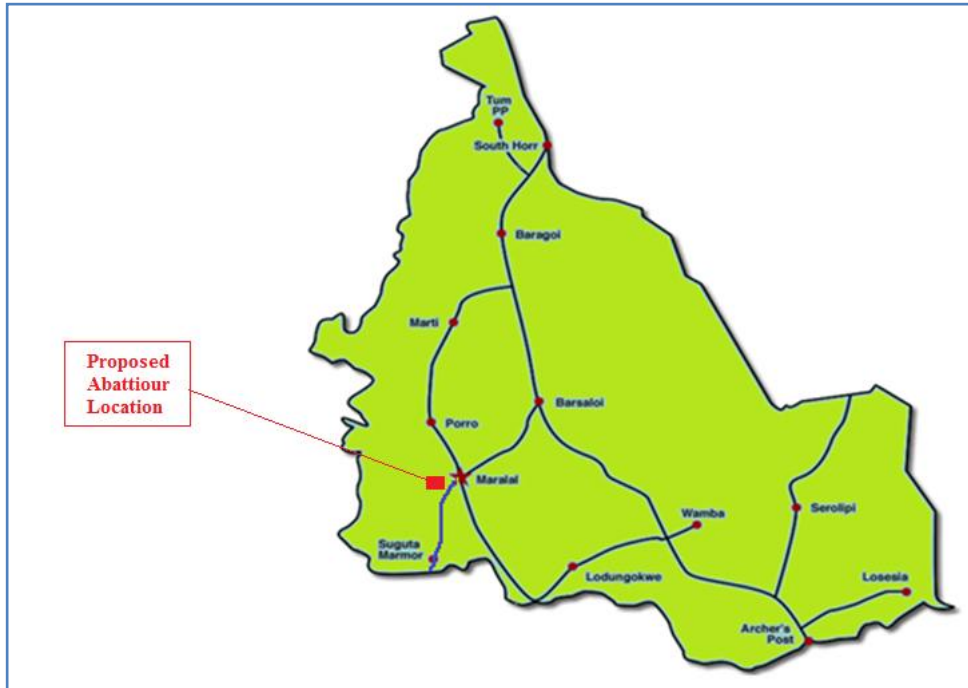
4.4 Infrastructure and access

4.4.1. Road transport

The County has a total road length of 1,449 kilometers most of which are rural access roads whose management falls under the Kenya Rural Roads Authority, and those linking major urban centers within the County (Figure 12). The road C77 Rumuruti-Maralal-Baragoi considered the gateway to the county, and falls under the management of the Kenya National Highways Authority is currently being tarmacked. Tarmacking the C77 will improve accessibility to the County and open up the County to potential investors. The proposed abattoir location can be accessed using two roads – Maralal-Baragoi Road, branching off near Maralal High School, and from C77 Highways branching off near Maralal

Teachers College then driving southwards towards, the newly established Maralal Mixed High School, then branching off westwards to LIC Farm.

Figure 12: Link roads networks and the proposed abattoir location, Samburu County



4.4.2. Airstrips

Samburu County is home to Samburu, Kisima, Lkurroto and Buffalo Spring Airstrips among others.

4.4.3. Posts and telecommunication networks

The county has four Post Offices situated in Maralal, Baragoi, Wamba and Suguta. The mobile phone network coverage within the county is estimated to be about 3 percent but concentrated in urban centres. The major mobile providers in the county include Safaricom, Telkom and Airtel. Usage of landline telephone services has been on the decline in the past few years following the entrance of the mobile phone service providers in the Kenyan market.

4.4.4. Security and public safety

The county is prone to frequent cattle rustling between communities within the county and also with those from neighbouring counties of Baringo, Marsabit, Turkana and Isiolo. This is caused by cultural and economic factors. Community conflicts over pasture and watering points are also common during dry periods. Insecurity is said to have paralysed farming activities around Loosuk, Amaiya and Porro areas. In addition, most of upcoming market centres and schools located around the areas prone to attacks do not develop due to

desertion. Highway banditry especially along Nyahururu – Maralal – Baragoi and Isiolo – Wamba - Maralal roads is yet another security threat. The county proposes to address this state of insecurity by strengthening of community peace committees to conduct peace building initiatives and conflict resolution both within the county and across its borders. Other measures will include strengthening community policing, providing additional police reservists, improving the capacity of anti-stock theft department, setting up more police posts and improving communication infrastructure for rapid response by security agencies. According to Samburu Central Sub-county commissioner, the proposed project area is currently very secure due to its proximity to Maralal Township.

CHAPTER 5: PUBLIC PARTICIPATION

5.1. Introduction

Stakeholder engagement refers to an organization's efforts to understand and involve stakeholders and their concerns in its activities and decision-making processes.¹ Stakeholders are defined as any group or individuals who can affect, or can be affected by, an organization or its activities, including employees, community groups, environmental non-profit organizations, customers and others. The overall purpose of stakeholder engagement in this project is to drive strategic direction and operational excellence for the proponent. Done correctly, engaging stakeholders can result in learning, innovation, and enhanced performance that will not only benefit the proponent, but also its stakeholders and society as a whole. In addition to serving as a key tool to support a facility's sustainability reporting efforts, stakeholder engagement is a foundation that supports a facility's broader sustainability efforts to set strategic goals, implement action plans, and assess its performance over time.

Public participation is essentially concerned with involving, informing and consulting the public in planning, management and other decision-making activities. Public participation tries to ensure that due consideration is given to public values, concerns and preferences when decisions are made. It encompasses the public actively sharing in the decisions that government and other agencies make in their search for solutions to issues of public interest. The main objectives of the consultation were to:

- Inform the public and key stakeholders about the proposed project and activities that will be undertaken;
- Seek views, concerns and opinions of people in the area concerning the project;
- Incorporate the views, concerns and proposals of community members, and other stakeholders on their expectations from the project activities;
- Establish if the local people foresee any positive or negative environmental impacts from the project and if so, how they would wish the perceived impacts to be addressed; and
- Obtain socioeconomic information about the project area.

5.2. Methodology

Public participation was achieved through direct interviews, observations and questionnaire administration conducted between **9th and 11th April 2018**. Traditionally, the tool used to collect information is the administration of open ended questionnaires where the respondent is free to comment on issues at own thinking. After individuals complete the

¹*The Stakeholder Engagement Manual – Volume 1: The Guide to Practitioners Perspectives on Stakeholder Engagement. Stakeholder Research Associates, UNEP; and Accountability, 2005, p.6*

questionnaires individually and the expert finds some divergent and conflicting responses, usually Focus Group Discussions are held only on the conflicting ideas for the respondents to discuss the contentious issues and come to an agreement by themselves after informing each other.

Stakeholders were identified and Key Informant interviews carried out. A public consultation meeting was held at the proposed site on **10th April 2018** to find out the community concerns regarding the proposed project. Minutes of stakeholder meetings are provided in Annex 3 of this report. Questionnaires were then administered. For this study, interviews were conducted individually on a pre-set open ended questionnaire to collect the views of various stakeholders. Respondents were selected among key organisation and government departments as well as community members. All the stakeholders accepted to respond. The following is a detailed discussion of public consultation methodology used by the ESIA team:

5.2.1. Key Informant Interviews

Key Informant interviews were used to get responses from key stakeholders in the project area. Their comments were sought through engaging them in discussions about the proposed project and associated activities.

5.2.2. Questionnaire administration

Questionnaires were uniformly distributed to the sampled residents. The community was informed of the proposed project and requested for their views concerning the project. Their views in terms of the anticipated positive and negative impacts and mitigation measures were captured using questionnaires (attached to this report). Details of participants and their inputs are shown in Annex 4.

5.2.3. Issues and concerns raised

Table 7 summarizes the expectations, concerns and the mitigation measures that were discussed during the key informant interviews, stakeholders' consultations and public meetings. Minutes of the public discussion forums are provided in Annex 3.



Plate 0-1: Members of the public during a public participation activity.

Table 7: Summary of stakeholders' expectations, concerns and mitigation measures

Stakeholders	Expectations (Positive Impacts)	Concerns (Adverse Impacts)	Proposed Mitigation Measures and Recommendations by the Stakeholders
Lekartiwa Simon (Department of Livestock Production – Samburu)	<ul style="list-style-type: none"> Increased livestock sale thus increased income to pastoralists; Increased revenue to the county government 	<ul style="list-style-type: none"> Destruction of vegetation during the construction phase; Livestock congestion near the abattoir leading to degradation of the surrounding vegetation; Disturbance to nearby learning institutions 	<ul style="list-style-type: none"> Plant many trees around the abattoir; Reseeding of pastures in the vicinity of the project site;
Moses Omondi (Physical Planning Department)	<ul style="list-style-type: none"> Source of livelihood to the pastoralist communities Ripple effect to support secondary production/industries 	<ul style="list-style-type: none"> Foul smell from the site during operation phase; Infestation of the area by scavenging birds; 	<ul style="list-style-type: none"> Plant trees to buffer the site from direct view; Design the waste water management system properly;
Lolochum Gregory (ASDSP)	<ul style="list-style-type: none"> Creation of employment opportunities to the locals; Creation of market for livestock 		
Ann Nteyie	<ul style="list-style-type: none"> Improvement in terms of handling of meat (Clean way of handling meat); Source of revenue to the county government 		<ul style="list-style-type: none"> Alternative site near Maralal town for ease of accessibility.
Thomas Lokine (Kenya Bureau of Statistics)	<ul style="list-style-type: none"> Economic benefits to the community 	<ul style="list-style-type: none"> Air and water pollution 	<ul style="list-style-type: none"> Sustainable waste management.
Ezekiel (Kenya Bureau of Statistics)	<ul style="list-style-type: none"> Create employment to the local communities; Promote economic development in the county. 	<ul style="list-style-type: none"> Air pollution; Environmental hazard to the nearby dam Foul smell 	<ul style="list-style-type: none"> Treat all wastes generated to avoid air pollution.
Alex Nadome (Kenya National Bureau of Statistics)	<ul style="list-style-type: none"> Improved manner in which animals are slaughtered; Access to clean inspected meat; Central point for tax collection. 	<ul style="list-style-type: none"> May affect the only water source that is in the area; Poor waste management 	<ul style="list-style-type: none"> proper management of wastes protect the water dam
James Kiptoon (Ministry of Health)	<ul style="list-style-type: none"> creation of employment; improvement in the well being of the residents; market for 	<ul style="list-style-type: none"> offensive smell; attraction of scavengers (vultures) to the site 	<ul style="list-style-type: none"> fence the abattoir properly; abattoir workers to undergo medical examination; provide adequate

Stakeholders	Expectations (Positive Impacts)	Concerns (Adverse Impacts)	Proposed Mitigation Measures and Recommendations by the Stakeholders
	livestock		<ul style="list-style-type: none"> water to the abattoir; construct condemnation pits; provide PPEs to the abattoir workers.
Joseph Mahihu (Veterinary Department)	<ul style="list-style-type: none"> creation of employment opportunities; value addition to meat products; 	<ul style="list-style-type: none"> Foul smell from the slaughterhouse 	<ul style="list-style-type: none"> Treat waste water for further use.
Erastus Sinoti (Department of Health)	<ul style="list-style-type: none"> Creation of employment; Value addition to meat products; Improved well being of the residents; Will do away with middlemen who have exploited the ordinary pastoralist; Will help in destocking especially during drought. 	<ul style="list-style-type: none"> Foul smell from the stomach contents; Attraction of vultures and wild animals; General environmental degradation; 	<ul style="list-style-type: none"> Construct lagoons/septic tanks for storage of liquid wastes; Construct condemnation pits; Fence the abattoir to discourage intrusion; Ensure proper medical examination of all livestock before slaughtering; Workers onsite to use PPEs; Provide adequate water to the facility for day to day operations.
Jonathan Lepoora (World Vision- Lorroki ADP)	<ul style="list-style-type: none"> It is likely to enhance World Vision's programmes on livestock intervention 	<ul style="list-style-type: none"> Poor waste management 	<ul style="list-style-type: none"> Properly disposal of wastes
Salim Lesamana (Community Member)	<ul style="list-style-type: none"> Market for livestock; Improvement of access roads in the area; Creation of job opportunities 	<ul style="list-style-type: none"> Increased cases of livestock theft in the area; Contamination of water sources; Foul smell in the area; Increased dangers posed by wild animals life hyenas that would be attracted to the area to scavenge. 	<ul style="list-style-type: none"> Proper treatment of waste water; Improve on security during the operation phase; Construct a fence around the abattoir.
Letesi Lepeere (Community Member)	<ul style="list-style-type: none"> Creation of job opportunities; Ready market for livestock; Development of roads in the project area. 	<ul style="list-style-type: none"> Possibility of water contamination; Bad smell; Increase in cases of animal theft. 	<ul style="list-style-type: none">
William Lekupe (Community Member)	<ul style="list-style-type: none"> Creation of employment opportunities 	<ul style="list-style-type: none"> Bad odours from animal wastes; Water pollution due to carcasses draining into the rivers; Toxic chemicals may contaminate grazing field. 	<ul style="list-style-type: none"> Put in place proper waste water management system.
Juma Leodip (Community Member)	<ul style="list-style-type: none"> Creation of job opportunities; Market for 	<ul style="list-style-type: none"> Water contamination; Bad smell; Increase in theft 	<ul style="list-style-type: none"> Enhance security in the area; Treat waste water;

Stakeholders	Expectations (Positive Impacts)	Concerns (Adverse Impacts)	Proposed Mitigation Measures and Recommendations by the Stakeholders
	<ul style="list-style-type: none"> livestock; Development of roads. 		<ul style="list-style-type: none"> Construct septic tanks.
Kaseti Francis (Member, Nomotio Land Board)	<ul style="list-style-type: none"> Creation of job opportunities. 	<ul style="list-style-type: none"> Bad smell in the area. 	<ul style="list-style-type: none">
Aniko Lekalesoi (CLMC, Samburu)	<ul style="list-style-type: none"> It will provide ready market for livestock 	<ul style="list-style-type: none"> Possibility of pollution. 	<ul style="list-style-type: none">
David Lenonkulal (Chairman, Samburu CLMC)	<ul style="list-style-type: none"> Creation of employment opportunities; Marketing of livestock and their products; The project would place Samburu County on the national map. 	<ul style="list-style-type: none"> Air pollution; Water pollution. 	<ul style="list-style-type: none"> Manage wastes properly; Manage the bad dour properly
Samwel Litiwani Leparie (CLMC, Samburu)	<ul style="list-style-type: none"> Ready market for livestock and livestock products; Creation of employment to locals; Promote marketing of livestock; Would put the name of Samburu on the national map. 	<ul style="list-style-type: none"> Pollution of water sources when waste water is channelled into water bodies; It may promote theft due to availability of ready market. 	<ul style="list-style-type: none"> Address the wastes emanating from the project site properly; Involve the community and security agencies on the issue of buying livestock to minimise theft.
Julius Leparie (CLMC, Samburu)	<ul style="list-style-type: none"> Creation of employment opportunities. 	<ul style="list-style-type: none"> Pollution to the environment. 	<ul style="list-style-type: none"> Uphold the hygiene in the site as well as the surrounding area.
Diana (Kenya National Bureau of Statistics)	<ul style="list-style-type: none"> Assistance to the community especially livestock keepers. 	<ul style="list-style-type: none"> It is an environmental hazard. 	<ul style="list-style-type: none">
Dr. Edward S. Kimani (ASDSP)	<ul style="list-style-type: none"> Creation of employment opportunities; Farmers to get ready market for their livestock at the prime stage of disposal; Fertilizers from wastes; Biogas as clean energy; 	<ul style="list-style-type: none"> Bad smell from wastes; Likelihood of pathogens getting introduced into water bodies should waste management be poor; 	<ul style="list-style-type: none"> Incorporate biogas processing plant into the project; Convert the animal wastes into package-able fertiliser; Use technologies that would ensure recycling of liquid wastes; Use technologies to ensure that all parts of the carcasses are value added to reduce solid wastes and improve on incomes.
Naanyu Lenaseiyau	<ul style="list-style-type: none"> Improvement in livelihoods; 	<ul style="list-style-type: none"> Increase in wastes in the area; 	<ul style="list-style-type: none"> Put in place proper waste management

Stakeholders	Expectations (Positive Impacts)	Concerns (Adverse Impacts)	Proposed Mitigation Measures and Recommendations by the Stakeholders
(Director Cooperatives, Samburu County Government)	<ul style="list-style-type: none"> Improvement in marketing of livestock products; Support to Meloni hides and skin tannery. 	<ul style="list-style-type: none"> Foul smell. Possible contamination of nearby water dams 	system.
Robinson Macharia (Ministry of Water)	<ul style="list-style-type: none"> Creation of employment; Ready market for livestock; Increase in income; Safe meat to residents 	<ul style="list-style-type: none"> Theft of livestock; Monopoly of entrepreneurial exercise; Solid and liquid wastes from the abattoir may lead to pollution. 	<ul style="list-style-type: none"> Enhance security; Create community awareness through sensitization programmes on the importance of the project to cultivate a spirit of co-existence; Proper waste management system for both waste water and solid wastes.
Moses Lekoiten (A civil servant)	<ul style="list-style-type: none"> Creation of jobs. 	<ul style="list-style-type: none"> Water pollution; Bad smell 	<ul style="list-style-type: none"> Proper waste management
Frankline Letoni Lekatap (Samburu County Government)	<ul style="list-style-type: none"> Employment opportunities. 	<ul style="list-style-type: none"> May pose danger to environment due to wastes and chemicals; Danger to the water dams due to pollution. 	<ul style="list-style-type: none"> Properly handle the wastes; Put in place and implement strict measures. Citing should be done in a place where waste water does not drain towards the dam and away from human habitats;
William Lekatap (Community Chairman)	<ul style="list-style-type: none"> Job creation and development. 	<ul style="list-style-type: none"> Proposed location is not suitable since it is close to the Maralal Day Mixed Secondary School. 	<ul style="list-style-type: none"> Move the site away from the current proposed area by a kilometre.
Samwel Lewarges (Village Council Member)	<ul style="list-style-type: none"> Job creation; Road development; Livestock market. 	<ul style="list-style-type: none"> Water contamination; Bad smell; Increase in livestock theft cases; Influx of dangerous animals like hyenas to the site. 	<ul style="list-style-type: none"> Tighten security; Proper waste treatment; Construct tanks/pits for disposing waste; Construct a fence around the abattoir.
Lotukoi Monica (Water, Environment, Natural Resources and Energy)	<ul style="list-style-type: none"> Improved livelihoods; Employment opportunities; Availability of ready market for livestock. 	<ul style="list-style-type: none"> Air polluting; Water pollution should liquid wastes drain into nearby streams in case it is not properly managed. 	<ul style="list-style-type: none"> Use proper waste management strategies; Continuous public participation to enhance project ownership by the community.
Amina Mohamed (Butcher, Maralal Town)	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> It is near water dam thus may contaminate the only source of water to Maralal town; Cost of transporting meat from the abattoir will be expensive on the butchers. 	<ul style="list-style-type: none"> Avoid the construction of new abattoir, instead improve the existing slaughterhouse.

Stakeholders	Expectations (Positive Impacts)	Concerns (Adverse Impacts)	Proposed Mitigation Measures and Recommendations by the Stakeholders
Jane Wangui (Cheers Guest House)	<ul style="list-style-type: none"> Will be of help to the community in many ways. 		

Generally, the community welcomed the project and are looking forward to its full implementation. They however, proposed that the project site be moved 1 kilometre away from the current proposed site. This they argued will lessen interference that the project might pose to the existing schools.

CHAPTER 6: ALTERNATIVES TO THE PROJECT

Given the nature of abattoirs/slaughterhouse activities, the consideration of alternatives is of prime importance. Generally, the ESIA Study should identify and assess alternatives with only the best alternative (one with the least adverse impacts) selected based on less negative impacts and cost-benefit analysis. This is a very important analysis because it helps the proponents measure the impacts from the project against those which would have taken place without the project. For the Nomotio abattoir project, alternatives were described in different ways indicating the main reasons for selecting the proposed project, namely alternative locations, designs and processes. This section analyses the proposed abattoir project alternatives in terms of site, technology and waste management options. It summarizes the various alternative options relative to the selection of the proposed abattoir site, design and process.

6.1. Description of alternative locations

Site selection is usually conducted prior to establishing a final developmental site. While some locations may have more inherent environmental problems, other locations could be more ideal. Sites with inherent environmental problems should be avoided, and sites with fewer constraints and the maximum capacity to sustainably assimilate the development selected. The final location selected for the Nomotio abattoir was based on economic, engineering and topographic justifications. In relation to the proposed project, three alternatives were taken in to consideration after which the best alternative has been selected for implementation. The brief description of the alternative analysis has been presented in Table 8.

Table 8: Description of analysis of location alternatives for the proposed abattoir

Alternatives	Advantages	Limitation	Remark
Alternative 1 Expansion or upgrading of the existing abattoir/slaughterhouse in Maralal Town	Availability of an existing infrastructure with expected low cost for renovation, water supply and electricity	<ul style="list-style-type: none"> • Has low capacity for the increasing demand for meat and meat products • Lack of sufficient land for installation of integrated waste management systems • Located within Maralal Town • Unsuitable for modern abattoir requiring modern machineries and standards 	Not selected
Alternative 2 New abattoir around	<ul style="list-style-type: none"> • Easily accessible from the highway, C77 	<ul style="list-style-type: none"> • High cost of land • In close proximity to the 	Not selected

Alternatives	Advantages	Limitation	Remark
Suguta Marmar/Kisima areas	<ul style="list-style-type: none"> Open and suitable for modern machineries 	<ul style="list-style-type: none"> Kisima Airstrip thus prohibited under the KAA and KCAA regulations Open area which tends to be windy and dusty during dry seasons Area mostly in community land used for grazing 	
Alternative 3 New abattoir at Nomotio LIC Farm	<ul style="list-style-type: none"> Availability of sufficient land – County Government land, Suitable for modern abattoir involving installation of new machineries and integrated waste management systems Compatible with the current land use in the farm – fodder production, tannery and livestock improvement The location is in the outskirts of the Maralal Town. Good access and availability of infrastructure such as water – to be supplied from a nearby borehole, road – planned upgrade to bitumen standard of the access road, electricity – near the mains electricity supply. Sufficient wood vegetation to sequester expected carbon/odour from the abattoir The proposed location site is in the lowland, and will not have effects on the two water dams supplying Maralal Town The proposed site already has a proposed tannery – better for the processing of hides and skins by-products from the abattoir Low environmental impact anticipated, not species of conservation concern and low risks to nearby ecosystems 	<ul style="list-style-type: none"> Mains electricity supply will have to be connected to the site Emerging human settlements around the Nomotio LIC farm The new abattoir will reduce/limit the grazing lands which are occasionally used by local communities for grazing 	Selected

6.2. Alternative designs and processes

Typical approach towards alternative Nomotio abattoir designs can include the following: (i) minimization of environmental impacts including, noise, odour and aspect; (ii) optimum capital and running costs; (iii) land area requirements. Table 9 outlines design and

processes alternatives for the proposed modern abattoir at Nomotio LIC Farm, Samburu County.

Table 9: Description of analysis (design/processes) alternatives for the proposed abattoir

Alternatives	Remark
<p>Alternative 1</p> <p>This alternative, although, was just the same as the former (export standard Abattoir) in terms of minimization of environmental impacts, land area requirements and basic structural plan and functions, the basic facility design and capacity was standardized abattoir design was NOT considered as a best alternative for implementation. The design has the following facilities:</p> <ul style="list-style-type: none"> • Slaughter houses for Cattles and shoats separately • Slaughtering equipments • Cattle holding and inspection area • Quarantine/condemned animals holding yard • Truck parking • Administration offices/cafeteria • Hide/skins storage area • Laundry • Rendering section with all equipment • Incinerator • Separate gates • Site facilities like water, drainage, roads, walkway, landscaping trees etc • Waste treatment plant 	<p>Not Selected</p>
<p>Alternative 2</p> <p>Designers were briefed at an early stage of the project to design a well-equipped export standard Abattoir with the following basic requirements:</p> <p>Structural Requirement</p> <ul style="list-style-type: none"> • Production of safe meat • Safe working condition for workers • An initial investment of 100 million Kenyan Shillings <p>Layout and composition</p> <ul style="list-style-type: none"> • Four gates (transportation of by-products, clean gate – for meat dispatch; administrative/slaughter workers, slaughtering animals entering the abattoir) • Abattoir for both cattle and sheep/goats • Anti-mortem inspection yard • Lairage • Stunning area • Rail system • Bleeding area • Shank removing area • Hind leg and hind flaying area • Flaying area • Hide/skin outlet • Head removing area • Brisket breaking area • Green and red offal removing area • Green offal storage room and outlet • Green offal cleaning-cutting in four pieces • Dispatching room • Red offal inspection area • Post-mortem inspection room • Caracas chilling room • Caracas detention room • Chest breaking or carcass splitting spot • Cutting area • Caracas collection and dispatch room • Processed meat packaging area 	<p>Selected</p>

Alternatives	Remark
<ul style="list-style-type: none"> • Meat inspection office • Laboratory rooms with facility • Shower and changing rooms • Office rooms • Generator room • Guard house • Incinerator • Rendering Plant • Ground water reservoir/water tower • Rainwater harvesting system • Wastewater treatment structures • Blood collection pits • Truck parking • Rendering plant • By Product store collection area (bones, heads, etc) • Biogas production unit • Solar power system • Hide/skins dispatch store • Site facilities like cabro-paved roads, walkways, storm water drainages, landscaping trees etc. <p>This report is prepared according to this design – all the production/processing (slaughtering house), utilities (water, electricity, sanitation facilities), integrated waste management system, by-products stores are designed for modern export abattoir.</p>	

6.3. No project/”ZERO” alternative

The no-project alternative is often defined by the baseline information and is crucial in the assessment of impact because other alternatives are weighed with reference to it. From the qualitative analysis and the summary of the proposed site for the project, there will not be any significant negative effect on either the biophysical or the socio-cultural environment of the proposed project. Without the project, the environmental situation will neither improve nor can we say that it will necessarily deteriorate. The no-project option will however lead to the following (general) major negative and long term impacts:

- The economic status of Samburu County residents will remain unchanged.
- The increasing demand for quality meat products for local and potential export market will not be addressed;
- The County Government of Samburu priority focus on agro-processing and industrialization will not be achieved;
- No employment and business opportunities will be created for the County residents;
- No multiplier investments opportunities for the livestock sector associated with abattoir such as tannery, bone-meal processing, blood processing for pharmaceuticals will be established;
- Discouragement for investors and loaners for investment projects in Samburu County;
- Development of infrastructural facilities (roads and associated infrastructure) will not be undertaken;

- Likely levels of poverty will increase or remain the same;
- Modernization of value chain and value addition to livestock products will not be achieved.

The No Project alternative is therefore not a viable alternative as the proposed modern abattoir at Nomotio, Samburu County will not only spur economic growth in Samburu County, but also support the County's enterprise development in the livestock production and marketing sector.

6.4. Analysis of alternative construction materials and technology

The proposed abattoir is expected to meet all the national and international standards for a modern abattoir. It has to be constructed using modern, preferably locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. The abattoir works will be made using locally sourced materials that meet the Kenya Bureau of Standards (KEBS) requirements. Table 10 gives an overview of options for construction materials.

Table 10: Description of analysis for materials/technology for the proposed abattoir

Alternatives	Description	Remark
Alternative 1 Traditional construction materials only. These are as outlined below: <ul style="list-style-type: none"> • Concrete foundation • Concrete structures for columns, beams and roof • Floor concrete finishing • Galvanized steel roofing • Metallic doors • Security windows 	This is primarily represented by concrete structures, and concrete or clay bricks	Not selected
Alternative 2: Steel frame and precast concrete + traditional construction materials. These are as outlined below: <ul style="list-style-type: none"> • Concrete foundation • Metallic structures for columns, beams and roof • Thermo-acoustic panel for roofing • Precast concrete panels • Security windows • Metallic doors and louvers • Granite tiles in the floor and walls • Non-skid concrete floor finishing • Use of recycled materials • Reduction in noise levels at construction sites • Reduction in the amount of construction waste • Reduction in transport cost • Reduction in site disturbance • Savings in construction time and cost 	This will involve the use of steel frames and precast concrete/granite panels for the main abattoir, and traditional construction materials for other structures	Selected
Alternative 3: Steel frame and thermo-acoustic aluminium panels + Traditional construction materials. These are as outlined below: <ul style="list-style-type: none"> • Concrete foundation 	This will involve the use of aluminium and therm-acoustic aluminium panels for the main abattoir construction, and	Not selected

Alternatives	Description	Remark
<ul style="list-style-type: none"> • Metallic structures for columns, beams and roof • Thermo-acoustic panel for the roof • Metallic doors and windows • Concrete floor non-skid finishing • Use of recycled materials 	traditional construction materials for other structures	

6.5. Waste management alternatives

A lot of solid wastes will be generated from the proposed project. An integrated solid waste management system is recommendable. First, the proponent will give priority to reduction at source of the materials. Recycling and reuse options of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. Finally, the proponent will need to engage licensed waste management dealers to ensure regular waste removal and disposal in an environmentally-friendly manner. In this regard, a NEMA registered solid waste handler would have to be engaged. This is the most practical and feasible option for solid waste management considering the delineated options at all the three phases of the project. Wastewater management will apply a combination of aerobic and anaerobic systems. Tables 11 & 12 give description of solid and liquid wastes management alternatives respectively for the proposed abattoir

Table 11: Description of solid waste management alternatives for the proposed abattoir

Alternative	Description	Remark
Alternative 1: Offsite solid waste disposal	This involves a solid waste management system whereby contracted waste dealers collect all wastes for offsite disposal away from the abattoir. This alternative requires the engagement of licensed waste dealer or the engagement of Maralal Town Municipal Authority to regularly collect the wastes from the site.	Not selected
Alternative 2: Biogas production only	The proposed abattoir at Nomotio is expected to generate substantial quantity of solid wastes, which can be processed in environmentally acceptable manner. A bio-methanation plant installed at the facility can be used to process wastes consisting of rumen and paunch contents, dung, agriculture residue, fat and blood for biogas production. Such a power plant can be designed to produce biogas (60% methane, 30% carbon dioxide and traces of hydrogen, carbon monoxide etc.) by digestion of animal waste. The biogas can be used for boiler or power generation.	Not selected
Alternative 3 Composting only	Composting involves the aerobic biological decomposition of organic materials to produce a stable humus-like product. The slaughter house waste can be used for compost making. The left over feed, dung from the lair age, ruminal and intestinal contents, blood, meat trimmings, floor sweepings, hair, feathers, hide trimmings can be stabilized by composting. This produces very good quality bio-manure which may be utilized as fertilizers for the agriculture land and gardens.	Not selected
Alternative 4 Rendering only	This is a useful method for the physical separation of fats from solids and water. The raw material i.e. solid waste from the various processes in the namely raw	Not selected

Alternative	Description	Remark
	bones. Offal's, head etc. are processed in the same and the finished product in the form of meat bone meal and tallow will be produced. Blood collected from the abattoir can be used for pharmaceutical – manufacturing of haemotonic preparations. Alternatively, blood plasma could be used in sausage preparations. Blood can also be converted to blood meal which, after mixing and drying with rumen digesta can be used as animal feed.	
Alternative 5 Combined recycling processes	This involves recycling of all solid wastes produced from the abattoir. Among the possible recycling methods include: <i>Biogas production</i> <i>Composting</i> <i>Rendering</i>	Selected

Table 12: Description of liquid waste management alternatives for the proposed abattoir

Alternatives/description	Remark
<p>Alternative 1: Physicochemical treatment</p> <p>This is the most practical methods of treatment of primary SWW. It applies dissolved air floatation (DAF) techniques to reduce fat, oil, grease, TSS and BOD. The most commonly used physicochemical treatment methods are:</p> <ul style="list-style-type: none"> • <i>Dissolved air flotation (DAF):</i> Liquid-solid separation by air introduction. The fat and grease along with light solids are moved to the surface creating a sludge blanket. • <i>Electrocoagulation (EC):</i> Removal of organics, heavy metals, and pathogens from SWW by inducing an electric current without chemical addition. • <i>Membrane processes:</i> Different membrane processes, including microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO) are used for SWW treatment to remove particulates, colloids, macromolecules, organic matter, and pathogens with overall efficiencies of up to 90%. 	Not selected
<p>Alternative 2: Biological treatment</p> <p>Biological processes include lagoons with anaerobic, aerobic, or facultative microorganisms, trickling filters, activated sludge (AS) bioreactors, and constructed wetlands (CWs) for organic and nutrient removal efficiencies of up to 90%. The most commonly used approaches are:</p> <ul style="list-style-type: none"> • <i>Anaerobic treatment:</i> This is the most preferred method for SWW due to its effectiveness in treating highly concentrated industrial effluents since organic compounds are degraded by anaerobic bacteria in the absence of oxygen into CO₂ and CH₄. Anaerobic systems have the advantage of achieving low sludge production, minimum energy requirements with potential resource recovery, and high COD removal. Typical anaerobic processes for the treatment of meat processing effluents comprise anaerobic baffled reactor (ABR), anaerobic digester (AD), anaerobic filter (AF), anaerobic lagoon (AL), septic tanks (ST), and up-flow anaerobic sludge blanket (UASB). • <i>Aerobic treatment:</i> Aerobic processes are frequently employed for nutrient removal and further treatment after primary treatment. The required oxygen and treatment time are directly related to the strength of the SWW. There are many advantages of using aerobic wastewater treatment processes, including low odour production, fast biological growth rate, and rapid adjustments to the temperature and loading rate changes. Conversely, the operating costs of aerobic systems are higher than those for anaerobic systems due to the maintenance and energy requirements for artificial oxygenation. • <i>Constructed wetlands:</i> Constructed wetlands (CWs) emulate the degradation mechanisms of natural wetlands for water decontamination, integrating biological and physicochemical processes from the interaction of vegetation, soil, microorganisms, and atmosphere for the adsorption, biodegradation, 	Selected (Option 1)

Alternatives/description	Remark
filtration, photo-oxidation, and sedimentation of organics and nutrients. Results have shown a wide range of organic and nutrient removal for different vegetation with encouraging maximum removals of 99, 97, 85, and 78% for BOD, COD, TSS, and TN, respectively. CWs are simple methods with low operation and maintenance costs and few negative impacts on the environment, which make them an attractive alternative to conventional treatment.	
Alternative 3: Combined processes The implementation of combined processes is operationally and economically beneficial for SWW treatment since it couples the advantages of different technologies to treat high-strength industrial wastewaters. The combined ABR-AS-UV/H ₂ O ₂ system is recognized as a cost-effective solution for SWW treatment with removal efficiencies of over 95% for organics and nutrients at optimum operating conditions.	Selected (Option 2)

6.6. Incremental alternatives

Incremental alternatives are modifications or variations to the design of a project that provide different options to reduce or minimize environmental impacts. There are several incremental alternatives that can be considered, including: The design or layout of the activity including the technology/materials to be used in the activity.

CHAPTER 7: ENVIRONMENTAL AND SOCIAL IMPACTS

This chapter provides an analysis of the potential impacts likely to emerge from implementation of project activities. It addresses potential impacts associated with the proposed abattoir project and delivers measures for both mitigating (i.e. avoidance, reduction, or restoration of) negative impacts and enhancing (i.e. improving) the positive effects of the project. The major positive impacts of the proposed project were mainly the economic and social benefits that can be acquired at the county and national levels. On the other hand, the major adverse impacts arise from generation of solid wastes, wastewater and air pollutants. Cost-effective and environmentally sustainable techniques that can mitigate the adverse impacts and enhance the positive effects are proposed. Emphasis is given in selection of best available techniques (BAT) and practices for preventing and reducing discharge of processed wastes to the environment. Special consideration is also given to the sustainability of the proposed project through integration of best available pollution prevention technique e.g. reusing and recycling of process wastes and by-products without compromising the economic and social benefits of the project (Irshad et al 2015; Chatli et al. 2005). Based on the standard requirements a suitable by-products rendering and wastewater treatment plants are proposed and a preliminary design data and operational requirements is given. The impacts of the project during each of its life cycle stages (construction, operation and decommissioning) are categorized into: impacts on the biophysical environment; health and safety impacts and socio-economic impacts.

7.1. Steps of impact assessment

The potential impacts of the proposed project were assessed using the following steps: (i) characterization of the baseline conditions or rather the existing conditions before the project is undertaken and any effects are generated; (ii) description of the project components throughout the project lifespan (construction, operation and decommissioning); (iii) identify sources of impacts and the impacts themselves that are generated by any aspect of the project; (iv) identification of mitigation and enhancement measures to address the impact. Table 13 summarizes the environmental and social impacts associated with the proposed project

Table 13: Summary of environmental/social impacts and mitigation measures

Project phase	Possible impacts	Mitigation measures
Construction	Flora and fauna	<ul style="list-style-type: none"> • Limit clearing/soil disturbance around construction sites • Limit/control movement of machineries during construction • Undertake selective vegetation clearing that allows regeneration. • Re-vegetate disturbed areas at the construction site. • Undertake routine monitoring/clearance of invasive species • Restoration plans should incorporate measures to improve the ecological status of the site. • Give provisions for wildlife corridors and buffer zones
	Landscape integrity and land use pattern	<ul style="list-style-type: none"> • Undertake dumping of excavated material at selected and designated sites • Minimize movement of vehicles/construction machineries outside the premise of the project site • Incorporate existing habitat features into site design. • Create habitats to compensate for habitat losses and to improve ecological potential for the site.
	Water quality and demand	<ul style="list-style-type: none"> • Optimize water use and monitor consumption during construction • Install construction water storage facilities at the site • Minimize disposal wastewater disposal at the construction site
	Noise and vibrations	<ul style="list-style-type: none"> • Provide PPE to construction workers and persons visiting the site • Ensure the machineries do not exceed acceptable noise limits • Inform local residents when construction activities are likely to generate excessive noise • Truck drivers to switch off engines during offloading materials & avoid unnecessary hooting
	Soil erosion	<ul style="list-style-type: none"> • Allow minimal vegetation clearing and disturbance at the site • Re-vegetate all cleared areas during construction with indigenous vegetation species • Undertake proper planning of site clearing of natural vegetation during the construction works • Encourage re-use of excavated materials for back-filling and landscaping activities. • Install proper and functional wastewater and storm water drainage channels.
	Air quality	<ul style="list-style-type: none"> • Sprinkle water on fresh construction soil to minimize dust emissions. • Provide personnel with Personal Protective Equipment & Clothing (PPE&C) such as dust masks. • Palliate stockpiles of earth generated with water regularly to suppress evolution of particles; • Maintain equipment and machinery in good condition to minimise unnecessary emissions • No burning of materials should be permitted at the project site; • Limit traffic movement within the earmarked project areas.

Project phase	Possible impacts	Mitigation measures
	Occupational health and safety	<ul style="list-style-type: none"> • Ensure all equipments are inspected before use for appropriate safeguards. • Ensure controlled working hours and that employees do not extend working hours unnecessarily • Ensure appropriate road safety signages are strategically placed in and round the construction site. • Erect speed breaks where human and vehicular traffic have high interactions.
	Solid wastes	<ul style="list-style-type: none"> • Encourage wastes segregation at source into different wastes categories before disposal • Contract licensed waste management firm for disposal of large quantities of solid wastes • Domestic solid wastes to be temporarily stored in refuse bins before disposal by licensed contractor • Concrete, asphalt and other waste aggregate should be stored and reused. • All reusable materials should be reused to minimize on quantity of solid waste generated.
	Liquid wastes	<ul style="list-style-type: none"> • Provide workers with appropriate and adequate sanitary facilities i.e. exhaustible mobile toilets. • Effluent from mobile toilets should be disposed by a registered NEMA waste handler. • Wastewater from concrete//aggregates to be disposed into sedimentation pools & reuse clean water • Designate specific areas for washing of cement trucks/equipments away from a water body. • Ensure no oil spills during machineries' fuelling with all vehicles re-fuelled at designated stations
Operation	Increased pressure on water resources	<ul style="list-style-type: none"> • Investigate options for water efficient measures to reduce pressure on existing water resources. • Undertake water treatment of potable standard for reuse in production processes • Incorporate relevant and practical wastewater reuse options into the operational procedures • Ensure compliance with Water Resources Management Rules, 2007 on groundwater abstraction. • Undertake regular groundwater monitoring, especially of boreholes supplying water to the abattoir
	Increased storm water	<ul style="list-style-type: none"> • Undertake regular surface water monitoring in the downstream • Ensure storm water drainage system is in good functional condition • Develop and implement contingencies for groundwater and downstream wetlands
	Wastewater effluents	<ul style="list-style-type: none"> • Apply best available technologies and adopt cleaner production techniques • Collect all blood for processing of animal feeds, fertilizers or pharmaceutical products. • Install grease traps in the drains to remove solidified fat from the abattoir wastewater. • Install a functional biological treatment (aerobic/anaerobic processes) for wastewater treatment • Apply for waste discharge permits from NEMA • Undertake annual environmental audits and submit findings to NEMA

Project phase	Possible impacts	Mitigation measures
	Solid wastes	<ul style="list-style-type: none"> Hide and skin should be removed from site daily after slaughter operations. Install a functional incinerator to destroy condemned animals/meat Contract NEMA licensed waste handlers for disposal of various solid wastes; Sludge and coagulated blood should be de-watered to solid contents before disposal Condemned carcasses to be stored in chilled room and disposed by licensed waste handlers Install a functional rendering plant for processing solid by products to useful products Consider alternative energy (biogas) generation from wastes to supplement energy needs Undertake aerobic composting of manure and secure composting pits from rain and scavengers Undertake annual environmental audits and submit report to NEMA
	Air emissions	<ul style="list-style-type: none"> Design and construct an efficient wastewater treatment system in accordance with best practice s De-sludge anaerobic treatment ponds every 5 years Plant indigenous trees around the site to help sequester carbon Cover the composting area to control insects and scavenging birds If biogas is installed, ensure the design encourages burning via flares Install a functional rendering system with an air cooled condenser and deodorizing capacity Manure management practices should focus on dry systems to reduce methane gas emissions. Design of facility chimneys, generators and boilers should comply with the air control standard. Provide water hose points for floor cleansing of lairages, unloading/olding areas to reduce odour. Provide chutes for direct dumping of manure into the collection skips to reduce odour.
	Spread of invasive species, insects, vermin and pests	<ul style="list-style-type: none"> Undertake regular invasive species monitoring/implement remedial measures. Clear/remove invasive plant species immediately they are sighted Undertake prudent and efficient solid/liquid waste management to keep away scavenging birds. Set vermin baits at the facility Develop/implement Integrated Pest and Disease (IPD) focusing on pest monitoring/pesticides use.
	Noise	<ul style="list-style-type: none"> Develop and implement a noise management plan Install acoustic enclosures and silencers in the main plant. Install efficient and super silent power generators Ensure livestock yards are supplied with adequate water/pasture to minimize noise from animals
	Increased pressure on energy resources	<ul style="list-style-type: none"> Reduce boiler start-up and shutdown frequencies by programming the operation Construct impermeable secondary tanker for collecting and reuse of oil spills and prevent leakages Undertake training and reminding workers to switch off lights when leaving the premises Install solar and biogas energy systems to supplement electricity/energy demands

Project phase	Possible impacts	Mitigation measures
	Socio-economics, community health and amenity impacts	<ul style="list-style-type: none"> • Install good fencing and other site security to prevent trespass and vandalism. • Form environmental management committee with locals to address all emerging issues/complaints • Undertake annual environmental audits and submit reports to NEMA
	Flora and fauna	<ul style="list-style-type: none"> • Monitor invasive plant species at the project area and uproot unwanted germinating plants • Plant soil-erosion preventing grass species (i.e. <i>Sporobolus pyramidalis</i>, <i>Cynodon dactylon</i>, <i>Heteropogon tortulus</i> and <i>Bothriochloa insculpta</i> at bare or sloppy grounds at the site • Do not plant exotic plant species at the project site • Unnecessary vehicular disturbances such as hooting should be discouraged at the vicinity of site. • Use of floodlights on site should be restricted where necessary • Engage KWS in problem animal control
	Occupational health and safety hazards	<ul style="list-style-type: none"> • Register the workplace with Director, Directorate of Occupational Health and Safety (DOHS). • Provide PPE to staff and personnel at the site. • Ensure compliance with Occupational Safety & Health Act (Part XI) regulations on construction activities. • Undertake regular occupational health and safety audits and submit reports to DOHS • Provide first aid kit at the facility
Decommission	Noise pollution	<ul style="list-style-type: none"> • Schedule noisy activities during the day time period; • Use silencers on machines where possible. • Ensure machinery is well maintained to reduce noise emitted.
	Air/dust pollution	<ul style="list-style-type: none"> • Practice dust management techniques, including watering down dust; • Set up dust barriers/ screens at strategic locations • Provide and enforce the appropriate use of PPE against dust for staff
	Liquid wastes	<ul style="list-style-type: none"> • Ensure prudent use of water to reduce liquid waste volumes. • Adhere to EMCA 2006 water quality regulations. • Adhere to WRMA 2007 guidelines for effluent discharge into surface water resources. • Undertake proper demolition of wastewater structures to prevent ground water pollution by content
	Solid wastes	<ul style="list-style-type: none"> • Undertake disposal of solid waste in compliance with EMCA 2006 waste management regulations; • Segregate wastes to encourage reuse and recycling • Contracted NEMA licensed waste collector to collect and dispose wastes
	Social impacts	<ul style="list-style-type: none"> • Provide earlier notice to all affected parties concerning the development. • Dismissal procedures should be compliant with the Employment Act, 2007. • Notify residents in advance on planned decommissioning of the abattoir and its structures

Project phase	Possible impacts	Mitigation measures
	Occupational health and safety hazards	<ul style="list-style-type: none"> • Contractor to register the workplace with Directorate of Occupational Health and Safety (DOHS). • Provide PPE to staff and personnel at the site. • Ensure compliance with Occupational Safety & Health Act (Part XI) regulations on construction activities. • The Contractor should provide a standard First Aid Kit on site. • Ensure all materials in use have no negative effects on environment and health.

7.2. Construction phase

Positive Impacts

During the construction period, there is a likelihood of having the following impacts:

Creation of employment opportunities

Many job opportunities will be available for construction workers during the construction phase of the project. Employment opportunities are a benefit both in economic and social sense. For the construction development non-skilled labour, from the local community, will be hired. Although only during the duration of the project, several workers including casual labourers, masons, carpenters, joiners, electricians and plumbers are expected to work on the site during the construction.

Increased business opportunities with construction workers

The construction workers required will provide ready market for various goods and services, leading to several business opportunities for small-scale traders such as shop owners, accommodation providers, and food vendors near the project site.

Provision of market for supply of development materials

The project will require supply of large quantities of project materials some, of which will be sourced locally in the surrounding areas. For instance, the project shall provide ready market for construction material suppliers such as quarrying companies, hardware shops and individuals with such materials.

Increased revenue to suppliers of construction materials and utilities

This will be an opportunity for the suppliers of construction materials and other utility suppliers to create market and sell their goods. In turn this will boost their profit margin which is an advantage to their businesses. Companies such as Kenya Power Company will gain revenue from supply of electricity for construction activities. Other small businesses will also be pulled by the construction activities such as small eating cafes.

Negative Impacts

The construction phase of the project involves clearing, land levelling, transportation of construction materials, erection of machineries, and installation of utility systems etc.

Potential adverse impacts associated with the construction activities of the project are:

Impact on flora and fauna

Construction of the abattoir and associated services will have impacts of different strengths on flora and fauna in the proposed project site. Potential impacts on flora include those associated with the loss of vegetative habitats and increase in natural instability of plant communities. However, since the project site is characterized by scattered wooded vegetation and bushes, de-vegetation of native vegetation cover is expected to be minimal. Similarly, physical site disturbance and noise from construction activities will cause temporary displacement of most fauna from the vicinity of the construction site and adjacent areas. However, following construction, displaced species are expected to resume their normal habitats consistent with the availability of post – construction habitats. Generally, due to the less ecological significance of the existing environment, the construction phase is expected to have minimum impact on flora and fauna.

Mitigation measures

- Limit clearing/soil disturbance around construction sites
- Limit/control movement of machineries during construction
- Undertake selective vegetation clearing that allows regeneration.
- Re-vegetate disturbed areas at the construction site.
- Undertake routine monitoring/clearance of invasive species
- Restoration plans should incorporate measures to improve the ecological status of the site.
- Give provisions for wildlife corridors and buffer zones

Impact on landscape integrity and land use pattern

Land clearing and levelling as well as dumping of excavated material can be a cause for the alteration of landscape integrity in the project area. However, from the existing environmental features of the project area point of view, the impact from land clearing and levelling will not be significant. Although construction of the abattoir and utility systems will cause landscape modification in the project area, the setting of the proposed abattoir will not interfere with the scenic value of the landscape (for example it will not obstruct the panoramic view of the landscape) the impact is not significant. In addition to this, the site does not have any interference with any traditionally important feature of landform.

Mitigation measures

- Undertake dumping of excavated material at selected and designated sites
- Minimizing the movement of vehicles and construction machineries outside the premise of the project site
- Incorporate existing habitat features into site design.
- Create habitats to compensate for habitat losses and to improve the landscape and ecological potential for the site.

Impacts on water quality and demand

Excavation and earth movement during construction and operation can cause pollution of surface and groundwater quality and alter hydrological conditions (i.e. World Bank 2003). The main source of pollution from these activities is increased surface runoff and soil erosion from exposed ground causing high turbidity (suspended solids) and sedimentation in water bodies. In addition to this, during the construction phase of the project foreign materials like oil, grease, fuel and residues of derbies can originate, which are potential threats for water quality degradation. However, the problem is not significant, since the potential ground water in the area is generally encountered at a high depth below ground surface. It is expected that water will be sourced from already existing borehole located about two kilometres from the project site during the construction phase of the project, and this is expected to have impact on water supply to the community from the target borehole.

Mitigation measures

- Optimize water use and monitor consumption during construction
- Install construction water storage facilities at the site
- Minimize disposal wastewater disposal at the construction site

Noise and vibrations

Construction of the abattoir may cause temporary and localized increases in background ambient sound of different strengths with specific impact dependent on the method of construction and equipment used. The principal noise sources associated with the proposed abattoir construction activities include heavy equipment such as bulldozers, scrapers, and trucks which will only have a temporary impact for the duration of the construction. Since the construction doesn't involve the use of explosives or blasting, it does not entail significant noises that affect human population or wildlife of the project area.

Mitigation measures

- Provide PPE to construction workers and persons visiting the site
- Ensure the machineries do not exceed acceptable noise limits
- Inform local residents when construction activities are likely to generate excessive noise
- Sensitise truck drivers to switch off engines while offloading materials and avoid unnecessary hooting

Soil erosion

Removal of soil cover and excavation works associated with this project may lead to increased soil erosion at the project site and release of sediments into the drainage systems, especially if construction works are done during the rainy seasons. Soil erosion may also pollute local streams/rivers from contaminants carried with or attached to soil particles and it may also negatively affect the soil fertility of the affected land. Appropriate and timely control measures will arrest and minimize soil loss and siltation as well as the sedimentation along the gentle slope and water courses.

Mitigation measures

- Allow minimal vegetation clearing and disturbance at the site
- All cleared, excavated and exposed areas during construction should be re-vegetated using native vegetation species.
- Undertake proper planning of site clearing of natural vegetation during the construction works

Mitigation measures

- Excavated materials should be reused as much as possible in backfilling the trenches or landscaping activities.
- Install proper and functional wastewater and storm water drainage channels.

Air quality

The anticipated impacts on ambient air quality during the construction of the abattoir are expected to be minor and short-term. Operation of construction equipment results in crankcase emissions, exhaust and fugitive dust being released. Construction equipment to be utilized by the project will also produce emissions of nitrogen oxides (NO_x), hydrocarbons, and suspended particulates along with limited quantities of sulphur dioxide (SO₂), which will result from the use of diesel fuel. However, the contribution of their impacts on the air quality degradation is expected to be localized and insignificant.

Mitigation measures

- Sprinkle water on fresh construction soil to minimize dust emissions.
- Provide personnel with Personal Protective Equipment & Clothing (PPE&C).
- Palliate stockpiles of earth generated during construction works with water regularly;
- Maintain equipment and machinery in good condition to minimise unacceptable emissions
- No burning of materials should be permitted at the project site;
- Limit traffic movement within the earmarked project areas.

Occupational health and safety

Potential impacts during construction include: exposure to physical hazards from the use of equipments; trips and fall hazards; rock falls/slides in steep areas and exposure to dust and noise.

Mitigation measures

- Ensure all equipments are inspected before use for appropriate safeguards.
- Ensure the working hours are controlled and that employees are not allowed to extend the working hours beyond an acceptable limit.
- Ensure appropriate road safety signages are strategically placed in and round the construction site.
- Erect speed breaks where human and vehicular traffic have high interactions.

Solid wastes

Solid waste will be generated at the site during construction of the abattoir and related infrastructure. The sources of this waste will be rejected materials, surplus materials, surplus spoil, excavated materials and deleterious material. Deleterious material may originate from aggregate screening, maintenance and, repair of machinery at the contractor's camp, workers domestic related waste as well as waste water, paper bags, and empty cartons. At the end of the construction stage waste will be generated due to the demobilization of contractor's camps. The expected wastes from such demolitions shall include: rejected materials, paper bags, and empty cartons, among others.

Mitigation measures

- Encourage wastes segregation at source into different wastes categories before disposal
- Contract licensed waste management firm for disposal of large quantities of solid wastes
- Domestic related solid waste should be stored temporarily in refuse bins before disposal at designated waste dumping sites.
- Concrete, asphalt and other waste aggregate should be stored and reused.
- All reusable materials should be reused to minimize on quantity of solid waste generated.

Liquid wastes

Different liquid wastes are expected during the construction phase. Among the key liquid wastes include machinery oils, paints, waste oil, bitumen and wastewater from sanitation, among others. Poor maintenance and operation of heavy trucks and equipment might lead to oil and fuel spills at the construction site which may contaminate land and water resources in the area. Release of hydrocarbons to the environment has several impacts including sub-soil and groundwater contamination; air pollution, fire and effects on human health due to dermal contact, inhalation or ingestion.

Mitigation measures

- Provide workers with appropriate sanitary facility which can be in the form of exhaustible mobile toilets.
- Effluent from mobile toilets should be disposed by a registered NEMA waste handler.
- Wastewater from concrete batching and aggregate screening should be discharged into a sedimentation pools and clean water re-used;
- Identify and designate specific areas for washing of cement trucks and equipments not near a water body.
- Avoid fuel spills during fuelling of machineries and ensure all vehicular equipments are fuelled at designed fuelling stations.

7.3. Operation phase**Positive impacts**

During the operation phase the following positive impacts are foreseen:

Additional knowledge and skills in meat processing sector

Since the project is a technology intensive enterprise, which involves many industrial technologies, it is also believed that its implementation will add additional knowledge to the local industries and at the same time create the opportunity and exposure to the local experts on the sector. Executing the proposed project in a manner that benefits the Samburu County at large (example: production of quality products, introduction of technologies that maximize the product yield at the same time reducing the environmental burden of the production process) is proposed as a benefit enhancement measure.

Aesthetic quality

The new abattoir, with its associated access road and other amenities will improve the aesthetics of the area, better than its current situation.

Attraction of new investors to Samburu County

The improvement in quality meat processing at the proposed abattoir will be a flashpoint translating to economic growth in the County and leading to attraction of more investors in the livestock value chain, and other sectors.

Direct and indirect employment opportunities

The project would be able to employ a number of staff from the locality during the operation phase thereby contributing to the social and economic wellbeing of the community. For instance, the project is expected to create direct job opportunities for more than 50 slaughter men who will be from the local people residing near by the project area and from Maralal Town. Furthermore, the project is also expected to have interactions with local small and micro enterprises, product dealers and service providers through its provision of access for by products like hide and skin, organic fertilizer and animal feeds.

Improved efficiency in meat processing

The opening of the abattoir will improve efficiency in quality and hygienically processed meat products to be supplied to both the local, national and international markets.

Improved livestock trade

The trade in livestock in Samburu County is expected to increase and improve in more positive manner. Livestock producers will have ready market for their livestock. Traders from far areas will be able to process carcasses, and transport meat products to the markets instead of transporting live animals – considered more expensive.

Increased compliance ability to public health guidelines

Increased abilities of butchers to comply with public health and hygiene regulations resulting in the reduction of public disease levels and the income generation through sales of by products processed in rendering plant are some of the economic benefits to be realized at a regional level.

Professional capacity enhancement

Participating local professionals at different stages of the project will enhance capacity building in the livestock production and marketing sector. This is also an opportunity to minimize operating costs and professionals can be readily available locally for maintenance and expansion activities.

Revenue to county government

Through payment of relevant taxes, rates and fees to the County Government of Samburu, the project will contribute towards the County Government revenue earnings from those using the improved facilities, and any increase from economic activities brought about by the improved station.

Negative impacts***Increased pressure on water resources***

Abattoir consumes vast amounts of water in operations at different stages of processes (Table 14). The maximum water consumption is expected to be in the range of 100,000 litres

daily when the facility is operating at optimum capacity. On average large stocks (cattle and camel) will each require a minimum of 1000 litres of water in the whole slaughtering process, while small stocks (sheep and goats) each requires an average of 300 litres (FAO 2004). Table 15 gives the water use under different slaughter scenarios. The proposed abattoir is has been designed to process fifty (50) large stock and 200 small stocks. This leads to high water demand, and this level of consumption is expected to put pressure on the available water resources in the area, and create competition for water between local residents and the abattoir. Water for use in the abattoir will be sourced mainly from a borehole located some two kilometres away from the proposed site. Rain water harvesting from roof of the abattoir structures has been incorporated in the design as a means to reducing abstraction of ground water in the area.

Table 14: Breakdown of water consumption in an abattoir

Meat Processing Activities	Percent of total fresh water consumption
Stockyard (wash down and animal (watering)	7-24 %
Slaughter, evisceration	44-60 %
Boning	5- 10 %
Inedible & edible offal processing	7- 38
Casings processing	9-20 %
Rendering	2- 8 %
Chillers	2%
Boiler losses	1- 4 %
Amenities	2- 5 %

Source: Meat and Livestock Australia Ltd, 2007

Table 15: Water use under different processing scenarios for the proposed abattoir

Scenario	Large stock (Av.1000L per stock)	Small stock (Av. 300L per stock)	Daily water demand (Litres)	Remarks	Viability
1	50	200	110,000	The expected full operational capacity of the abattoir	YES
2	25	100	55,000	The abattoir operating at half capacity	YES
3	10	200	70,000	Fewer (<=10 large stock) and maximum number of small stock	YES
4	50	100	80,000	Fewer (half small stock) and maximum number of large stock	YES
5	100	200	160,000	Double large stock, maximum capacity of small stock	NO
6	100	400	220,000	Double large stock, double small stock	NO
7	50	400	170,000	Expected capacity of large stock and double small stock	NO
8	150	200	210,000	Triple large stock, maximum capacity for small stock	NO
9	50	0	50,000	Maximum capacity of large stock (No small stock)	YES
10	0	200	60,000	Maximum capacity of small stock (No large stock)	YES

Mitigation measures

- Investigate additional options for water efficient measures, which will result in reducing the impact on existing water resources.
- Undertake water treatment of potable standard for reuse in production process, and implement efficient measures for water use.
- Incorporate relevant and practical wastewater reuse options into the operational procedures to limit the potential cumulative impacts.
- Ensure strict compliance with the Water Resources Management Rules, 2007 on approval and permits for ground water abstraction.
- Undertake regular groundwater monitoring, especially of boreholes supplying water to the abattoir

Increased storm water

Storm water from the roof catchment and surface run-off may pose some environmental issues which can lead to increased erosion or flooding in the neighbouring areas if not adequately mitigated. The key risks relating to storm water and effluent management include changes in surface water quality, leaching into aquifers and impacting downstream environments. Given that the proposed abattoir is downstream, there is will be need to manage storm water effectively by using well designed systems.

Mitigation measures

- Undertake regular surface water monitoring in the downstream
- Ensure storm water drainage system is in good functional condition
- Develop and implement contingencies for groundwater and downstream wetlands
- Collect all blood for processing of animal feeds, fertilizers or pharmaceutical products.
- Install grease traps in the drains to remove solidified fat from the abattoir wastewater.
- Install a functional biological treatment (aerobic and anaerobic processes) for conversion of complex soluble and insoluble organic compounds into simple non-polluting compounds.
- Apply for waste discharge permits from NEMA

Wastewater effluents

The high water consumption of water by abattoirs leads to a corresponding increase in the amount of water discharged from the production processes. The wastewater from different production stages has nutrient loads of different strengths. Unless an appropriate treatment work is put in place, the wastewater to be discharged from the abattoir during its operational phase would have polluting effect on the nearby seasonal water course and the rich underground water and also degrade the soil. Discharge of untreated wastewater from any stage of production process can have significant negative impacts on the environment. It is expected that, on average, it would take about 100 litres of water for each cattle slaughtered and 50 litres for each small ruminant slaughtered giving rise to an average flow of 40,000 litres of water per day. The main sources of effluent water from the proposed abattoir are expected to be: floor washing, carcasses washing, cleaning of offal's (intestine etc), equipment washing, tools cleaning, cutting & packing table washing, from laboratory, boiler blow down, cooling tower discharge (once in a month) and domestic (toilets, canteen etc.).

Mitigation measures

- Apply best available technologies and adopt Cleaner Production techniques
- Collect all blood for processing of animal feeds, fertilizers or pharmaceutical products.
- Install grease traps in the drains to remove solidified fat from the abattoir wastewater.

Mitigation measures	
<ul style="list-style-type: none"> • Install a functional biological treatment (aerobic and anaerobic processes) for conversion of complex soluble and insoluble organic compounds into simple non-polluting compounds. • Apply for waste discharge permits from NEMA • Undertake annual environmental audits and submit findings to NEMA • Install wastewater stabilization lagoons 	

Solid wastes

The expected solid wastes from the proposed abattoir will comprise mainly of offals, by products, hide and skin and dead or infected animal bodies. While dead or infected animals are rarely encountered in a day to day activity of the abattoir during veterinary inspection, it is still important that mitigation measures are implemented to remove them from the facility. Table 16 gives the division of cattle and goats & sheep into various by-product categories and quintiles of by products as estimated by IPCC 2007 (Rajendra & Andy 2007). The quintiles are based on the proposed slaughter capacity of 50 cattle and 200 sheep/goats.

Table 16: Slaughtered livestock species and products/by product quintiles of an abattoir

Products/quintiles	Description	Livestock species	
		Cattle	Sheep/Goats
Product	Blood (% LWK)	2.10%	3.30%
	Soft offal and bones (%):	15%	5.50%
	Leaf fat (%):	1.20%	2.20%
	Paunch and manure (%):	8	6.5
Quintiles by products	Daily slaughtering capacity		
	Number	50	200
	Average live weight in kg	300	20
	Total live weight kg/day	15000	4000
	Quantity of By product available		
	Blood		
	percentage of live weight	2.10%	3.30%
	Kg/day	315	132
	soft offal and bones		
	In percentage of live weight	15%	5.50%
	Kg/day	2250	220
	Leaf fat		
	percentage of live weight	1.20%	2.20%
	Kg/day	180	88
	Paunch and manure		
	In percentage of live weight	8%	6.5%
Kg/day	1200	260	
Total		3945	700

Source: Fearon et al. 2014.

Mitigation measures	
<ul style="list-style-type: none"> • Hide and skin should be removed from site daily after slaughter operations. • Install a functional incinerator to destroy condemned animals/meat • Contract NEMA licensed waste handlers for disposal of various solid wastes; • Sludge and coagulated blood should be de-watered to meet with 30% solid content requirements before disposal • Condemned carcasses and meat should be stored in chilled room and disposed by licensed waste handlers • Install a functional rendering plant with a deodorizing unit to cook, crush and process the waste and convert them to useful products • Consider alternative energy (biogas) generation using solid wastes to supplement energy needs at the facility 	

Mitigation measures

- Undertake aerobic biological decomposition through composting. The composting area to be secured from rain and scavenging birds
- Undertake annual environmental audits and submit report to NEMA

Air emissions

Operations at slaughterhouses may cause problems with unpleasant odours. Discharges of unpleasant odours come from different sources (Table 17) but primarily from paunch tanks, fan press, disposal of offal and waste, solid wastes collection pits, rendering, anaerobic lagoons, biogas flares, the internal wastewater treatment and the holding pens, among others. Generally, almost all activities in an abattoir projects would have a potential to release bad odours if not well managed by using appropriate mitigation measures. However, the impact of odours on sensitive receptors will also vary depending on the location of the slaughterhouse. The meat processing plant itself is not expected to generate any odours as the building would be mechanically ventilated to prevent odour penetration into the facility

Table 17: Identified potential odour sources for the proposed abattoir

Potential odour Source	Description/Assessment
Paunch Tank	Medium source of odour emission during hours of operation
Fan Press	Low source of odour emission during hours of operation
Abattoir Wastewater transfer pit	Closed system – sealed lid / removal for servicing only
DODA Screen	Low source of odour emission during hours of operation (2 hrs / day)
Solids Collection	Very low source of odour emission
Rendering	In rendering plants, odour is the most important air pollution issue which results in public nuisance and pollution of the environment.
Livestock manure	The portion of manure that can generate methane is the volatile solids portion (VS). The VS portion depends on livestock type and diet, which also affect the quantity of methane that can be produced per kilogram of volatile solids (VS) in the manure.
Combustion process	Slaughtering is an activity that requires great amounts of hot water and steam for sterilization and cleaning purposes. In the process of generating the energy for heating, gasses are emitted (CO ₂ , NO _x and SO ₂).
Covered anaerobic lagoon (CAL)	Fully seal cover
Biogas Flare	Potential source of odour emission in event of flame failure
1 st Aerated Pond	Low source of odour emission
Settling Pond	No odour emissions expected
Sludge Removal	Low odour emission expected

Mitigation measures

- Design, construct and operate and efficient wastewater effluent treatment ponds in accordance with best practice guidelines.
- De-sludge anaerobic treatment ponds every 5 years
- Plant indigenous trees around the site to help sequester carbon
- Cover the composting area to control insects and scavenging birds
- If biogas is installed, ensure the design encourages burning via flares
- Install a functional rendering system with an air cooled condenser and deodorizing capacity of reduce volatile organic compounds.
- Manure management practices should focus o dry systems to reduce methane gas emissions. Dry manure produces less methane gas.
- Gas emission from chimney of emergency generator and boiler exhaust should be designed to comply with the air control standard.

Mitigation measures

- Provide water hose points for floor cleansing of lairages, external unloading and holding areas to reduce odour.
- Provide chutes for direct dumping of manure into the collection skips to reduce odour.

Spread of invasive species, insects, vermin and pests

The project will have the potential for introducing invasive plants and animal species (mainly scavenging birds and rodents) to the site and surrounds. Invasive plant species seeds may be introduced from the other areas via livestock (hooves, hides and manure), the transport trucks, and construction and operation vehicles. Additionally, invasive species may be transported off site if composted materials are inadequately treated, transported downstream if storm water retention is inadequate. Fauna species, especially scavenging birds such as marabou stork can be attracted to the site during operation phase.

Mitigation measures

- Undertake regular invasive species monitoring/implement remedial measures.
- Clear/remove invasive plant species immediately they are sighted
- Undertake prudent and efficient solid/liquid waste management to keep away scavenging birds.
- Set vermin baits at the facility
- Develop and implement an Integrated Pest and Disease (IPD) that include pest monitoring and selective pesticides use.

Noise

The ambient noise levels are likely to increase as a result of this project with an accumulation of noise level sources including high livestock densities, and heavy vehicle movements. Transport to and from the slaughterhouse as well as loading and unloading may cause noise disturbances. Fans, refrigeration equipment and similar machines may also cause this kind of disturbance. The main generators of noise during the operation of the project include: plant noise, unloading area noise, traffic noise, slaughter operation noise and human activities.

Mitigation measures

- Develop and implement a noise management plan
- Install acoustic enclosures and silencers in the main plant.
- Install efficient and super silent power generators
- Ensure that livestock yards are supplied with adequate water and pasture to minimize noise from livestock.

Increased pressure on energy resources

The operation stage of the proposed project requires high amount of steam. In order to full fill this steam requirement the factory consumes heavy furnace fuels as energy source for the boiler unit. The operation of the proposed project requires a considerable electrical energy resource for: running of machines, power for the facility, buildings, etc. While a wide range of alternative energy sources have been discussed in the literature only a limited range of alternative energy sources are likely to be of interest in most abattoir situations. When considering using alternative energy sources it must be borne in mind that the primary purpose of the abattoir is to provide hygienic facilities for animal slaughter and

dressing; the incorporation of alternative energy sources should not require a large degree of management input. For this reason only alternative energy sources with a proven history in the area should be considered for installation in the abattoir. For this reason, and because of widely varying costs of energy from conventional sources, each abattoir site will require individual consideration. Some of the potential alternative energy sources for the proposed abattoir include: (i) *biogas*: With the availability on site of raw material in the form of animal wastes and the requirement for hot water for processing, the generation of biogas should be considered. It is not possible to give hard and fast rules for considering installation of biogas plants; (ii) *solar heating*: Simple solar water heating panels unfortunately, cannot produce water temperatures required for pig scalding (60-65°C) thus supplementary heating is required. Investment costs are inevitably high for heating systems incorporating solar panels and are likely to render such systems uneconomic except where fuel costs are very high; and (iii) *solar lighting*: standard systems are now available from several suppliers and would be very effective for Samburu County, especially Maralal areas that has good solar irradiance.

Mitigation measures
<ul style="list-style-type: none"> • Reduce boiler start-up and shutdown frequencies by programming the operation • Construct impermeable secondary tanker for collecting and reuse of furnace fuel spills and leakages • Undertake training and reminding workers to switch off lights when leaving the premises • Install solar and biogas energy systems to supplement electricity/energy demands

Socio-economics, community health and amenity impacts

Apart from many beneficial aspects, the main problems associated with slaughterhouse are as follows: (a) Local nuisances such as odours from poorly maintained slaughterhouses operations; (b) Health risks – poor hygiene practices at operational and waste management level; and (c) Land use conflicts and depreciation in land values. The site selected by the Proponent has the potential to create amenity issues due to the presence of rural residences. If the Project is not carefully managed, there is a high risk that the amenity of the nearby residents and, potentially, stakeholders could be impacted. The potential impacts that this Project may have on the health and amenity of the community include odour, noise, dust, insects and vermin.

Mitigation measures
<ul style="list-style-type: none"> • Install good fencing and other site security to prevent trespass and vandalism. • Form an environmental management committee incorporating local area representatives to deal with issues that arise regarding community health and amenity complaints. • Undertake annual environmental audits and submit reports to NEMA

Flora and fauna

Invasive weeds such as *Lantana camara*, *Datura stramonium* and *Solanum incanum* and other opportunistic weed plants may encroach disturbed areas in particular the cleared or bare grounds left behind after construction at the site or on the road fringes. This may change the

initial physiognomy and the aesthetic appeal of the area. Noise from machines and other installations at the abattoir site as well as from human and vehicle traffic along the road may force mammals to alter their routine ecological and movement patterns. The proposed project may attract specific scavenging birds and displace others, especially those most sensitive to habitat alterations. For instance, floodlights strongly shining upwards or covering a large area at night may interfere with birds' movements at night, particularly those migrating.

Mitigation measures

- Monitor invasive plant species at the project area and uproot unwanted germinating plants
- Plant soil-erosion preventing grass species such as *Sporobolus pyramidalis*, *Cynodon dactylon*, *Heteropogon tortulus* and *Bothriochloa insculpta* at bare or sloppy grounds at the site
- Do not plant exotic plant species at the project site
- Unnecessary vehicular disturbances such as hooting should be discouraged at the vicinity of site.
- Use of floodlights on site should be restricted where necessary
- Engage KWS in problem animal control

Occupational health and safety hazards

Occupational Health and Safety are likely during the operation phase of the project. Some of these hazards could be risks of accidents and injuries for staff and fire risks.

Mitigation measures

- Register the workplace with Director, Directorate of Occupational Health and Safety (DOHS).
- Provide PPE to staff and personnel at the site.
- Ensure compliance with regulations as set out by the Occupational Safety and Health Act (Part XI: Section 96) as pertains to construction activities.
- Undertake regular occupational health and safety audits and submit reports to DOHS
- Provide first aid kit at the facility

7.4. Decommissioning Phase

In the event that the property development will be shut down, the primary activity is expected to be demolition and rehabilitation of the site. The following key activities should be considered:

Negative impacts

Noise pollution

Activities likely to produce noise during decommissioning include cutting and demolition of structures.

Mitigation measures

- Schedule noisy activities during the day time period;
- Use silencers on machines where possible.
- Ensure machinery is well maintained to reduce noise emitted.

Air/dust pollution

This is expected to result from demolishing of structures at the proposed site.

Mitigation measures

- Practice dust management techniques, including watering down dust;

Mitigation measures

- Set up dust barriers/ screens at strategic locations
- Provide and enforce the appropriate use of PPE against dust for staff

Liquid wastes

These are likely from cleaning and rinsing activities

Mitigation measures

- Ensure prudent use of water to reduce liquid waste volumes.
- Adhere to EMCA 2006 water quality regulations.
- Adhere to WRMA 2007 guidelines for effluent discharge into surface water resources.
- Undertake proper demolition of the wastewater structures to prevent pollution by contents into the environment and groundwater

Solid waste material

It is expected that large amounts of solid waste material arising during demolition will include stone, wood, glass, metal, paper, plastic, equipment, vegetation, etc. The proper disposal of these materials is critical.

Mitigation measures

- Undertake disposal of solid waste in compliance with EMCA 2006 waste management regulations;
- Segregate wastes to encourage reuse and recycling
- Contracted NEMA licensed waste collector to collect and dispose wastes

Social impacts

During operation of the abattoir, a variety of small business enterprises will be attracted to the County by the development. These businesses will be lost/adversely affected during decommissioning of the abattoir. Some employees in the abattoir and associated businesses may also be rendered jobless; residence will be displaced.

Mitigation measures

- Provide earlier notice to all affected parties concerning the development.
- Dismissal procedures should be compliant with the Employment Act, 2007.
- Resident to be notified prior to any decommissioning of the proposed abattoir buildings and any other facility on site.

Occupational health and safety hazards

Occupational Health and Safety hazards such as falling objects, open pits, sharp objects lying around, and dust may all be a health risk to construction workers. Health, safety and security are important aspects through all the stages of the proposed project.

Mitigation measures

- The contractor should ensure registration of workplace by the Director, Directorate of Occupational Health and Safety (DOHS).
- Provide PPE to staff and personnel at the site.
- Ensure compliance with regulations as set out by the Occupational Safety and Health Act (Part XI: Section 96) as pertains to construction activities.
- The Contractor should provide a standard First Aid Kit on site.
- Ensure all materials in use have no negative effects on environment and health.

CHAPTER 8: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

This chapter presents the environmental management plan (EMP) for the proposed abattoir at Nomotio LIC Farm, Samburu County. The EMP specifies the mitigation and management measures which the Proponent will undertake and shows how the Project will mobilize organizational capacity and resources to implement these measures. The EMP covers information on the management and/or mitigation measures that will be taken into consideration to address impacts in respect of the three project phases: construction, operation and decommissioning.

8.1. Approach and strategies for EMP implementation

The implementation of the proposed EMP will be the responsibility of the Department of Agriculture, Livestock and Fisheries, Samburu County. However, it will have links with other departments such as health, environment, operation and maintenance. Table 18 shows the range of approaches that will be used to manage potential impacts of the proposed project.

Table 18: Approaches to manage potential impacts associated with the proposed abattoir

Approach	Description
Avoidance	Avoiding activities that could result in adverse impacts and/ or resources.
Prevention	Preventing the occurrence of negative environmental impacts and/ or preventing such an occurrence having negative impacts.
Minimization	Limiting or reducing the degree, extent, magnitude or duration of adverse impacts through scaling down and redesigning elements of the project.
Mitigation	Measures taken to minimize adverse impacts on the environment.
Enhancement	Magnifying and/ or improving the positive effects or benefits.
Rehabilitation	Repairing affected resources
Restoration	Restoring affected resources to an earlier (possibly more stable and productive) state, typically 'background or pristine' condition

Management structure and responsibility for implementation of the EMP

Environmental management structure

- (i) The Proponent (Samburu County Government) through Department of Agriculture, Livestock and Fisheries will utilize the existing arrangements in the implementation of the EMP during construction, operation and decommissioning/closure.
- (ii) The Proponent will be accountable for ensuring that resources are made available to effectively implement the EMP and necessary environmental management measures arising from the project.
- (iii) The proponent will develop organizational structure for the proposed Project, showing the reporting lines of staff to be involved in environmental management of the project. Table 19 shows the applicable management structure for the implementation of this EMP.

- (iv) Environmental monitoring will be undertaken regularly, and environmental audits of performance conducted from time to time by independent NEMA approved environmental experts.

Table 19: Proposed organizational structure and staff in implementation of EMP

Position	Responsibility
Engineering Manager	performing technical and organizational role of construction works overseeing Implementation of EMP
Project Manager	Schedule preparation, work supervision and resource forecasting for engineering and other technical activities relating to the project.
Contractor(s)	<ul style="list-style-type: none"> Undertake development and construction of the abattoir including all its facilities in accordance with contract signed with the Proponent; Adhere to Proponent HSE policies, procedures and other requirements while undertaking the project implement aspects of EMP assigned to them
Construction Manager	<ul style="list-style-type: none"> Ensure effective implementation of the EMP. Regular performance reviews including corrective and/or remedial action where required.
Department of Agriculture, Livestock and Fisheries/QHSE Manager/County Department of Environment	<ul style="list-style-type: none"> Conducting monitoring and review of EMP implementation by contractors Develop policies/procedures on the environmental, social, health and safety issues, and oversee their implementations. Oversee inspection of the constructed facilities after completion of construction works. Overseeing annual environmental, health and safety audits Overseeing of construction process and ensuring the implementation of avoidance and mitigation measures Planning of training programs for personnel in accordance with relevant laws e.g. OSHA 2007 Preparation of environmental monitoring reporting and any permit applications Running of day-to-day requirements for EMP implementation
NEMA Registered & licensed EIA/EA Expert	<ul style="list-style-type: none"> Periodically commissioned to undertake statutory environmental audits, and guide the Proponent during implementation of the EMP.
DOSHS Approved H&S advisor	<ul style="list-style-type: none"> Carry out statutory health and safety audit of the abattoir

Management of contractors

The Proponent fully recognizes that it is not absolved from those management responsibilities, and the ultimate responsibility for meeting all commitments lies with the Proponent. The Proponent will commit contractors to meeting the relevant responsibilities by means of specific conditions in the contracts of appointment. Where there is concern over the capacity of contractors to undertake specific activities according to the system stated here, the Proponent will provide additional training to improve the capacity of the contractors. Activities of contractors will be overseen by the Project Manager and appointed staff as appropriate. The Proponent will put in place the following construction phase contractor arrangements to support EMP implementation:

- (i) Contractors will have certain key environmental line functions included in their job descriptions and performance criteria. Critical among these will be the Construction Manager who shall be accountable for environmental (including social) management during the construction phase, undertake regular performance reviews and undertake corrective and/or remedial action as required.
- (ii) Regular (at least monthly) liaison between the Construction Manager, the Project Manager and the Department of Agriculture, Livestock and Fisheries and County Department of Environment, and their teams must be carried out. At the commencement of the construction phase, weekly meetings shall occur. Such meetings shall among others review implementation of EMP requirements, highlight issues of concern, identify required interventions, prescribe corrective actions, schedule work programmes, and allocate budget and appoint responsible parties.
- (iii) A code of practice for construction teams will be prepared and implemented. This code will guide the management and behaviour of construction teams. The code will include items relating to health safety and community relations.

8.2. Monitoring and compliance assessment

During the construction phase, the Proponent will monitor and inspect contractors' written records to demonstrate compliance with the EMP. This compliance monitoring will verify that the responsible parties are implementing the specifications contained in the EMP. Compliance will mean that the contractor is fulfilling contractual obligations.

Incident handling and reporting

- (i) An incident can arise from the following: (i) significant non-conformance with the EMP identified during an internal inspection; (ii) any non-conformance identified by either the authorities or an external audit; (iii) accidents or spills resulting in potential or actual environmental harm; (iv) accidents or near misses that did or could result in injury to staff, visitors to site or the surrounding communities, and (v) significant complaints received from any source.
- (ii) All incidents will be formally recorded and noted in the General Register in accordance with requirements of OSHA 2007.

Checking, corrective action and reporting

- (i) **Checking:** Checking and if necessary implementing corrective action, to ensure that required EMP management activities are being implemented and desired outcomes are achieved. As such this component includes four key activities namely: monitoring

selected environmental quality variables as defined in the objectives and targets; inspections of the operational controls and general state of the operations; internal audits to assess the robustness of the EMP or to focus on a particular performance issue; and external audits to provide independent verification of the efficacy of the EMP.

- (ii) **Corrective action:** There are several mechanisms for implementing corrective actions, both during the construction and operational phases. The main mechanisms to address transgressions include verbal instruction (in the event of minor transgressions from established procedure, usually following a site inspection); written instruction (identifying source(s) of problems, usually following an audit and contract notice (following possible breach of contract)).
- (iii) **Reporting:** The findings of all of the above will be structured into instructive reporting that provides information to all required parties on EHS performance, together with clearly defined corrective action where this is seen to be required. Both the monitoring and inspections are to be reported continuously.

8.3. Management review and liaison

The Proponent will organize for formal management review at defined intervals both during the construction and operational phases. The purpose of the reviews will be to assess environmental management performance and improving that performance in the spirit of continuous improvement. Throughout the project cycle, the Proponent will liaise with authorities especially NEMA to ensure ongoing feedback on the environment performance of the project.

8.4. Proposed project and the EMP context

The EMP (Table 20) addresses the planning and design, construction, operational and decommissioning phases of the proposed project.

8.4.1. Construction Phase

The EMP contains measures to avoid and mitigate impacts and optimize benefits arising from activities during the pre-construction (e.g. clearing of the construction site) and construction phase (e.g. construction of required infrastructure) of the Project. The principal focus of Project management for construction will include: contractor management and training; site management; emergency preparedness and mitigation of all impacts associated with the construction phase of the project. Contractors will be held to the highest HSE performance requirements to meet all mitigation measures associated with the impacts as identified.

8.4.2. Operation phase EMP

The operation phase of the project will mainly involve processing of meat and waste management. The activities, mitigation measures, allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase would be critical.

8.4.3. Decommissioning Phase EMP

The EMP addresses how the actions and activities for decommissioning phase that have to be dealt with including the rehabilitation and closure plans.

Table 20: Environmental Management Plan for the proposed abattoir

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
CONSTRUCTION	MINIMIZATION OF CONSTRUCTION IMPACTS ON FLORA AND FAUNA AT THE SITE AND SURROUNDING AREAS				
	Flora and fauna	<ul style="list-style-type: none"> Limit clearing/soil disturbance around construction sites Limit/control movement of machineries during construction Undertake selective vegetation clearing that allows regeneration. Re-vegetate disturbed areas at the construction site. Undertake routine monitoring/clearance of invasive species Restoration plans should incorporate measures to improve ecological status of the site. Give provisions for wildlife corridors and buffer zones 	CDE. Con-M CONT CPP DALF KFS KWS	Routine during construction period	20
	ENSURING LANDSCAPE INTEGRITY IS MAINTAINED AND THE EXISTING FEATURES ARE NOT INTERFERED WITH				
	Landscape integrity and land use pattern	<ul style="list-style-type: none"> Undertake dumping of excavated material at selected and designated sites Minimize movement of vehicles/construction machineries outside the project site Incorporate existing habitat features into site design. Create habitats to compensate for habitat losses/improve ecology for the site. 	CDE Con-M CONT. CPP EngM NEMA PRM	Routine during construction period	70
	MAINTAINING WATER QUALITY TO BE BEST STANDARDS AND MINIMIZING PRESSURE ON EXISTING WATER RESOURCES				
Water quality and demand	<ul style="list-style-type: none"> Optimize water use and monitor consumption during construction Install construction water storage facilities at the site Minimize disposal wastewater disposal at the construction site 	CDE Con-M CONT. CWD DALF EngM NEMA PRM	Routine during construction period	40	
MINIMIZE THE NOISE AND VIBRATION IMPACTS AT THE SITE AND SURROUNDING AREAS					
Noise and vibrations	<ul style="list-style-type: none"> Provide PPE to construction workers and persons visiting the site 	Con-M CONT.	Once and routine during construction	---	

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		<ul style="list-style-type: none"> Ensure the machineries do not exceed acceptable noise limits Inform local residents of construction activities are likely to generate excessive noise Truck drivers to switch off engines during offloading materials avoid unnecessary hooting 	DALF EngM PRM	period	
ENSURING THAT THE CONSTRUCTION ACTIVITIES DO NOT LEAD TO SOIL EROSION					
	Soil erosion	<ul style="list-style-type: none"> Allow minimal vegetation clearing and disturbance at the site Re-vegetate all cleared areas during construction with indigenous vegetation species Undertake proper planning of site clearing of vegetation during construction works Encourage re-use of excavated materials for back-filling and landscaping activities. Install proper and functional wastewater and storm water drainage channels. 	CDE. Con-M CONT. EngM KFS PRM	Once and routine during construction period	50
MINIMIZING AIR EMISSIONS (DUST AND EXHAUST AIR FROM MACHINES) FROM THE CONSTRUCTION ACTIVITIES					
	Air quality	<ul style="list-style-type: none"> Sprinkle water on fresh construction soil to minimize dust emissions. Provide personnel with Personal Protective Equipment & Clothing (PPE&C) such as dust masks. Palliate stockpiles of earth generated with water regularly to suppress evolution of particles; Maintain equipment and machinery in good condition to minimise unnecessary emissions No burning of materials should be permitted at the project site; Limit traffic movement within the earmarked project areas. 	Con-M CONT. EngM PRM	Routine during construction period	45
ENSURING THE OCCUPATIONAL HEALTH AND SAFETY IS ACCORDED THE HIGHEST STANDARDS DURING CONSTRUCTION WORKS					
	Occupational health and safety	<ul style="list-style-type: none"> Ensure all equipments are inspected before use for appropriate safeguards. 	Con-M CONT.	Weekly and routine during construction	---

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		<ul style="list-style-type: none"> Ensure controlled working hours and that employees do not extend working hours unnecessarily Ensure appropriate road safety signages are strategically placed in and round the construction site. Erect speed breaks where human and vehicular traffic have high interactions. 	EngM PRM	period	
MINIMIZING AND ENSURING GOOD SOLID WASTE MANAGEMENT					
	Solid wastes	<ul style="list-style-type: none"> Encourage wastes segregation at source into different wastes categories before disposal Contract licensed waste management firm for disposal of large quantities of solid wastes Domestic solid wastes to be temporarily stored in refuse bins before disposal by licensed contractor Concrete, asphalt and other waste aggregate should be stored and reused. All reusable materials should be reused to minimize on quantity of solid waste generated. 	Con-M CONT. DALF NEMA PRM	Routine and weekly during construction period	45
MINIMIZING AND MANAGING DISCHARGE OF LIQUID WASTES DURING CONSTRUCTION WORKS					
	Liquid wastes	<ul style="list-style-type: none"> Provide workers with appropriate and adequate sanitary facilities i.e. exhaustible mobile toilets. Effluent from mobile toilets should be disposed by a registered NEMA waste handler. Wastewater from concrete//aggregates to be disposed into sedimentation pools & reuse clean water Designate specific areas for washing of cement trucks/equipments away from a water body. Ensure no oil spills during machineries' fuelling with all vehicles re-fuelled at designated stations 	Con-M CONT. DALF EngM NEMA PRM	Weekly during construction period	55

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
OPERATION	MINIMIZING PRESSURE ON WATER RESOURCES DURING THE ABATTOIR OPERATION				
	Increased pressure on water resources	<ul style="list-style-type: none"> Investigate options for water efficient measures to reduce pressure on existing water resources. Undertake water treatment of potable standard for reuse in production processes Incorporate relevant and practical wastewater reuse options into the operational procedures Ensure compliance with Water Resources Management Rules, 2007 on groundwater abstraction. Undertake regular groundwater monitoring, especially of boreholes supplying water to the abattoir 	Con-M CONT. CWD DALF EngM PRM WQM WRMA	Monthly and annually during operation period	140
	MINIMIZATION AND MANAGING OF STORM WATER FROM THE ABATTOIR				
	Increased storm water	<ul style="list-style-type: none"> Undertake regular surface water monitoring in the downstream Ensure storm water drainage system is in good functional condition Develop and implement contingencies for groundwater and downstream wetlands 	CWD DALF EngM PRM WQM	Monthly and annually during operation period	130
	MANAGING WASTEWATER EFFLUENT GENERATED FROM THE ABATTOIR AND ITS AUXILIARY FACILITIES				
Wastewater effluents	<ul style="list-style-type: none"> Apply best available technologies and adopt cleaner production techniques Collect all blood for processing of animal feeds, fertilizers or pharmaceutical products. Install grease traps in the drains to remove solidified fat from the abattoir wastewater. Install a functional biological treatment (aerobic/anaerobic processes) for wastewater treatment Apply for waste discharge permits from NEMA Undertake annual environmental audits and submit findings to NEMA 	CDE. Con-M CONT. DALF EngM ESIA-X NEMA PRM	Routine and monthly during operation	150	
MANAGING SOLID WASTES GENERATED FROM THE ABATTOIR					
Solid wastes	<ul style="list-style-type: none"> Hide and skin should be removed from site 	Con-M	Routine and monthly	180	

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		daily after slaughter operations. <ul style="list-style-type: none"> • Install a functional incinerator to destroy condemned animals/meat • Contract NEMA licensed waste handlers for disposal of various solid wastes; • Sludge and coagulated blood should be de-watered to solid contents before disposal • Condemned carcasses to be stored in chilled room and disposed by licensed waste handlers • Install a functional rendering plant for processing solid by products to useful products • Consider alternative energy (biogas) generation from wastes to supplement energy needs • Undertake aerobic composting of manure and secure composting pits from rain and scavengers • Undertake annual environmental audits and submit report to NEMA 	CONT. DALF EngM EngM ERC ESIA-X NEMA PRM QHSE SLH-S	during operation	
CONTROLLING AND MANAGING AIR POLLUTION (ODOUR) FROM THE ABATTOIR					
	Air emissions	<ul style="list-style-type: none"> • Design and construct an efficient wastewater treatment system in accordance with best practice s • De-sludge anaerobic treatment ponds every 5 years • Plant indigenous trees around the site to help sequester carbon • Cover the composting area to control insects and scavenging birds • If biogas is installed, ensure the design encourages burning via flares • Install a functional rendering system with an air cooled condenser and deodorizing capacity • Manure management practices should focus on dry systems to reduce methane gas emissions. 	CDE. CONT. DALF EngM KFS NEMA PRM QHSE-M	Routine and annually during operation	50

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		<ul style="list-style-type: none"> Design of facility chimneys, generators and boilers should comply with the air control standard. Provide water hose points for floor cleansing of lairages, unloading/loading areas to reduce odour. Provide chutes for direct dumping of manure into the collection skips to reduce odour. 			
MINIMIZING AND MANAGING THE SPREAD OF INVASIVE SPECIES, VERMINS AND PESTS IN AND AROUND THE ABATTOIR					
	Spread of invasive species, insects, vermin and pests	<ul style="list-style-type: none"> Undertake regular invasive species monitoring/implement remedial measures. Clear/remove invasive plant species immediately they are sighted Undertake prudent and efficient solid/liquid waste management to keep away scavenging birds. Set vermin baits at the facility Develop/implement Integrated Pest and Disease (IPD) - focus pest monitoring/pesticides use. 	CDE. DALF PRM QHSE	Monthly and annually	135
MINIMIZING AND MANAGING NOISE IMPACTS FROM THE ABATTOIR					
	Noise	<ul style="list-style-type: none"> Develop and implement a noise management plan Install acoustic enclosures and silencers in the main plant. Install efficient and super silent power generators Ensure livestock yards are supplied with adequate water/pasture to minimize noise from animals 	DALF EngM PRM QHSE-M	Once and routine during operation	145
ENSURING PROPER ENERGY MANAGEMENT AND EXPLORING ENERGY OPTIONS					
	Increased pressure on energy resources	<ul style="list-style-type: none"> Reduce boiler start-up and shutdown frequencies by programming the operation Construct impermeable secondary tanker for collecting and reuse of oil spills and prevent leakages Undertake training and reminding workers to switch off lights when leaving the 	DALF EngM PRM QHSE-M	Once and annually during operation	180

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		<ul style="list-style-type: none"> premises Install solar and biogas energy systems to supplement electricity/energy demands 			
MANAGING SOCIO-ECONOMIC IMPACTS ON COMMUNITIES BROUGHT ABOUT BY THE ABATTOIR					
	Socio-economics, community health and amenity impacts	<ul style="list-style-type: none"> Install good fencing and other site security to prevent trespass and vandalism. Form environmental management committee with locals to address all emerging issues/complaints Undertake annual environmental audits and submit reports to NEMA 	CONT. DALF ESIA-X NEMA PRM Project Engineer	Once and annually during operation	100
MINIMIZING THE IMPACTS OF THE ABATTOIR ON FLORA AND FAUNA					
	Flora and fauna	<ul style="list-style-type: none"> Monitor invasive plant species at the project area and uproot unwanted germinating plants Plant soil-erosion preventing grass species (i.e. <i>Sporobolus pyramidalis</i>, <i>Cynodon dactylon</i>, <i>Heteropogon tortulus</i> and <i>Bothriochloa insculpta</i> at bare or sloppy grounds at the site Do not plant exotic plant species at the project site Unnecessary vehicular disturbances such as hooting should be discouraged at the vicinity of site. Use of floodlights on site should be restricted where necessary Engage KWS in problem animal control 	CDE. DALF EngM KWS PRM QHSE-M	Routine and annually during operation	160
ENSURING BETTER OCCUPATIONAL HEALTH AND SAFETY DURING THE PROJECT OPERATION					
	Occupational health and safety hazards	<ul style="list-style-type: none"> Register the workplace with Director, Directorate of Occupational Health and Safety (DOHS). Provide PPE to staff and personnel at the site. Ensure compliance with Occupational Safety & Health Act (Part XI) regulations on construction activities. Undertake regular occupational health and safety audits and submit reports to DOHS 	DALF OSH-A PRM QHSE-M	Once and routine during operation	120

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		<ul style="list-style-type: none"> Provide first aid kit at the facility 			
DECOMMISSION	MINIMIZING NOISE AND VIBRATIONS				
	Noise pollution	<ul style="list-style-type: none"> Schedule noisy activities during the day time period; Use silencers on machines where possible. Ensure machinery is well maintained to reduce noise emitted. 	CONT. EngM PRM	Once	----
	ENSURING AIR AND DUST POLLUTION ARE MINIMIZED				
	Air/dust pollution	<ul style="list-style-type: none"> Practice dust management techniques, including watering down dust; Set up dust barriers/ screens at strategic locations Provide and enforce the appropriate use of PPE against dust for staff 	CONT. QHSE-M	Routine during decommissioning period	140
	MANAGING AND MINIMIZING LIQUID WASTES				
	Liquid wastes	<ul style="list-style-type: none"> Ensure prudent use of water to reduce liquid waste volumes. Adhere to EMCA 2006 water quality regulations. Adhere to WRMA 2007 guidelines for effluent discharge into surface water resources. Undertake proper demolition of wastewater structures to prevent ground water pollution by content 	CDE. CONT. CWD EngM NEMA PRM	Routine during decommissioning period	170
	MANAGING SOLID WASTES GENERATED				
Solid wastes	<ul style="list-style-type: none"> Undertake disposal of solid waste in compliance with EMCA 2006 waste management regulations; Segregate wastes to encourage reuse and recycling Contracted NEMA licensed waste collector to collect and dispose wastes 	CONT. CWD NEMA PRM	Routine during decommissioning period	100	
MINIMIZING SOCIO-ECONOMIC IMPACTS TO THE LOCAL COMMUNITIES DURING DECOMMISSIONING WORKS					
Social impacts	<ul style="list-style-type: none"> Provide earlier notice to all affected parties concerning the development. Dismissal procedures should be compliant with the Employment Act, 2007. Notify residents in advance on planned 	CONT. DALF EngM PRM	Once	----	

Phase	Impacts	Recommended mitigation measures	Responsibility	Timeframe	Cost (KES'000)
		decommissioning of the abattoir and its structures			
INTEGRITY OF WORK PLACE FOR ALL PERSONNEL					
	Occupational health and safety hazards	<ul style="list-style-type: none"> Contractor to register the workplace with Directorate of Occupational Health and Safety (DOHS). Provide PPE to staff and personnel at the site. Ensure compliance with Occupational Safety & Health Act (Part XI) regulations on construction activities. The Contractor should provide a standard First Aid Kit on site. Ensure all materials in use have no negative effects on environment and health. 	CONT. DALF PRM QHSE-M	Once and routine during decommissioning period	40

- CDE:** County Department of Environment
- ConM:** Construction Manager
- CONT.:** Contractor)
- CPP:** County physical planner
- CWD:** County Water Department
- DALF:** Department of Agriculture, Livestock and Fisheries
- EngM:** Engineering Manager
- ERC:** Energy Regulatory Commission
- ESIA-X:** EIA/EA Expert
- KFS:** Kenya Forest Service
- KWS:** Kenya Wildlife Service
- NEMA:** National Environment Management Authority
- OSH-A:** DOSHS advisor
- P-Eng:** Project Engineer
- PRM:** Project Manager
- QHSE-M:** Quality, Health and Safety Manager
- SLH-S:** Slaughterhouse staff
- WQM:** Water Quality Consultant
- WRMA:** Water Resources Management Authority

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

9.1. Conclusions

- (i) The proposed abattoir will be the first of its kind multiplier investment in the livestock sector in Samburu County. It is economically feasible in regard to opening up the County for more enhanced livestock production and marketing in Kenya. It also has the potential to increase business activities to the County; provision of more enhanced social services especially to Samburu Central Sub-county, and will effectively increase fresh and quality meat both to the County residents and external markets.
- (ii) The proposed abattoir will have all modern slaughtering and meat processing facility so that no by products or left over are taken outside. The abattoir will include modern rendering plant for the treatment of in edible offals, fat, bones and other by products. The abattoir will further install a modern technology oriented Effluent treatment plant for the treatment of waste water generated from the process of slaughtering, meat processing and rendering and utilization of other by products.
- (iii) Although development of this magnitude may have potential negative environmental and social implications, this study has provided appropriate mitigation measures for all potential negative impacts, and it is hoped that the proponent will strictly adhere to the implementation of proposed mitigation measures including full implementation of environmental management plan.
- (iv) During the preparation of this report for the development of the proposed abattoir project it was observed and established that most of the negative impacts on the environment are rated low and short term thus can be abated through the proposed mitigation measures. The positive impacts are highly rated and will benefit all stakeholders, Samburu County and the country at large. The project proponents should aim to prudently implement the Environmental Management Plan.

9.2. Recommendations

While there is a general acceptability of the abattoir by the local community, interference with water points, increased exposure to environmental risks such as adour and general safety are among concerns of the local communities. In conclusion the following are recommended.

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- (i)** Integrate suitable mitigation measures as outlined in this report in the designs for all sections of the project abattoir for implementation during construction and operation of the abattoir.
 - (ii)** Form an environmental and management committee with full representation of the local communities for purposes of addressing any emerging environmental challenges from the project. As a procedure, the proponent will be expected to consult the communities and other stakeholders, particularly property owners, to the extent possible on planning the works, especially where other aspects of social interest are concerned;
 - (iii)** Engage the services of a NEMA licensed waste handling firm in regard to waste considerations during all the phases of the abattoir so as to ensure safety from waste released and also for management issues among other concerns;
 - (iv)** Institute effective communication, education and awareness towards the project beneficiaries for enhanced acceptability and social harmony. This is particularly important for all sub-counties within Samburu County with Samburu Central Sub-county prioritized.
 - (v)** Implement the environmental management plan throughout the project implementation with assistance of appropriate experts and in conjunction with relevant line ministries at county and national levels.
 - (vi)** Institute regular environmental audits and monitoring to assess the levels of compliance in the implementation of EMP, and submit reports to NEMA. During such audits, occupational health and safety audits shall also be undertaken and reports submitted to DOSH.
 - (vii)** The Proponent is to incorporate relevant and practical wastewater reuse options into the operational procedures to limit the potential cumulative impacts that this project may have on the water supply, especially in Samburu Central Sub-county and Maralal Township in particular. Additional water efficiency measures should be developed in consultation with Water Resources Management Authority (WRMA) and Samburu Water and Sanitation Company, and in keeping with the principles of Ecologically Sustainable Development.
 - (viii)** Prior to commencement of works, the Proponent is to establish a network of bores within the site boundaries in order to conduct a site specific hydrogeological assessment. This will inform development by the proponent of a conceptual model

to enable assessment of the potential impacts to groundwater and surrounding receptors. During operation, the bores will then serve as monitoring bores. Groundwater monitoring (establishing bores and collecting data), including its frequency, should be in accordance with WRMA guidelines.

- (ix)** Prior to commencement of works, an erosion and sediment control plan (ESCP) is to be developed and implemented. The plan should detail control measures for construction and operational phases.
- (x)** The design plans for wastewater management system including oxidation ponds and storm water system should be provided Public Health Department for approval prior to works commencing.
- (xi)** The proposed composting area shall be covered, to the satisfaction of the Public Health Department, to prevent the composting material being exposed to rainfall. The floor surface of the composting area is to be a concrete hardstand to prevent leaching into the soil substrate.
- (xii)** Develop an odour management plan before the commencement of the operations and ensure its full implementation during the lifespan of the project.

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ANNEXES

ANNEX 1. Land ownership documents for the proposed site

MRL/PSN/SCG/



SAMBURU COUNTY GOVERNMENT.
P.O. BOX 3-20600 Tel: 0368/2621/2003 fax 2063 Maralal
Email: Info@samburacountygovernment.go.ke

Date: 15/11/2016


PLOT ALLOCATION LETTER

The County Government is pleased to inform that you had been allocated plot at MARALAL NOMOTIO TRADING CENTRE of our jurisdiction, the town planning committee has approved your application.


NAME /ADDRESS	PLOT NO	TYPE (RES/COM)	AREA STANDARD MEASUREMENT
COUNTY DEPARTMENT OF AGRICULTURE.LIVESTOCK PRODUCTION DEPARTMENT P.O BOX 3-20600 MARALAL	NOMOTIO FARM	PUBLIC UTILITY	295.35 HA

The County Government approved your application; you are required to fulfil the following conditions:


1. You should build your Plot within a period of one-year failure to which the County will repossess the Plot.
2. You are required to pay the sum of Ksh NIL being plot allocation and Survey fees to the County before you are shown the site of the plot.
3. No one is allowed to sell any Plot without the consent of the Plots allocation committee especially undeveloped Plots and once one has sold his or her Plot be assured that the County will never in future allocate you any Plot throughout the County.
4. Prospective sellers of Plots must apply through the Plots allocation committee to the effect that they intend to sell their Plots before receiving any money from the buyer. The Prospective buyer pays money to the prospective seller at his/her own peril without the approval of the Plots allocation committee.
5. AR Lease (Land Rent) of the sum Kshs NIL is payable annually to the County. Please adhere to the above-stipulated conditions.



BERNARD LESURMAT
C.O-Land, Housing & Urban Development,
SAMBURU COUNTY GOVERNMENT.



CHIEF OFFICER
LAND HOUSING & URBAN DEVELOPMENT
15 NOV 2016
SAMBURU
COUNTY GOVERNMENT



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Annex 2. Architectural design and drawings of the proposed abattoir

Annex 3: Minutes of the public meeting held on 10th April 2018 with the members of the public and village council of Lkurroto sub-location, Maralal Town Location, Kirisia Division, Samburu County

The meeting was held on the 10th April 2018 from 11:00 am to 3: 00 pm, between the Consultancy Firm, Oikos Veritas and members of Lkurroto Sub-location. The meeting was held at the proposed project site in the Nomotio LIC Farm.

Present

Alfred Owino-Chief Consultant with Oikos Veritas Services
 Erick Ojunga- Consultant with Oikos Veritas Services
 Monique Wambui- Research Assistant with Oikos Veritas Services
 Chief of Lkurroto Sub-location
 Sub-chief Lkuroto Sub-location
 Chairman of Nomotio Farm
 Vice-Chairman of Nomotio Farm
 Members of the Village Council
 Caretaker of Nomotio Farm on Behalf of County Government of Samburu

1. Commencement of the meeting

The meeting began with a word of prayer from one of the community members. Thereafter, those present did self introductions. The consultants were welcomed and requested to feel at home by the chief of Lkurroto.

2. Preview of the meeting's agenda

Alfred Owino addressed the members and gave an overview and the agenda of the meeting. He then handed over to Erick Ojunga who went ahead and gave a detailed description of the proposed abattoir construction at Nomotio LIC Farm. The importance of the project in terms of the benefits, risks and mitigation measures for the anticipated adverse effects.

3. Feedback and Concerns from the Village Council

Member 1: Thanked the Oikos Veritas team for showing general interest and concern for the community by involving them in stakeholder discussions. Abattoirs had been present in the past and good systems were in place. Wastes were minimal and the project was beneficial to the community in terms of employment. Major concern was that the community should get benefits from the abattoir's construction and operation so that they do not feel left out.

Member 2: Thanked the consultants for coming to the proposed site and involving them in the meeting. He pointed out that the proposed site (Nomotio Farm) is under dual-ownership between the community and the County Government of Samburu. He then said that the construction of a modern abattoir is a good idea which will boost economic growth of the area. The community has high expectations from its construction. He however stated that the actual site on the farm should be agreed upon by all so that no opposition comes up during its construction.

Member 3: A similar project that had begun close to the farm but faced a lot of resistance from the community due to its proximity to the dam which supplies water to Maralal Town, as well as lack of public consultation. The construction of the tannery in Nomotio LIC Farm was carried out without proper consultation and this made them unhappy. He however stated his gratitude for their involvement in the project in time before construction works begin. His major concern was the management of waste so that it doesn't drain into the dam.

Member 4: He acknowledged that that was the third meeting about the proposed modern abattoir construction that he had been involved in. The community of Lkurroto has preserved the land for many years and thus they would expect that the project wouldn't cause damage to the environment. He stated that the abattoir would bring benefits and development to Samburu County.

Member 5: Cattle cartels in slaughterhouses existed and Samburu pastoralists got a lot of losses, as they would end up selling their cattle for a meagre price. His major concern was the economic benefits that the host Samburu pastoralists would get from the project having the abattoir in their area. He also suggested that the abattoir be relocated slightly away from the school due to bad odour from the abattoir.

Member 6: The security of the area was raised as a concern because of the perceived threat from the Pokot cattle rustlers. Damage to the environment (grazing lands) due to too much livestock accessing the abattoir from different places of the county was also a concern he raised. Bad odour from the abattoir was also a concern, given the close proximity of the proposed site to a neighbouring primary school. Increase in wild animals (wild dogs, hyenas) in the area.

Member 7: The proposed abattoir site was too close to the primary school, which would mean that the children would be affected by the bad odour from the abattoir. He also stated that the abattoir wastes would drain into the dam and thus contaminate the main source of water for the area. Wild animals would be attracted to the abattoir due to odour and wreak havoc in the community. He also suggested that the abattoir be moved further from the school.

Member 8: The abattoir proposed site is too close to the school and thus the bad odour could have negative impacts on the children, hence relocation of the site would be needed. Contamination of the water source was also a concern that was raised. Involvement of the community in all matters pertaining to the land. Consultation of the community in terms of abattoir site location on the farm. Veterinary care of the cattle to be brought into the abattoir should be well done to avoid spreading of diseases.

4. Addressing of Concerns Raised

After the feedback and concerns were raised, Erick Ojungo went ahead and addressed some of the concerns: the waste water would be recycled and re-used in the facility and thus no waste water would drain into the dam; the proposed site was at a lower elevation in comparison to the dam, making it impossible for water to drain into the dam; the bad odour would be mitigated; security in the area would be tightened; the pastoralists would be encouraged to join livestock cooperatives so that they can get maximum benefits from their cattle sale.

5. Site Relocation

In the course of the meeting, all members of the village council were in unison that the abattoir site location on the farm would not be conducive for the neighbouring school. They deliberated and searched for an appropriate location on the farm further from the school. A location was found about one kilometre away from the original site, one that was agreed upon by all. The elevation was measured and was found to be appropriate for the project. Further consultations would also be done with the County Government.

6. Adjournment of Meeting

There being no any other business a vote of thanks was made and a closing prayer done by a community member after which the meeting officially ended at 3:00 pm.

Annex 4: Public participation – participants list and filled public consultation forms

Annex 5: Checklist of bird species recorded at the proposed abattoir site

Abyssinian Scimitarbill (*Rhinopomastus minor*)
 African Pied Wagtail (*Motacilla aguimp*)
 African Pygmy-Kingfisher (*Ispidina picta*)
 Baglafaecht Weaver (*Ploceus baglafaecht*)
 Brimstone Canary (*Crithagra sulphurata*)
 Broad Scarlet (*Crocothemis erythraea*)
 Chestnut Sparrow (*Passer eminibey*)
 Common Bulbul (*Pycnonotus barbatus*)
 Crowned Hornbill (*Lophoceros alboterminatus*)
 D'Arnaud's Barbet (*Trachyphonus darnaudii*)
 Eastern Chanting-Goshawk (*Melierax poliopterus*)
 Eastern Yellow-billed Hornbill (*Tockus flavirostris*)
 Fan-tailed Raven (*Corvus rhipidurus*)
 Fork-tailed Drongo (*Dicrurus adsimilis*)
 Greater Blue-eared Starling (*Lamprotornis chalybaeus*)
 Greater Honeyguide (*Indicator indicator*)
 Hartlaub's Turaco (*Tauraco hartlaubi*)
 Kenya Dwarf Gecko (*Lygodactylus keniensis*)
 Kenya Rufous Sparrow (*Passer rufocinctus*)
 Kenyan Rock Agama (*Agama lionotus*)
 Laughing Dove (*Streptopelia senegalensis*)
 Lilac-breasted Roller (*Coracias caudatus*)
 Mourning Collared Dove (*Streptopelia decipiens*)
 Northern Fiscal (*Lanius humeralis*)
 Northern Red-billed Hornbill (*Tockus erythrorhynchus*)
 Northern White-crowned Shrike (*Eurocephalus ruppelli*)
 Nubian Woodpecker (*Campethera nubica*)
 Parrot-billed Sparrow (*Passer gongonensis*)
 Pearl-spotted Owlet (*Glaucidium perlatum*)
 Pygmy Batis (*Batis perkeo*)
 Red-cheeked Cordonbleu (*Uraeginthus bengalus*)
 Red-eyed Dove (*Streptopelia semitorquata*)
 Reichenow's Seedeater (*Crithagra reichenowi*)
 Ring-necked Dove (*Streptopelia capicola*)
 Rufous-crowned Roller (*Coracias naevius*)
 Speckled Mousebird (*Colius striatus*)
 Superb Starling (*Lamprotornis superbus*)
 Vitelline Masked-Weaver (*Ploceus vitellinus*)
 White-bellied Go-away-bird (*Corythaixoides leucogaster*)
 White-browed Robin-Chat (*Cossypha heuglini*)
 White-browed Sparrow-Weaver (*Plocepasser mahali*)
 White-eyed Slaty-Flycatcher (*Melaenornis fischeri*)
 White-headed Buffalo-Weaver (*Dinemellia dinemelli*)
 White-throated Bee-eater (*Merops albicollis*)

Annex 6: Laboratory Analysis Reports

Annex 7: NEMA practicing license of the firm of exerts

Annex 8: NEMA practicing licensjke of Lead ESIA Expert
