

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR  
THE PROPOSED CONSTRUCTION OF CARDIOTHORACIC CENTRE FOR TENWEK  
HOSPITAL ON PLOT LR No. KERICHO/SILIBWET/3395 – BOMET COUNTY.**



***PROPOSED PROJECT SITE***

**Prepared for:**



TENWEK HOSPITAL,  
P.O Box 39, 20400,  
Bomet, Kenya.  
Tel: +254 20 2045542/ 728 091900

**Prepared by:**



OLIGERM HOLDINGS LIMITED,  
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NEMA Reg. No. 1753

**Latitude:** 0°44'34.92" S

**Longitude:** 35°21'17.53" E

**MAY 2019**

## SUBMISSION LETTER

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15<sup>th</sup> May 2019

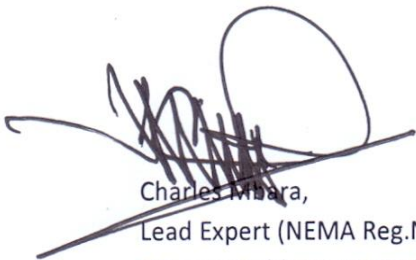
Director General,  
National Environmental Management Authority,  
Popo Road, South 'C'  
P O BOX 67839-00200,  
NAIROBI, Kenya

Dear Sir,

**RE: SUBMISSION OF ESIA STUDY REPORT FOR THE CONSTRUCTION OF PROPOSED  
CARDIOTHORACIC CENTRE FOR TENWEK HOSPITAL ON PLOT LR NO.  
KERICHO/SILIBWET/3395 – BOMET COUNTY.**

We hereby submit the above study report on behalf of the proponent, Tenwek Hospital, for your consideration and approval. We confirm that this study report has been done in accordance with the provisions of the Environmental Management and Coordination Act of 1999 (revised 2015) as well as the Environmental (Impact Assessment and Audit), Regulations of June 2003 and other relevant pieces of Kenyan legislation.

Yours sincerely,



Charles Mbara,  
Lead Expert (NEMA Reg.No.0121),  
Oligerm Holdings Limited.

OLIGERM HOLDINGS LIMITED  
P. O. Box 466-00100  
NAIROBI  
TEL: 020 2404185

## CERTIFICATION

This study report has been prepared by Oligerm Holdings Ltd. The report has been done with reasonable skills, care and diligence in accordance with the Environmental Management and Co-ordination Act, 1999(revised 2015) and the Environmental (Impact Assessment and Audit) Regulations, Legal Notice No.101 of June 2003. We certify that the particulars given in this report are correct to the best of our knowledge.

### FIRM OF EXPERTS

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**Lead Expert:** Charles Mbara + NEMA Registration Certificate No.: 0121

**Signature of Lead Expert:** .....

8/05/2019

### PROJECT PROPONENT

**Name:** Tenwek Hospital – CTC

**Nature of the Business:** Hospital – Medical Services

**Date of assessment:** 24<sup>th</sup> April 2019 to 29<sup>th</sup> April 2019

**Contact Person:** Jeremy Barr – Project Manager

**Phone No:** +254 748 812 675

### Specific Project Details

**Proposed Project:** Construction of Cardiothoracic Centre

**Site Location:** Plot LR. No. KERICHO/SILIBWET/3395- Bomet County.

**Signature of Proponent:** .....

**Date:** 9/5/19

**Rubber Stamp:**



## ACKNOWLEDGEMENT

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We, the Consultants (OLIGERM HOLDINGS LIMITED) acknowledge with gratitude the opportunity provided by the Proponent (TENWEK HOSPITAL) to undertake the Environmental and Social Impact Assessment Study and prepare an ESIA Study Report for the proposed construction of CARDIOTHORACIC CENTER on Plot LR. No. KERICHO/SILIBWET/3395, Bomet County

This report will be submitted to NEMA HEADQUARTERS, NAIROBI for review and consideration for approval and issuance of EIA licence to the Proponent to proceed with the Construction.

The ecological and environmental data collection was facilitated by Mr. Jeremy Barr (the Project Manager) who arranged site visits and inspections of the proposed project location.

We highly appreciate the support and Cooperation accorded to us by ZADDY C.CHUMO (Chief Officer, Medical Services Department – County Government of Bomet), Mr. Metto (Deputy Commissioner – Bomet), Mr. Dennis Diffu ( Assistant Commissioner – Silibwet) and Mr. Daniel Mutai (Assistant Chief – Silibwet Sub-location) all in the Department of Interior and Co-ordination of National Government in Bomet County..

Finally we would like to convey our deepest appreciation for the support provided by Tenwek Hospital during the Public meetings (*Barazas*) held at the proposed project site on Friday and Monday (26<sup>th</sup> and 29<sup>th</sup> April, 2019)and in this regard, special thanks to Mr. Geoffrey Langat (CEO) and Mr. Joseph Maiyo (Maintenance Manager).

Also; Mr. Julius Tallam of Triad Architects and the other Experts who have not been mentioned here; to all, we earnestly recognize their efforts.

Last, but not least; all the local community members who attended the two day public meetings and contributed immensely to the success of the *barazas*.

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# NON TECHNICAL EXECUTIVE SUMMARY

## E 1: Project Overview

The proposed Cardiothoracic Centre for Tenwek Hospital will provide approximately of 13,000m<sup>2</sup> specialized surgical theatres supported by clinical and inpatient spaces in a multi-story facility with Ground + 4 floors with a 1No. Basement. The project site is located outside Bomet town, some 300m to the west of the Tenwek Hospital campus entrance proper, Latitude: 0°44'34.92"S and Longitude: 35°21'17.53"E.

The proposed plot is approximately 3 acres of gradually sloping land. Though the site is disconnected from the Hospital campus, utility infrastructure for the project shall tie-in to Hospital utilities that are being upgraded and extended to accommodate the Centre's demand.

The planning and design shall be completed such that tender offers can be introduced by April 2019; with bids accepted in May 2019; with construction anticipated to commence in June, 2019.

The project budget for the construction of the project is anticipated to be in the range from KSH 1,500,000,000.00 to KSH 2, 000,000,000.00. This cost range is for the building construction and associated utilities only.



**Figure 1: GOOGLE MAP INDICATING LOCATION OF THE PROPOSED CARDIOTHORACIC CENTER FOR TENWEK HOSPITAL (Latitude: 0°44'34.92"S and Longitude: 35°21'17.53"E.)**

## **E 2: Purpose of ESIA study**

The purpose of this study is first and foremost to ensure adequate identification of potentially negative environmental impacts. Secondly, to propose workable mitigation measures, and thirdly to formulate an Environmental and Social Management and Monitoring Plan articulating envisaged impacts and mitigation measures, and to obtain an Environmental Impact Assessment licence.

## **E 3: ESIA Study Scope and Rationale**

The scope of this ESIA study conforms to Environment Management and Coordination Act of 1999(revised 2015) and the Environmental (Impact Assessment and Audit) Regulations of June 2003, other related pieces of Kenyan environmental legislation and guidelines. The study report been prepared for the sole purpose to enable environmental and social implications to be assessed during the implementation of the project.

## **E 4: Methodology**

This Environmental and Social Impact Assessment (ESIA) was carried out based on site inspection and assessment of the surrounding developments, laboratory analysis of the base environmental elements mainly soils and water and comprehensive consultation and public participation process that included the following:

- Consultants developed ESIA Questionnaires(sample attached)
- Consultants in consultation with Mr Daniel Mutai prepared Fliers(**NOTICES OR THE BARAZA**) indicating place and dates for the *baraza*
- The ESIA Questionnaires were administered to stakeholders during the Consultation and Public Participation process and particularly during the *barazas*
- Consultants conducted public meeting (*barazas*) with the residents and neighbouring community
- The *baraza* was chaired by Assistant chief(DANIEL MUTAI) and the minutes recorded by hand)
- The Consultant recorded the views and opinions of stakeholders during the *barazas* in the Minutes attached as evidence of Consultation and Public Participation

This process was conducted for seven days from Wednesday (**23<sup>rd</sup>, April, 2019**) to Monday (**29<sup>th</sup> April, 2019**) and peaked off with two *barazas* on **Friday (26<sup>th</sup> April, 2019)** and **Monday (29<sup>th</sup> April, 2019)**.

The public meetings (*barazas*) were attended by 79 members of local and neighbouring community.

In addition to the above; consultants had one on one consultations with various stakeholders at Bomet County Government level and Department of Internal Security and Government Coordination.

Relevant document reviews were undertaken by the consultants. The proponent provided the proposed project layout plans and design details. Further consultations involved senior staff at TRIAD ARCHITECTS which also included Geotechnical and Quantity Surveyors, Civil, Structural and Electrical Engineers and other experts.

The data collection was carried out through site Evaluation of Environmental and Social impacts, site inspection and assessments, administration of structured questionnaires during public consultations, interviews and observations during site visits in the manner prescribed and specified in Part V (Regulation 35) of the Kenyan Environmental (Impact Assessment and Audit) Regulations, of June, 2003 and in accordance with International Finance Corporation's Policy on Social and Environmental Sustainability (IFC 2012 Guidelines for Environmental studies).

Potential negative environmental and social impacts were predicted and their mitigation measures were developed by the consultants during the period of assessment.

These covered construction, operation and decommissioning phases during entire implementation of the proposed project.

## **E 5: Special Desk studies**

The following special desk studies were undertaken in the course of the ESIA to complement the report in earnest:

### **E5.1 Hydrological Status of River Nyangores**

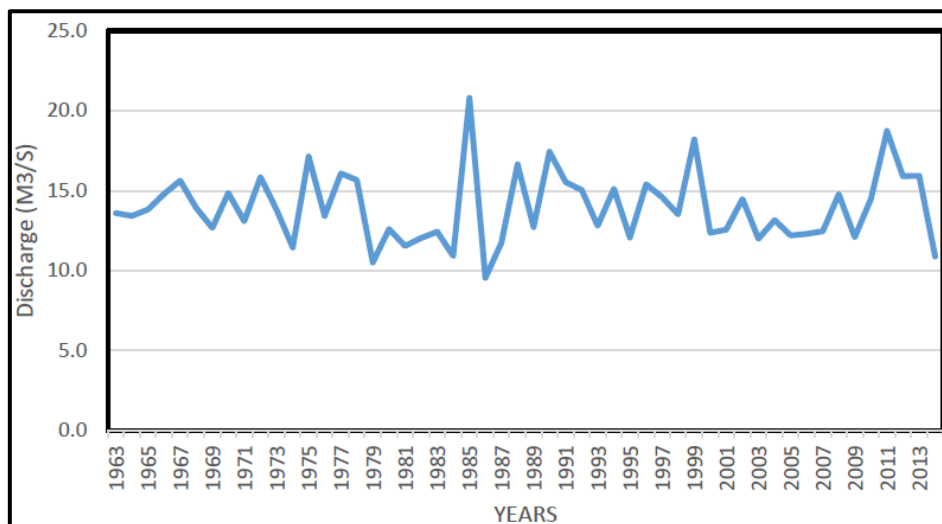
Originating on the Mau Escarpment of Kenya, among swamps and remnants of a once expansive forest, headwaters of the Nyangores River begin a remarkable journey.

At nearly 3000 m above sea level, an average of 1400 mm of rain falls every year at the river's source. Where forests remain, the rainwater percolates through the dense canopy

into the soil and ultimately into the seeps and springs that form the Nyangores River. (LVBC & WWF-ESARPO, 2010)

The historical (1970–1996) daily average flow at Nyangores River was  $8.4\text{m}^3/\text{s}$  with a standard deviation (SD) of  $7.1\text{m}^3/\text{s}$ . (Dessu & Melesse, 2012)

The Figure shows time series plot of stream flow for Bomet river gauging station located along Nyangores River. This is the station's daily discharge data from 1963 to 2013 with relatively small data gaps of 13%. A hydrographical plot for the station shows that the highest discharge of  $21\text{m}^3/\text{s}$ , was recorded on the 18<sup>th</sup> of May, 1985 with an average mean flow of  $20.4\text{m}^3/\text{s}$ . The general trends in the mean base flow indicated an overtime decrease from:  $4.5\text{m}^3/\text{s}$  in 2000 to  $3.0\text{m}^3/\text{s}$  in 2010. (Ng'eno Edgar, 2016)



**Figure 2: Hydrograph of Nyangores River Stream flow**

The deforestation and degradation of the forested upstream areas has led to increase run off downstream leading to increase in siltation (Mati et al., 2005). The building up of silt at Tenwek dam is an indication that soil erosion is taking place upstream (Kilonzo, 2013). The siltation therefore could have contributed to the increased in the peak flows in 2010 than in 1995. This shows that the river catchment is experiencing intensive land use land cover change that affects the Nyangores river stream flow (Mati et al., 2005).

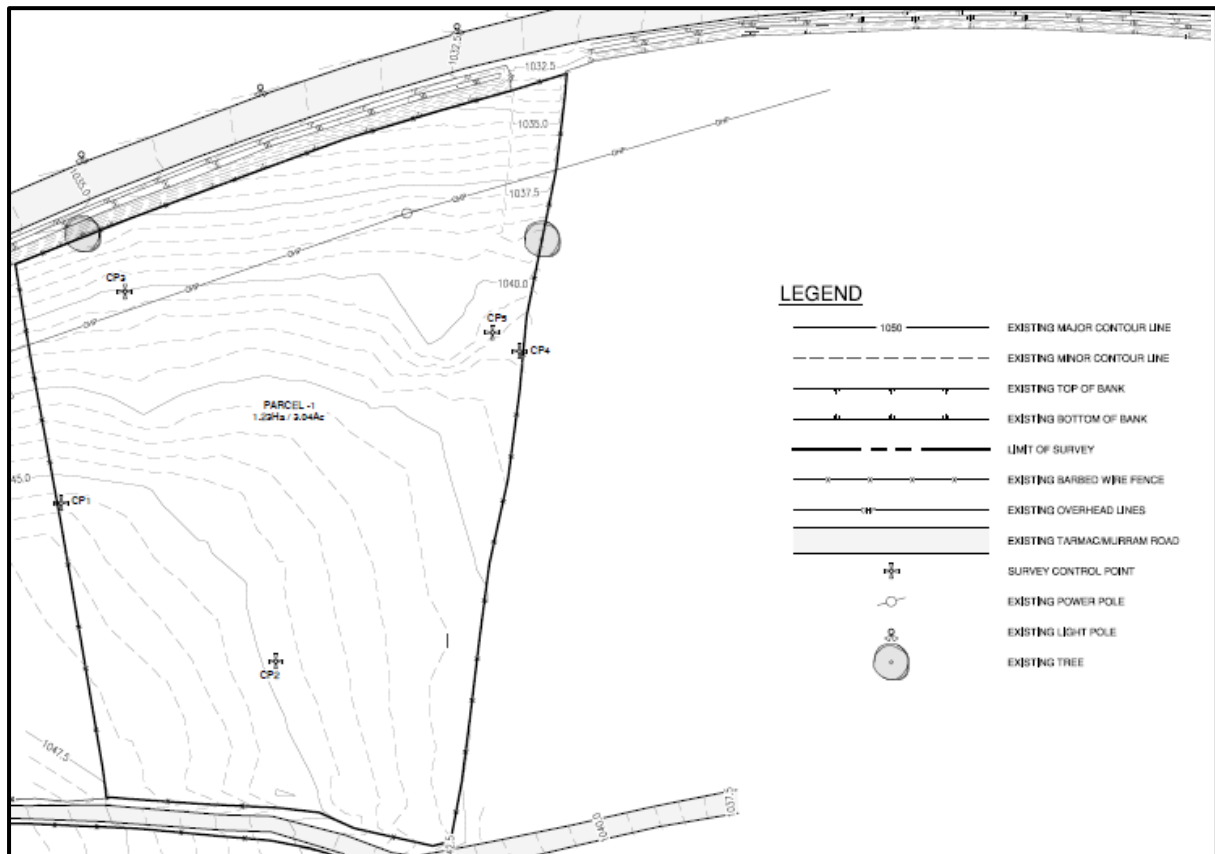
## **E5.2 Geo-technical Survey Report of the proposed project site**

In general, the soils portray a surface layer of dark brown, fine grained, wet, highly plastic and low plastic clay soils of average thickness of 3.0m below the surface of the ground. These residual soil layers are underlain by layers of tuffs of different colours ranging light

brown to whitish brown to light grey which show different degrees of weathering from highly weathered at different depths.

Highly weathered decomposed tuffs were found to a depth of 11.5m. Water was encountered between 10.0m and 15.0m.

**E5.3: Topographical Survey to determine the exact size required for the proposed project**



**Figure 3: Topographical Survey of the Proposed Project Site**

**E5.3: Health Facilities/Infrastructure in Bomet County**

Bomet County has 78 health facilities in total. There are: 2 District Hospitals, 1 Sub-District Hospital, 61 Dispensaries, 10 Health Centres, 1 Medical Clinic, a VCT centre and 1 privately owned institution.

Notable public health facilities are the Longisa and Ndanai District Hospitals. Notable private health facilities are: Kaplong Mission Hospital and School of Registered Community Nursing, Tenwek Hospital.

The most prevalent diseases in the county are Malaria, Respiratory Tract Infections, and Skin Diseases.

The doctor to population ratio in Bomet County is 1:102,048.

The Infant Mortality Rate in Bomet County is 54 per 1000; while mortality rate for children under the age of five is 82 per 1000.

## E 6: Environmental and Social Impacts Assessment

As for the biophysical and social environment; the Oligerm assessment team predicted the potential environment and social impacts associated with the activities of the proposed project as follows:

Each potential impact was assessed using the matrix below after applying the mitigation measures:

**Table 1: Environmental Impacts Assessment**

EXTENT		MAGNITUDE	
Located at localized scale and only a few hectares in extent	1	Will have no effect on the environment	0
Study area (study site and immediate environment)	2	Minor and will not result an impact on existing /baseline natural or social processes )	2
Regional (County level)	3	Low and will cause a slight impact on the natural and social processes	4
National (Country level)	4	Moderate and will result in natural or social processes continuing but in a modified way	6
International (Beyond Kenya )	5	High and result in natural or social processes being altered to the extent that they temporarily cease	8
	6	Very high and will result in complete destruction of patterns and permanent cessation of natural and social processes	10



## Duration

DURATION		PROBABILITY	
Very short (1 -10 years)	1	Highly improbable (>20% chance of occurring)	1
Short 1-3 years	2	Improbable (20-40% chance of occurring)	2
Medium term(5-10 years)	3	Probable (40-70 % chance of occurring)	3
Long Term (5-15 years)	4	Highly probable (70-90% of occurring)	4
Long term (>15 years)	5	Definite (100% chance of occurring)	5
Permanent			

## E 7: Method used to determine Environmental risks or impacts

**Consequence** is defined as a combination of extent and duration and magnitude i.e. addition of the values of all the three criteria.

**Risk** (Impact significance) in a combination of Consequences and Probability as indicated in the equation here below:

**RISK** (Significance) =Consequence (Extent +Duration +Magnitude) X Probability

The resulting significant value determines whether the impact is low, medium or high as indicated in the tables below:

**CONSEQUENCES** (Extent +Duration +Magnitude)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

PROBABILITY

**Significance**

<b>Significance</b>	<b>Value</b>	<b>Effect on Decision making</b>
Low	<30%	Where this impact would not have influence on decision making to develop
Medium	30-60%	Where the impact could influence the decision to develop unless it is effectively mitigated
High	>60%	Where the impact must have an influence on the decision process to develop

Based on the above methodology, each potential impact was assessed for its significance during the construction and operational phases. As for adverse environmental and social impacts, practical mitigation measures were proposed in order to reduce the impacts to as low as reasonably practical (ALARP). And as for the positive environmental and social impacts enhancements were proposed to promote the impacts.

### **E 8: Proposed project implementation**

The implementation of this project in Bomet County will have significant positive and negative environmental and socio-economic impacts on the natural and socio-cultural environment of the location. The proposed development activities will create employment and business opportunities for local communities and Bomet County at large. The envisaged negative environmental and social impacts will mainly be the disruption to local biodiversity during construction phase and will include; soils disturbances, dust and noise pollution.

In addition to the above; impacts associated with operational phase of the facility will emerge and will include; solid waste materials, human and wastewater. The proponent (ie TENWEK HOSPITAL and the main contractors), will be required to take the necessary mitigation measures outlined in the environmental and social management plans during the implementation of the project.

### **E 9: Proposed mitigation measures**

The mitigation measures will be specific to each phase of the project implementation and will include; the protection of the biodiversity in the project area and ecosystems from degradation during the construction phase, the waste disposal in compliance with the required Kenyan Public Health standards, the proper use and conservation of water to

minimize wastage and to minimize air emissions and noise; and adherence to occupational, health and safety rules at the work place in order to control risks and hazards.

These measures will be taken in compliance with Water Quality, Waste management, Noise and vibration pollution guidelines as promulgated in the Environmental Management and Coordination Act of 1999(revised 2015).

## **E 10: Environmental and Social Management Plan**

The purpose of the Environmental and Social Management Plan (ESMP) is to ensure that environmental impacts, risks and liabilities identified during the EIA process are effectively managed during the construction, operation and closure of the proposed project.

The ESMP specifies the mitigation and management measures to which TENWEK HOSPITAL management will be committed to and shows how the project will mobilize the organizational capacity and resources to implement these measures.

It also shows how the management measures aimed at mitigating and enhancement will be scheduled.

Best practice principles require that every reasonable effort be made to reduce and preferably prevent negative environmental and social impacts while enhancing productive benefits especially within the local communities most directly affected by the proposed project.

These principles have guided ESIA process for the proposed CTC Project and the potential negative impacts will be avoided through careful designs.

The ESMP is a key product of the ESIA process and is generated based on management and/or mitigation measures that will be taken into consideration to address impacts during the planning and design, pre-construction and construction activities and operation as necessary.

The ESMP is a living document that will be periodically revised and updated. It may be necessary to update the version presented in this report during the detailed design phase prior to the commencement of construction.

The responsibility for the implementation of the ESMP will reside in the Environmental Health and Safety (EHS) functions of the Project, but these will be linked with other functions in areas such as operation and maintenance services.

## **E 11: Conclusion and Recommendations**

### **E11.1 Conclusion**

Based on the literature review, key contact interviews, assessment of the biophysical, ecological and social environment, information and data gathered during the assessment (ie during the site visits/inspections and public consultations), the following can be summarized:

1. The proposed project is essential for Tenwek Hospital to provide quality health care for cancer and Chest infected patients in Kenya and the wider East Africa region.
2. The construction and operation of the proposed project will generate both negative and positive biophysical environmental and social impacts
3. The envisaged negative bio-physical impacts will be as follows:
  - Possibility of Soil Erosion during construction
  - Possibility of Landslides during construction
4. The envisage negative social impact will be the potential of increasing social tensions and decreased social cohesion and increased social pathologies such as STDs during construction phase.
5. The anticipated positive environmental and social impacts will be:
  - Employment opportunities during construction phase
  - Numerous socio-economic benefits to the local community (ie supply of raw materials, goods and services to the contractors and workers)
6. This ESIA Study Report has been prepared for the construction of CTC Project for TENWEK Hospital in BOMET County
7. The report presents an overview on the development impacts on the biophysical and socio-economic environment of local communities in the project location.
8. The report has incorporated views and concerns of all HEALTH sector stakeholders consulted at the county level and at the project location.

9. The Health sector stakeholders consulted included Chief Officers of Health Services and Public Health and Sanitation Services respectively, the site location resident communities, affected parties and interest groups.
10. This assessment considered environmental, social, cultural, economic and legal aspects pertaining to the implementation of the project

## **E 12.2 Conclusions**

1. The negative biophysical impacts will be of relatively short duration and will be mitigated appropriately by the proponent. It is therefore concluded that the envisaged environmental and social impacts of the proposed project will be of such a nature that appropriate mitigation measures will prevent irreversible and long term damage to the biophysical environment.

As for the social impacts, the key negative impacts are typical of construction projects and provided there is adequate and open communication and cooperation with all stakeholders, these impacts will be mitigated adequately

The negative impacts also need to be viewed in the context of numerous employment opportunities for the local community.

## **E11.2 Recommendations**

The report contains recommendations on protection of biodiversity and ecosystems, reduced soils disturbances, dust and noise pollution during construction phase and health care solid and liquid waste management during the operational phase.

## **ACRONYMS AND ABBREVIATIONS**

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<b>CPP</b>	Consultation, Public Involvement and Participation
<b>DHIS</b>	District Health Information System
<b>EIA</b>	Environmental Impact Assessment
<b>EMCA</b>	Environmental Management and Coordination Act
<b>ESIA</b>	Environmental & Social Impact Assessment
<b>IAPs</b>	Interested and Affected Parties
<b>KPLC</b>	Kenya Power and Lighting Company Ltd.
<b>MoH</b>	Ministry of Health
<b>NEC</b>	National Environment Council
<b>NET</b>	National Environment Tribunal
<b>NOSH</b>	National Occupational Safety and Health
<b>OSHMG</b>	Occupational Safety and Health Management Governance
<b>OSHMC</b>	Occupational Safety and Health Management Committee
<b>PAACS</b>	Pan-African Academy of Christian Surgeons
<b>PCC</b>	Public Complains Committee
<b>PPEs</b>	Personal Protective Equipment
<b>R/F</b>	Radiography/Fluoroscopy
<b>ToR</b>	Terms of Reference

## DEFINITION OF TERMS

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**Biochemical transformation:** The breakdown of compounds by enzymes.

**Biodegradable substance:** A substance that can be degraded by microorganisms.

**Biomedical waste:** Any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological products.

**Board:** The Radiation Protection Board as established under the Radiation Protection Act, Chapter 243, Laws of Kenya.

**Chemical transformation:** Change of substance through chemical reactions

**Clinical waste:** Any waste arising from provision of healthcare or bio-medical research.

**Cytotoxic waste/genotoxic:** Waste generated during management of cancer.

**Disposal site:** Any area of land on which waste disposal facilities are physically located or final discharge point without the intention of retrieval but does not mean a re-use or recycling plant or site.

**Domestic Waste:** Means waste generated from residences.

**Environment:** Surroundings, including water, air, soil and their interrelationship, as well as all relationship between them and any living organisms.

**Environmentally Sound Management of Waste:** Taking all practical steps to ensure that waste is managed in a manner which will protect human health and the environment against the adverse effects which may result from the waste.

**Exporter:** Any person who causes trans-boundary movement of waste out of the country.

**General waste:** Waste that is generated from a health care facility and not from a medical procedure and therefore no infectious content in it.

**Generator:** Any person whose activities produces healthcare waste or is in possession and/or control of those wastes.

**Hazard:** A substance, mixture or substances, process or situation that have the potential to cause harm to human health or adverse effect to the environment.

**Hazardous waste:** A waste that is considered to be of special risk to human health or environment and therefore needs special management.

**Healthcare waste:** Waste that is generated during the diagnosis, treatment or immunization of human beings or animals, in bio-medical research and in the production or testing of biological products.

**Importer:** Any person who causes trans-boundary movement of waste into the country.

**Incineration:** The controlled burning of solids, liquids, gaseous combustible waste to produce gases and residues containing little or no combustible materials.

**Infectious waste:** All kind of waste that may transmit viral, bacterial, fungal or parasitic diseases to human beings and animals.

**Label:** The written, printed, or graphic matter on or attached to the container or wrapper of packaged waste.

**Mixed material waste:** Waste from products containing a mixture of substances, at least one being xenobiotic or waste from the manufacture of such products and where simple sorting may not separate the substances.

**Municipal solid waste:** Waste from household, commerce, administration and service companies that are disposed off through the public waste management system.

**Packaging:** The container together with the protective wrapping used to carry waste during storage and transportation.

**Poison:** A substance that can cause disturbance of structure or function, leading to injury or death when absorbed in relatively small amounts by human beings, plants and animals.

**Prior Informed Consent (PIC):** The international operation procedure for exchanging, receiving and handling notification information by the competent authority on waste.

**Protective clothing:** Any clothes, materials or devices that are designed to provide protection to the user when handling hazardous material.

**Radioactive Waste:** Any radioactive material that has been, or will be, discarded as of being of no further use.

**Recycling of waste:** The processing of waste material into a new product of similar chemical composition.

**Reprocessing:** The processing of waste into a new product of different chemical composition.

**Reuse:** Waste reused with or without cleaning and/or repairing.

**Segregation:** Any activity that separates waste materials for processing.

**Storage:** Temporary placement of waste in a suitable location or facility where isolation, environmental and health protection and human control are provided in order to ensure that waste is subsequently retrieved for treatment and conditioning and/or disposal.

**Thermo-transformation:** Change of a substance through application of high temperature with or without pressure.

**Toxic Chemical:** Any substance, which on entry into an organism through ingestion, inhalation and dermal contact is injurious, causes physiological, or biochemical disturbances or otherwise causes deterioration of the functions of the organism in any way.



**Treatment:** When used in reference to waste management, it means, any method, technique or process designed to change the biological character or composition of healthcare waste so as to reduce or eliminate its potential for causing harm.

**Waste Generator:** Any person whose activities or activities under his or her direction produces waste or if that person is not known, the person who is in possession or control of that waste.

**Waste Management:** The activities, administrative and operational, that are used in handling, packaging, treatment, conditioning, reducing, recycling, reusing, storage and disposal of waste.

# CHAPTER 1: INTRODUCTION AND BACKGROUND

## 1.1 Proposed Project Background

### 1.1.1 Tenwek Hospital

The Proponent, Tenwek Hospital, is a Christian community committed to excellence in compassionate healthcare, spiritual ministry, and training for service to the glory of God.

The Proponent is proposing to construct residential apartment blocks for doctors comprising of 20 units.

The hospital was founded in 1937 by missionaries from World Gospel Mission and has since grown to be a leading teaching and referral hospital in the region and one of the largest mission hospitals in Africa. It is a non-profit faith-based organisation, a ministry of Africa Gospel Church and in partnership with World Gospel Mission.

It has a capacity of 300 beds and offers a wide range of quality and affordable primary and specialised healthcare services. Some of the services provided include: Outpatient Services, Inpatient Services, Diagnostic Services, Pharmacy, Training, Outreach Services, Spiritual Ministry and, Research.

Through partnerships with various organizations, long term and visiting physicians (Facilitated through Samaritan's Purse), provide Tenwek patients with expertise in hospital care, out-patient treatment (Supported through USAID), and HIV/AIDS care through the PEPFAR program.

Tenwek is also supported by Friends of Tenwek (FOT), a U.S.-based non-profit organization dedicated to developing key relationships and resources that help Tenwek fulfil its mission. FOT has raised funds through various organizations and private donors to support the projects and goals of Tenwek Hospital in addition to keeping those who have visited Tenwek in the past informed and involved with what's happening at Tenwek today.

Tenwek Hospital is undergoing a vibrant period of growth and improvement.

Tenwek Hospital has a Water and Power Scheme that was conceptualised in 1955 and 1956. However, progress was not realised until the 1980s. On February 13, 1987 the installation of a turbine and generator for Tenwek Hospital began. Finally, Tenwek Hospital switched on the hydroelectric plant and a few moments later shut down the diesel generator. In 2014 the installation of a second hydroelectric generator greater than tripled the energy

production capacity of Tenwek, meeting the current and anticipated needs of the Hospital for the next 20 years.

The 2013/2014 saw the introduction of new residency programs, implementation of Electronic Medical Records, facility improvements and more. 2014 upgrades included a building remodel, new X-ray machine, extra CT-tube, new Sonography equipment. Beginning January 2014, Tenwek became the first PAACS site to host a full orthopaedic residency program. Improvements in 2015 included the procurement of a new Radiography/Fluoroscopy Machine and the completion of an R/F suite.

On April 15th, 2014 construction began on the new Tenwek Eye and Dental Building. With the help of American Schools and Hospitals Abroad (ASHA), a branch of USAID, which provided a \$1,800,000 grant for the project, the quality of ophthalmologic and dental care at Tenwek will grow exponentially, increasing services for millions of Kenyans.

### **1.1.2 The Cardiothoracic Centre (CTC)**

In 2019, the Proponent has planned to develop a Cardio-Thoracic Centre (CTC). This Centre shall add to the Hospital's specialist services. The CTC shall provide Heart (Cardiac) Chest/Lungs (Thoracic) specialist services. This project will increase the Hospital's capacity to perform critical heart & chest surgeries and other pressing procedures, including operations for those with cancer of the oesophagus.

The project components will consist of a 100-bed facility and six new operating theatres and will serve patients across East Africa and beyond. The centre will provide specialized surgical theatres supported by clinical and inpatient spaces in a multi-story facility.

## **1.2 Preliminary Prerequisite to Commencement of Construction**

A preliminary prerequisite to the commencement of the construction of the proposed CTC project consists of an ESIA report which is the main deliverable of this consultancy.

Under Part VI Section 58 of the Environmental Management and Coordination Act 1999 No. 8, any person, being a proponent of a project is required to apply for and obtain an Environmental Impact Assessment (EIA) license from National Environment Management Authority (NEMA) before he/she can finance, commence, proceed with, carry out, execute, or conduct any undertaking specified in the 2nd Schedule of the Act.

An Environmental impact assessment (EIA) is a systematic analysis of projects, policies, plans or programmes to determine their potential environmental and social impacts, the significance of such impacts and to propose measures to mitigate the negative adverse ones

The Environmental Management and Co-ordination Act (EMCA) of 1999(revised 2015) require that an Environmental Impact Assessment precedes all development activities with anticipated negative impacts. The EIA project report will be submitted to National Environment Management Authority (NEMA) for consideration and approval and issuance of a license. This assessment was therefore carried out to fulfill this statutory requirement.

Tenwek Hospital CTC (African Mission Healthcare) being the Project Proponent therefore procured the services of the Consultant (OLIGERM HOLDINGS LTD) on her behalf, to produce this Environmental Impact Assessment Report as required.

### **1.3 Rationale/Legal Requirements for ESIA Study**

#### **1.3.1 Introduction**

Under Part VI Section 58 of the Environmental Management and Coordination Act 1999 No. 8, any person, being a proponent of a project is required to apply for and obtain an Environmental Impact Assessment (EIA) license from National Environment Management Authority (NEMA) before he/she can finance, commence, proceed with, carry out, execute, or conduct any undertaking specified in the 2nd Schedule of the Act.

Tenwek Hospital CTC (African Mission Healthcare) being the project proponent therefore procured the services of the consultant on her behalf, to produce this Environmental Impact Assessment Project Report as required.

#### **1.3.2 Kenyan Environmental Legal requirement for ESIA Study**

**Part VI Section 58** of the Environmental Management and Coordination Act 1999 No. 8, states that:

“Any person, being a proponent of a project is required to apply for and obtain an Environmental Impact Assessment (EIA) license from National Environment Management Authority (NEMA) before he/she can finance, commence, proceed with, carry out, execute, or conduct any undertaking specified in the 2nd Schedule of the Act.”

**Replaced 2<sup>nd</sup> Schedule** (Legal Notice No.150 dated 19<sup>th</sup> August, 2016); specifies that:

Construction of Tenwek Hospital Cardiothoracic Centre in Bomet County falls under:

“High Risk Projects —;

(3) Urban Development including —;  
(e) establishment of hospitals”

Therefore it shall be required that an environmental impact assessment study report be submitted to NEMA, under section 58(2) of the Environmental Management and Co-ordination Act, 1999.

**The CTC falls under category Level ‘5’ Referral Hospital (Categorisation by Chief Officer-Health Services in Bomet County Government**

**The proponent** therefore, is obliged to undertake the environmental and social impact assessment study in order to comply with this legal requirement.

**Part III** of the Environmental (Impact Assessment and Audit) Regulations, 2003, **Regulation 11. (1)** Requires that an EIA study be conducted in accordance with the Terms of Reference developed during the scoping exercise by the proponent and approved by the Authority. According to **Regulation 16**, an EIA study prepared under the regulations shall take in to account the environmental, social and cultural, economic and legal considerations.

This study shall therefore aim at complying with this legal requirement.

### **1.3.3 The Policy on Environmental and Social Sustainability of the International Finance Corporation (IFC) (IFC, 2012)**

This policy requires initial screening and categorization of each proposed project to determine the appropriate extent and type of environmental assessment needed. The resulting category also specifies IFC’s institutional requirements for disclosure in accordance with IFC’s access to information policy.

Projects can be placed into one of four categories, depending on the type, location, sensitivity, and scale of the project, as well as the nature and magnitude of its potential environmental impacts. The different categories are listed in *Table 1*.

**Table 2: The Four IFC categories of Project Classification**

Category	Description
Category A	Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.

<b>Category B</b>	Business activities with potential limited adverse Environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
<b>Category C</b>	Business activities with minimal or no adverse environmental or social risks and/or impacts.
<b>Category FI</b>	Business activities involving investments in FIs (Financial Intermediaries) or through delivery mechanisms involving financial intermediation.  <i>*This category is not applicable to the Project being considered here.</i>

The proposed Tenwek Hospital CTC Project has the potential to cause adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

Therefore this project is considered to be a **'Category B'** project. It is considered feasible to mitigate and manage the majority of impacts associated with the project through appropriate environmental and social management together with the monitoring to be specified in the ESMP and related plans that will be the outcome of this ESIA process.

#### **1.3.4 WORLD BANK Environmental and Social Safeguards Policy for ESIA Study Environmental Assessment (OP4.01)**

This policy requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision-making. The EA is a process whose breadth, depth, and type of analysis will depend on the nature, scale, and potential environmental impact of the proposed investments.

The EA process takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property) and Trans- boundary and global environmental aspects.

This report which will establish a mechanism to determine and assess future potential environmental and social impacts during implementation of the proposed project activities, and then to set out mitigation, monitoring and institutional measures to be taken during operations of these activities, to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

The policy further calls for the project as a whole to be environmentally screened to determine the extent and type of the EA process. The World Bank system assigns a project to one of the four project categories, as defined below:

### **1.3.5 Alignment of WB and GOK Policies relevant to this ESIA study**

Both the World Bank safeguards policies and G.o.K laws are generally aligned in principle and objective:

- a) Both require Environmental Assessment before project design and implementation (which also includes an assessment of social impacts).
- b) Both require public disclosure of ESIA reports and stakeholder consultation during preparation.
- c) While OP 4.01 of World Bank stipulates different scales of ESIA for different category of projects, Kenya's EMCA requires environmental screening to be undertaken for new projects. In the event that notable environmental impacts will occur as a consequence of the sub- project, then an EIA will be undertaken for those sub-projects. If there would only be minimal impacts for a sub-project then the results of the environmental screening will be prepared and submitted to NEMA.
- d) Where EMCA requires Strategic Environmental Assessments, OP 4.01 requires that an Environmental Assessment be conducted, the complexity and nature of which depends on the project category.
- e) EMCA recognizes other sectorial laws while WB has safeguards for specific interests.
- f) The Bank requires that stakeholder consultations be undertaken during planning, implementation and operation phases of the project which is equivalent to the EMCA requirements. Additionally, statutory annual environmental audits are required by EMCA.

In Kenya, it is a mandatory requirement under EMCA 1999 for all development projects (Schedule Two) to be preceded by an EIA study. Thus, under the Laws of Kenya, environmental assessment is fully mainstreamed in all development process consistent with World Bank safeguard policies on EA.

## **1.4 Scope of the Environmental and Social Impact Assessment (ESIA) Study**

The Kenyan Government policy on all new projects, programs or activities requires that an environmental impact assessment is carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the Project. The scope of this Environmental and Social Impact Assessment covered:

- The baseline environmental conditions of the ESIA study area;
- Description of the proposed Project;
- Provisions of the relevant environmental laws;
- Public consultation through interviews and administration of questionnaires;
- Identification and discussion of any adverse impacts to the environment anticipated from the proposed Project;
- Appropriate mitigation measures; and
- Provision of an Environmental Management Plan outline

The output of this work led to this Environmental and Social Impact Assessment Project Report for purposes of applying for an EIA license as per the law.

## **1.5 Objectives of Environmental and Social Impact Assessment Study**

The objectives of the Environmental and Social Impact Assessment (ESIA) study are:

- To fulfill the legal requirements as outlined in Section 58 to 67 of the Environmental Management and Coordination Act (EMCA) and Part I and II of the EIA/Audit Regulations, 2003;
- To obtain background biophysical information of the site and legal and regulatory issues associated with the proposed CTC development
- To assess and predict the potential impacts during site preparation, construction and operational phases of the proposed project;
- To make suggestions of possible alterations to the proposed design, based on the assessment findings;
- To propose mitigation measures for the potential significant adverse environmental impacts and safety risks;
- To allow for public participation;
- To consider the net Project cost in the long term; and



- To prepare an Environmental and Social Management and Monitoring Plan.

## **1.6 Terms of Reference (ToR) for the ESIA Study**

Terms of Reference for conducting the Environmental and Social Impact Assessment Study for the proposed project were developed in line with the requirements of the Environmental Management and Coordination Act, 1999 (revised 2015) and the Environmental (Impact Assessment and Audit), Regulations, 2003 and other relevant pieces of Kenyan legislation.

According to the Regulations, the Study Report should where possible, contain description of the following:

- Description of the nature of the proposed project;
- The location of the project including the physical area that may be affected by the project's activities;
- The activities that shall be undertaken during the project construction, operation and decommissioning phases;
- The design of the project;
- The materials to be used, products and by-products, including waste to be generated by the project and the methods of their disposal;
- The potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project;
- An action plan for the prevention and management of possible accidents during the project cycle;
- A plan to ensure the health and safety of the workers and neighbouring communities;
- The economic and socio-cultural impacts to the local community and the nation in general;
- The project budget, and;
- Any other information the Authority (NEMA) may require.

## **1.7 Approach and Methodology for the ESIA Full Study**

### **1.7.1 Scope of the Assessment**

The scope of this study was guided by the requirements in the Environmental and Coordination Management Act No 8 of 1999 (Revised 2015) and in particular Environmental (Impact Assessment and Audit) Regulations of June, 2003.

The Kenyan requirements were supplemented by reference to World Bank Operational Policies (OP4.01-Environmental Assessment; OP 4.04-Natural Habitats; 4.36-Pest Management; 4.20 n-Indigenous Peoples and 4.12 –Involuntary Resettlement)as well as International Finance Corporation(IFC) guidelines for Environmental Impact Assessments

### **1.7.2 Methodology for the ESIA**

The Environmental and Social Impact Assessment (ESIA) was carried out based on field assessments and public consultations with the local community to the proposed Project site, relevant stakeholders and the proponent.

Relevant document reviews also took place. The Project Proponent provided the proposed Project details. The data collection was carried out through structured questionnaires, interviews and observations during site visits where necessary in the manner specified in Part V (Regulation 35) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

### **1.7.3 Desktop study**

A desktop study was conducted to review available published and unpublished reports, development plans and maps in order to compile relevant baseline biophysical and socio-economic information about the study area.

The biophysical information was compiled on environmental aspects such as climate, geology, infrastructure, human settlements and populations, flora and fauna.

On the socio-economic environment, the study compiled information on aspects such as economic activities and demographic status of the proposed project location.

### **1.7.4 Field survey**

Field visits were conducted in the study area in order to collect site-specific information on the biophysical and socio-economic environment and to cross-check the secondary data that had been compiled during the desktop studies.

While at the site, environmental data were recorded and potential impacts identified and in addition, environmental features water and soil samples were taken and relevant ecological aspects within the site were noted and photographs taken as record of key features.

#### **1.7.5 Impact assessment and Analysis**

The assessment and analyses methodologies for ESIA studies are based on multi-disciplinary approaches and structured to allow for holistic study and assessment of the following key components of the environment in relation to the proposed Project:

- Physical/chemical component;
- Biological/ecological component;
- Sociological/cultural component; and
- Economic/operational component.

#### **1.8 Oligerm Holdings Ltd Consultants Compliance**

OLIGERM HOLDINGS was appointed by TENWEK HOSPITAL CTC (African Mission Healthcare-Kenya) as a NEMA Registered Lead Experts to undertake the ESIA study as required by the provisions Environmental Management and Coordination Act 1999(revised 2015 ) and its subsidiary legislation Environmental (Impact Assessment and Audit) Regulations of June, 2003.

The personnel that executed this assignment comprised of:

- Charles Mbara –NEMA registered Lead Expert(no. 0121)
- Clyde Aruwa – NEMA registered Associate Expert (no. 10100)

We are registered with the National Environmental Management Authority (NEMA) and have also acquired membership with Environmental Institute of Kenya (EIK).

Physical address of our offices is:

Nyayo National Stadium, Aerodromes Road, Suite #115, P.O. Box 466-00100, Nairobi, Land Line: +254 20 240 4185, Cell: + 254 729 560 267/735 7850 420; E-mail: [cmbara@oligerm.org](mailto:cmbara@oligerm.org).

We have undertaken consultancy studies for large scale and small scale projects in different parts of the country including agricultural and land use studies for a variety of clients (eg World Bank, IFAD, Safaricom Ltd, Airtel Networks Kenya Ltd and property developers in Kenya)

We have a wide base of expertise that enables us undertake and provide consultancies to the diverse and ever dynamic natural and environmental challenges we face.

We achieve these through the use of up to date procedures as well as the most advanced and highly efficient technologies.

In addition, we employ the expertise of professional and well informed staff to provide services of superior quality promptly and as required by our diverse clientele.

We devote ourselves to applying professionalism and most appropriate technologies to develop workable and effective natural, economic and sustainable environmental solutions.

We value committed employees dedicated to providing innovative and excellent services to our clients.

We strive towards provision of exceptionally sound solutions that promote a balanced and sustainable development for the emerging and ever changing global environmental challenges.

We offer our clients a broad range of consultancy services that can be placed in four general divisions namely:

- *Environmental Management(Environmental Impact Assessment and Environmental Audit studies)*
- *Natural Resource Utilization and Management*
- *Agricultural Land use and Development*
- *Irrigation and Drainage Design Systems*

## **1.9 Reporting and Documentation**

A comprehensive ESIA study Report containing key findings has been compiled by the Consultants in accordance with EMCA, 1999(revised 2015) guidelines for consideration and approval.

In preparing the Study Report, the Consultants paid attention to the following issues as specified in the Second Schedule of the Environmental (Impact Assessment and Audit) Regulations, 2003:

- Ecological considerations including: Biological diversity, sustainable use, and ecosystem maintenance;

- Social consideration including: Economic impacts, social cohesion or disruption, effect on human health, communication, and effects on culture and objectives of culture value;
- Landscaping including: views opened up or closed, visual impacts (features, removal of vegetation, etc.), compatibility with surrounding area, and amenity opened up or closed e.g. recreation possibilities;
- Land used including: effects of proposal on current land uses and land use potentials in the Project area, possibility of multiple use, and effects of the proposal on surrounding land uses and land use potentials; and
- Water including: water sources (quantity and quality) and drainage patterns/drainage systems.
- Waste disposal systems, including: Liquid waste (sewage/effluent) disposal systems and solid waste management systems.

## **1.10 Structure of the ESIA Study Report**

- **Rule 18(1)**

This ESIA study report has been prepared in accordance with the requirements of Rule 18(1) of the Environmental (Environmental Impact Assessment and Audit) Regulations of June, 2003, which describes the content of an ESIA study Report.

This report incorporates the information as required in Rule 18(1) namely:

- ✓ The proposed location of the project;
- ✓ A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- ✓ The objectives of the project;
- ✓ The technology, procedures and processes to be used, in the implementation of the project;
- ✓ The materials to be used in the construction and implementation of the project;
- ✓ The products, by-products and waste generated project;
- ✓ A description of the potentially affected environment;
- ✓ The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short term and long-term effects anticipated;

- ✓ Alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- ✓ Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies;
- ✓ An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment including the cost, time frame and responsibility to implement the measures;
- ✓ Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the course of carrying out activities or major industrial and other development projects;
- ✓ The measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies;
- ✓ An identification of gaps in knowledge and uncertainties which were encountered in compiling the information; and
- ✓ An economic and social analysis of the project.

This report is arranged in chapters as follows:

**CHAPTER 1: INTRODUCTION AND BACKGROUND** – This Chapter describes the background and rationale for an ESIA, scope of the ESIA, objectives of ESIA, TOR, methodology of the ESIA, consultant’s compliance and reporting and documentation.

**CHAPTER 2: DESCRIPTION OF PROPOSED PROJECT** – Describes the nature and design components of the Project, proposed Project activities, Project materials and products and estimated Project cost.

**CHAPTER 3: ENVIRONMENTAL SETTING OF THE PROPOSED PROJECT LOCATION** – This section provides a description of the existing environment to achieve an understanding of the environmental setting.

**CHAPTER 4: ANALYSIS OF THE PROPOSED PROJECT ALTERNATIVES** – The Chapter describes the various alternatives that can be applicable to the proposed Project and the reasons for not using them. It also discusses the project alternatives.

**CHAPTER 5: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK** – This Chapter outlines Government policy on the environment, the relevant legislation relating to the proposed

Project and the administrative framework that deal with various aspects of environmental management.

**CHAPTER 6: ENVIRONMENTAL HEALTH AND SAFETY POLICY FOR THE HEALTH SECTOR IN KENYA** – This Chapter describes the Environmental Health and Safety Policy for the Health Sector in Kenya

**CHAPTER 7: HEALTHCARE WASTE DISPOSAL DURING OPERATIONAL PHASE** – This chapter highlights and gives guidelines on how to handle and dispose Healthcare waste.

**CHAPTER 8: IDENTIFICATION OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS** – It identifies the potential impacts on the bio-physical and socio-economic environment during construction, operation and decommissioning phases.

**CHAPTER 9: MITIGATION MEASURES AND MONITORING PROGRAMMES** – The chapter describes the mitigation measures for the anticipated negative impacts identified during construction, operation and decommissioning phases.

**CHAPTER 10: ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)** – It describes the measures to be taken and the monitoring requirements and responsibilities for mitigating the potential negative impacts. It also indicates the estimated costs for mitigating the impacts.

**CHAPTER 11: CONCLUSION AND RECOMMENDATIONS** – It provides a brief non-technical summary of the report findings and recommendations.

**REFERENCES**

**ANNEXES**

## CHAPTER 2: DESCRIPTION OF PROPOSED PROJECT

### 2.1 Location of Kenya and Basic Data

Kenya is located in east Africa, which lies on the equator. With the Indian Ocean to its south-east, it is bordered by Tanzania to the south, Uganda to the west, South Sudan to the north-west, Ethiopia to the north and Somalia to the north-east.

- Total area: 580 000 km<sup>2</sup> (11 227 km<sup>2</sup> of water bodies)
- Population: about 43 million people (Wesley, 2011)
- Languages: English, Swahili
- Capital City: Nairobi
- Currency: Kenyan shilling
- Climate: Kenya's climate varies from tropical along the coast to temperate inland to arid in the north and northeast parts of the country. The "long rains" season occurs from March/April to May/June. The "short rains" season occurs from October to November/December.

#### 2.1.1 Map of Kenya Indicating Bomet County



Figure 4: Map of Kenya indicating Bomet County



### 2.1.2 Map of Bomet County Indicating TENWEK

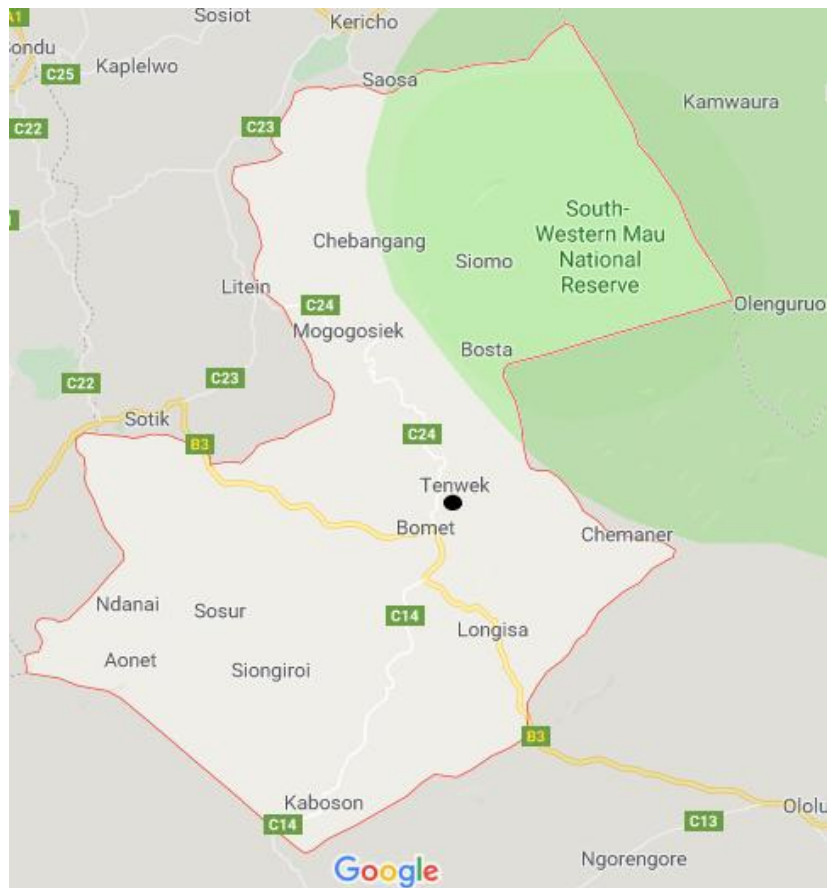
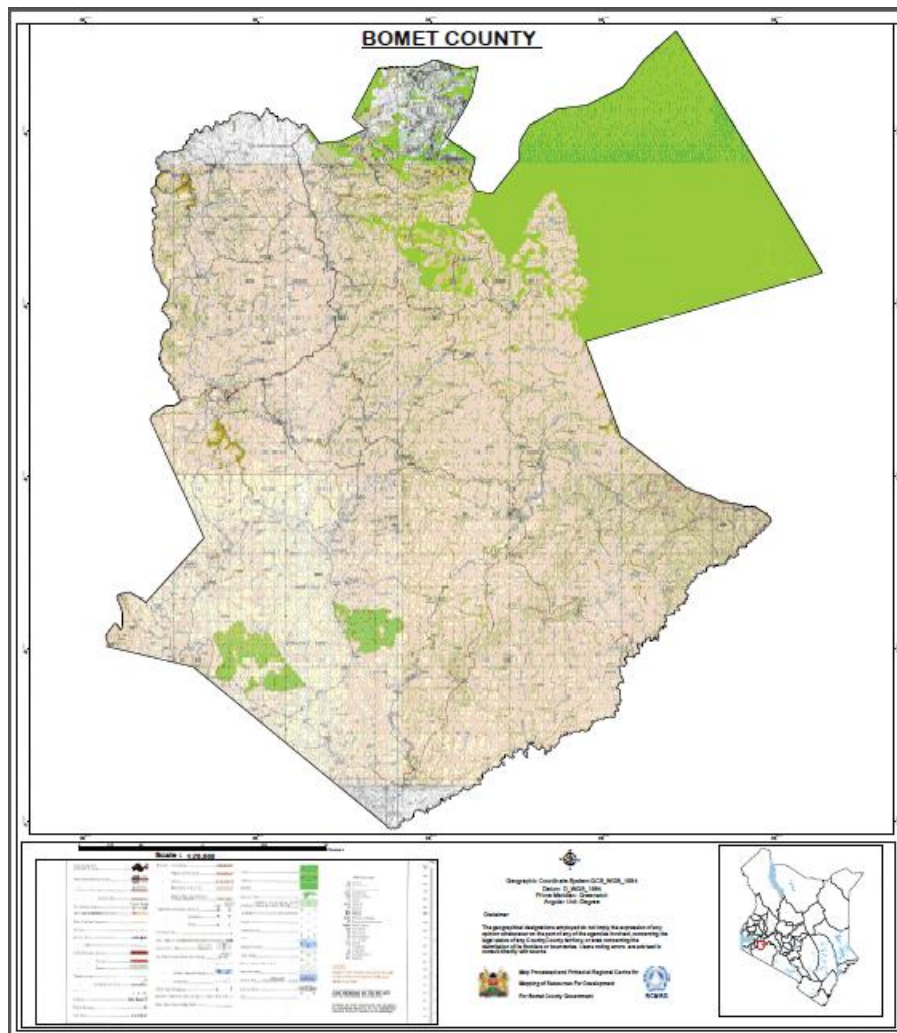


Figure 5: Map of Bomet County indicating Tenwek



### 2.1.3 Proposed Site Location and Access

- **Administrative Divisions of Bomet County**
  - ✓ Bomet County has five Sub-counties: Bomet Central, Bomet East, Chepalungu, Sotik, and Konoin.
  - ✓ Tenwek is situated in Bomet Central Sub-county, in Silibwet Sub-location of Township Location.
- **Access Roads to TENWEK HOSPITAL**

The proposed project site is located in Central sub-location (Tenwek area) next to Tenwek Day Primary School. The site is accessible from the road heading to Tenwek Hospital. From Bomet town, drive north along the Narok-Kaplong Highway then take a right turn onto the Bomet-Tenwek-Silibwet Road. After about 4.6 kilometres take a right turn at the Tenwek Road Junction. Drive about 1.2 kilometres towards Tenwek Hospital. Before the Hospital, take a right turn into a dirt road just before Tenwek High School. Drive about 350 metres to Tenwek Day Primary School. The proposed project site lies approximately 100 metres on the

right. The site slopes from west to east; with a 10.5 metre drop between the highest and the lowest point.



*Proponents Neighbours and their Activities*

<b>Direction</b>	<b>Neighbour</b>	<b>Activity</b>
<i>North</i>	Tenwek Road	Transport
<i>East</i>	Homestead	Residential
<i>South</i>	Road / Open Field	Transport/Residential
<i>West</i>	Tea Farm / Homestead / Church	Farming/Residential/Worship

**2.1.4 Proposed Project Site Description**

The Proposed project site is an open field; covered by grass and shrubs. The site slopes from south to north.

**2.2 Proposed Project Design**

**2.2.1 Site Layout Plan**

The site layout plan indicates the main hospital block, a services block, patients and staff parking, buried propane tanks, a guard house and a sewer pre-treatment tank for the CTC facility.

The main hospital block is divided into two wings: Wing A and Wing B.

**2.2.2 Basement 2 Layout**

- The main entrance is at basement level and loading access is on the North-east side and ramp circulation that shall lead to the Ground floor.
- This level shall contain the following:
  - ✓ Parking
  - ✓ Rainwater harvesting storage tank (about 200m<sup>3</sup>)
  - ✓ A Central Supply area ( a store for holding supplies for the hospital)
  - ✓ Locker rooms and changing rooms
  - ✓ Biohazard storage area(a holding site for biohazard waste before disposal)
  - ✓ Body Holding Room (mortuary)

### **2.2.3 Basement 1 Layout**

- This level contains the following:
  - ✓ Power distribution room( switchboard and power controls)
  - ✓ IT offices and Server room
  - ✓ Medical Workshop
  - ✓ Biomedical workshop
  - ✓ Laundry area( i.e. washing, drying, folding)

### **2.2.4 Ground Floor Layout**

This level shall be an outpatient centre.

The access ramp from Basement 2 lands and the level shall contain the following:

#### **Wing A**

- The Kitchen
- A Restaurant/Canteen
- A public dining area
- Medical gas supply room
- Store
- Employee wellness centre/Gym

#### **Wing B**

- Waiting area
- Cashiers and patient processing/registration rooms
- Medical examination rooms
- Laboratories and Blood Bank
- Pharmacy (complete); complete with its own pharmaceutical supplies storage, and offices.

### **2.2.5 1<sup>st</sup> Floor Layout**

This level shall serve as the Endoscopy Suite and shall handle endoscopy patients and shall contain:

- General wards for general patients

- Isolation wards
- Bed space to for endoscopy patients
- Endoscopy theatres
- Doctor's offices

Chaplain's office a Chapel and. There shall be a room to serve as a chapel from the 1<sup>st</sup> floor to the 4<sup>th</sup> floor

### **2.2.6 2<sup>nd</sup> Floor Layout**

This level shall contain the Training Suite and Patient wards.

#### **Wing A (Training Facility)**

- Classrooms
- Conference centre
- Offices around the conference centre

#### **Wing B (Patient Wards)**

- General patient ward
- Intensive Care Unit (ICU) ward
- Isolation wards

### **2.2.7 3rd Floor Layout**

#### **Wing A (High Dependency Unit – HDU)**

- HDU ward
- Holding and preparation area for patients due to go to theatre

#### **Wing B (Cardiothoracic Operating Theatres)**

- 5 Heart/Cardiothoracic Operating theatres
- 1 Hybrid Operating theatre
- 1 ERCP Theatre (Endoscopy)

### **2.2.8 4<sup>th</sup> Floor Layout**

This level provides room for expansion for Wing A.

However; shall be the rooftop for Wing B.

There shall be roof space and a Penthouse mechanical room at the centre of the roof area.

## **2.3 Sustainable Design Elements of the Proposed Project**

### **2.3.1 Landscape and Ecology**

The design of the project considers the landscape and ecology of the area and provides for introduction of landscaped green spaces (botanical garden) in the parking area.

These changes are intended to reduce the heat island effect, achieve cleaner air quality through the planting of shade trees, promote efficient management of storm water runoff, and to improve visual aesthetics.

### **2.3.2 Green Spaces**

The design has set aside space for a botanical garden (recreational area) and landscaped green spaces in the site plan.

The proposed open spaces will complement and enhance the hospitals facilities, including, but not limited to:

- Well-planned outdoor spaces where visitors, staff and students can mix and interact; and
- Open areas specifically designed to serve patients and their visitors

### **2.3.3 Natural Lighting**

The design of the building has taken advantage of natural lighting by maximizing on window space. This is evident especially on the circulation lobby (ramps and stairs), the outpatient centre, and in the classrooms. The design allows huge windows to let in natural light. This shall save on energy used for lighting during the day.

### **2.3.4 Fire Protection/Fighting Systems**

The design of the proposed CTC incorporates fire-fighting equipment and systems; and fire exits to be installed in all the project components as per the recommendations by the OSH guidelines.

### **2.3.5 Energy Supply**

The CTC project shall source its energy mainly from the Kenya Power. There is a Power House/Services Building in the site plan that shall contain the power unit. There is also a back-up generator that shall provide power in cases of emergency or power outage.

The Ground to the 1<sup>st</sup> Floor levels shall be naturally ventilated. This is an energy-saving measure.

### **2.3.6 Water Supply**

Tenwek Hospital sources its water from the nearby River Nyangores and treats it at a Water Treatment Plant they have developed. The CTC project shall increase demand on the already existing water treatment facility. Therefore, there is a program/project to expand and extend the water services to the Proposed CTC Site.

The design also incorporates a 200m<sup>3</sup> underground rainwater storage tank in the site plan.

### **2.3.7 Drainage Systems Designs**

The project design has carefully considered the drainage of surface run-off. The design considers a proper drainage system for surface run-off, and has a 200m<sup>3</sup> underground water storage tank for harvested rainwater.

### **2.3.8 Effluent Treatment Plant**

The CTC project shall increase demand on the already existing Effluent Discharge Treatment Facility. Therefore, there is a program/project to expand the capacity of the existing facility (up to 5 times) and extend the sewage services to the Proposed CTC Site.

***Proposed Project Designs are attached as Annex 2***

- **General Site Layout Plan**
- **Detailed Designs of Key Technical Features**
- **Structural Design**
- **Elevations Designs and Parameters**
- **Work Shop**
- **Electrical Equipment Design**

## **2.4 Proposed Project Activities**

For purposes of better understanding and analysis, the proposed project development shall be discussed in terms of its activity component format.

These activity components include design, construction, operation, and decommissioning phases.

During the proposed project cycle (proposed project implementation), several construction activities, as well as operational activities shall be discussed in the proceeding section.

### **2.4.1 Planning and design phase activities**

This phase entailed prefeasibility, feasibility and designing of the proposed project and included the following:

- ✓ Geotechnical survey
- ✓ Topographical survey
- ✓ Designs and Drawings

The planning phase considered type and nature of materials to be employed and involved careful consideration and balancing of the proposed project site physical conditions and *ergonomics in line with total costs as well as economic value of the project and scenic ambience and visibility of the general project area/location.*

The services of a qualified architect, responsible for developing the plans and other experts were involved such as; Civil Engineers, Quantity Surveyors, Geotechnical surveyor, Structural Engineers and EIA experts.

#### 2.4.2 Preparatory activities

- **Preconstruction investigations:** will include thorough investigation of the proposed project site to determine the physical and biological status of the site(Geotechnical Surveys)
- **Construction of site office for Project manager and Clerk of Works:** site office will be constructed and equipped with the necessary furniture, office equipment, computers and telephones
  - ✓ The site office will be a refurbished Container.
  - ✓ Sanitary facilities(Latrines)will be constructed and connected by sewer lines to the receptors of soak pits which shall be constructed for the temporary disposal of waste water and liquid wastes
- **Construction of Contractors Site office:** site office will be constructed and equipped with the necessary furniture, office equipment, computers and telephones
- **Construction of Building Materials store:** Stores for safe storage of building materials including cement, plumbing equipment and paints that can be affected by bad weather conditions should be constructed at the proposed project site. The store will be made of timber and GCI sheet
- **Construction of sanitary facilities for workers:** Temporary sanitary facilities should be constructed for workers. In addition to above there should be washrooms and clean water for drinking. This will be in compliance with OSH, Act of 2007
- **Sourcing and Transportation of building materials:** Building materials will be sourced from various supply destinations and will be transported to the proposed project site in trucks, vans and other transportation methods. It is highly anticipated that most of the materials will be sourced from the local area and greater emphasis should be laid on this because it will make economic and environmental sense as it will reduce transportation costs and environmental impacts.
- **Storage of building materials:** Building materials will be stored on site. Bulky ones such as rough stones, ballast, sand and steel will be carefully piled on site. In order to avoid piling large quantities of these materials on site, it is recommended that; that the contractors place orders in portions of immediate requirements at short notices.

#### 2.4.3 Construction phase activities

- **Proper Construction activities**
  - ✓ **Site clearing and levelling:** The commencement of construction will initially comprise site clearing and levelling. This will involve use of heavy machinery mainly bulldozers.
  - ✓ **Excavations for foundations and foundation works:** Excavations will be carried out to prepare the site for construction of perimeter wall, drainage systems and the foundations. This will involve use of heavy machinery mainly excavators.



- ✓ **Disposal of excavated top soil:** top soils at the site will be excavated and transported to a site approved by BOMET County Government engineer.
- ✓ **Drainage system:** trenches will be excavated as per specifications provided in the designs by Triad Architects and approved by Bomet County engineer and to the appropriate invert levels. Part of the excavated soils will be returned to be filled and watered to level the compound.
- ✓ **Masonry, concrete work and related activities:** In general substructure construction will involve lots of masonry work and will include: stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These works are labour intensive and will be supplemented by use of specific and specialized machinery and equipment.
- ✓ **All concrete mixes: will conform** to the required standards and specifications issued by the Structural Branch of Ministry of Works.
- ✓ **Super structure construction:** The superstructure construction will include the following: *structural steel works*, the formwork and moulds. This phase will involve steel cutting, welding and erection.
- ✓ **Roofing and sheet metal works:** Roofing activities will include steel metal cutting, raising the steel rafters and structural members of the roof and fastening.
- ✓ **Electrical works:** will include installation of electrical gargets and appliances such as electrical cables, lighting, and sockets.
- ✓ **Plumbing:** will involve installation of pipe work for water supply and distribution. In addition there will be connections to the receptors of sewer lines. Plumbing activities will include metal and plastic pipes, cuttings, use of adhesives, metal grinding and wall drilling.

▪ **Additional activities**

The proposed project will be located on a plot approximately 3 acres of gradually sloping land. Though the site is disconnected from the Hospital campus, utility infrastructure for the project shall tie-in to Hospital utilities that are being upgraded and extended to accommodate the Centre's demand.

The plot gradually slopes westwards and the project proponent must therefore include measures to control the expected storm water and reduce or halt any slight sheet erosion problems.

✓ **Storm water drainage and Soil Erosion Control**

The general topographical slope of the area tends slightly westwards. During the rainy season huge amounts of storm water flows off the adjacent plots from the dirt road from Tenwek Secondary School over the proposed project area into the natural water way alongside the Bomet – Tenwek road (frontage of proposed project ENTRANCE)

This storm water must be controlled and directed towards the natural water way alongside the road. This will require construction of controlled storm water drains as specified by the drainage designs by Triad Architects and approved by Bomet County Engineer.

The use of erosion control structures, protective re-vegetation and reforestation slope stabilization will be necessary to control sheet and gully erosion during the wet and rainy season.

The activities shall be carefully managed in order to avoid site erosion, stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatment as soon as practicable following earth works to minimize erosion.

✓ **Earth works cut and fill**

The following procedures will be taken:

- All earth works will be properly controlled especially during rainy season
- Maintain stable cut and fill slopes at all times and cause least possible disturbance to areas outside the limits of works; in order to protect any cut and fill slopes from erosion
- In accordance with drawings, cut off drains and toe drains shall be provided at the top and bottom of slopes and be planted with grass or other plant cover.
- Cut off drains should be provided above high cuts to minimize water runoff especially from the dirt road and slope erosion
- Any excavated cut or unsuitable soils shall be disposed of in designated disposal areas as agreed by the Bomet County Engineer
- Disposal sites should not be located where they can't cause future landslides, interfere with agricultural land, or any other properties or cause run off from the land fill towards any water course.

✓ **Disposal of Construction wastes**

These measures are:

- to minimize negative impacts of construction activities on local communities and the natural environment,
- to prevent pollution and to ensure that hazardous materials are stored properly without risks to the environment,
- to ensure no environmental accidents from release of hazardous substances (eg pollution of water ways from spills)
- training in environmental incidents and spill response provided to all relevant site based project personnel
- prevention of reoccurrences of incidents by appropriately implementing corrective and preventive actions and proper planning

✓ **Disposal of construction wastes**

- Daily site clean-up procedures will be established and enforced, including maintenance of adequate disposal facilities for construction debris.

- Excavated soils due to the excavations for foundations and structures shall be re used suitably to the best extent possible (eg as back fill material for embankments)
- Disposal of the remaining excavated materials shall be carried out only at sites identified and approved by the Bomet County Engineer.
- The contractor shall ensure that these sites: do not impact natural drainage courses and the endangered rare flora and fauna.
- Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas

✓ **Public health waste management**

A health and safety management plan shall be prepared to address matters regarding health and safety of construction workers and project staff.

The contractor shall prepare Health and Safety Plan to:

- to prevent and mitigate the effects of construction on the local population,
- prevent and mitigate effects of the population influx (workers) on the local population
- improve health situation of local population
- assist in capacity building of public health institutions by addressing their target population's health needs

✓ **Community relations and safety plan**

This plan gathers measures to inform the local community about the progress of the project and ensures community safety. It is aimed to inform the community about:

- Construction and work schedules interruption of services and traffic detour routes
- To ensure that construction activities shall occur mainly during day light hours,
- Provide a community relations form whereby interested parties can receive information on the site activities, project status and project implementation results
- Provide all information especially technical findings in a language that is understandable to the general public and in a form useful to the interested citizens and elected officials through preparation of fact sheets and news releases when major findings become available during the project phase,
- Respond to telephone enquiries and written correspondences in a timely and accurate manner
- Provide grievance mechanism and means of addressing disputes and concerns

✓ **Particulate emissions and dust**

Some methods and actions shall be proposed to control dust resulting from construction related activities, including crushing and concrete batching plants, earth works including road construction, construction, haulage of materials and construction work camps/sites

✓ **Other Construction works will involve the following activities.**

- Excavation and site clearing;
- Sub-structure (foundation) construction;
- Wall erection (superstructure);
- Roofing;
- Fittings; Plumbing;
- Electrical fittings;
- Finishes,
- Cladding, and,
- Landscaping.

#### **2.4.4 Description of Operational Phase Activities**

The operational phase activities of the proposed project will include;

▪ **Cardiothoracic Operating Theatres Activities**

- ✓ Specialized surgery in 5 Heart /Cardiothoracic Operating theatres
- ✓ Special surgery in one Hybrid Operating theater
- ✓ Special surgery in one ERCP theater(Endoscopy)

▪ **High Dependency Unit Activities**

- ✓ HDU ward
- ✓ Holding area for patients destined to the theatres

▪ **Patients Wards Activities**

- ✓ General patients wards
- ✓ Intensive care unit(wards)
- ✓ Isolation wards

▪ **Training facility Activities**

- ✓ Classrooms
- ✓ Conference Center
- ✓ Offices

▪ **Occupation of the CTC blocks:**

- ✓ During the operational phase the CTC Blocks (Wing 'A' and 'B' ) will be occupied and activities listed above shall be undertaken by Specialized Doctors, Surgeons and consultant Surgeons as well.
- ✓ There will be other workers of various categories performing all sorts and manner of work at the CTC
- ✓ During this period water and electricity will be used abundantly.
- ✓ Solid and ablution wastes including health care wastes will be generated in large quantities.

▪ **Gardening and beautification activities including;**

- ✓ Planting of trees and flowers to enhance the compound general scenic view.

- ✓ General Cleaning the premises
- **Cleaning and sanitation**
  - ✓ A regular cleaning scheme must be developed to ensure high standards of cleanliness and sanitation is maintained at all times

- **General repairs and maintenance:**

The facility shall be repaired and maintained on a regular basis during the operational phase and such activities will include:

- ✓ repair to perimeter and building walls,
- ✓ office and wards floors,
- ✓ electrical gadgets and equipment,
- ✓ leaking water pipes,
- ✓ fresh paintings, and,
- ✓ Replacement of worn out materials, machine and equipment parts.

- **Disposal of solid and liquid waste (waste water):**

Solid waste bins will be installed at specific designated locations inside the facility (ie theatres, wards, offices and in the compound).

The facility users will be expected to drop solid wastes into the designated bins marked by different colours for biodegradable and non-biodegradable.

The solid wastes will be collected on a regular basis by the HOSPITAL owned trucks and disposed off at the HOSPITAL INERATION PLANT.

This will be done in accordance with the regulations contained in the Health care waste disposal guidelines as specified in Chapter 7 of this study report.

*In the case of liquid wastes (human wastes and waste water); sewer line shall be constructed to the pre-treatment plant located in the north east corner the compound.*

*A sewer line shall be constructed to the receptors of the main EFFLUENT TREATMENT PLANT located near Nyangores River on the eastern side of the main Hospital Campus.*

#### **2.4.5 Description of decommissioning phase activities:**

During decommissioning the proponent will be required to dismantle and demolish the structure and restore the site to its original status. This is a reverse of the construction phase

- **Demolition Works**

Upon decommissioning, the project components including buildings, pavements, drainage systems, parking areas and perimeter fence will be demolished. This will produce a lot of solid waste, which can be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

- **Dismantling of Equipment and Fixtures**

All equipment including electrical installations, partitions and pipe-work among others will be dismantled and removed from the site on decommissioning of the project. Priority will be given to reuse of these equipment in other projects. This will be achieved through resale of the equipment to other building owners or contractors or donation of this equipment to schools, churches and charitable institutions.

- **Site Restoration**

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil.

- ***Solid Waste Generated***

Some solid wastes will be generated during construction of the project. These will include metal cuttings, rejected materials, surplus materials, surplus soil, excavated materials, paper bags, empty cartons, empty paint cans and solvent containers, broken glass among others. The proponent will take steps to minimize the generation of such waste and to ensure proper disposal procedures.

The proponent will be responsible for waste management within the project area and will put in place measures such as provision of waste handling facilities and ensuring prompt and regular waste disposal.

On decommissioning, large quantities of solid waste will be generated from demolition works and equipment dismantling. The proponent will provide measures for recycling, reuse or disposal of such wastes.

## 2.4.6 Materials used in Construction

**Table 3: Materials to be used in construction: products, by-products, wastes and disposal mechanism**

Segment to be Constructed	Material to be Used in Construction	Product	By-Product	Wastes Generated	Waste Disposal Mechanism
Foundations	Natural stones; cement , sand and gravel	NON	NON	Construction wastes	Collect and dispose of in designated sites by Sub-county engineer
The Floors	Concrete (cement, aggregates and sand) and the floor is lined with anti-static tiles.	NON	NON	Construction wastes	Collect and dispose of in designated sites by Sub-county engineer
The walls	Natural stones; cement , sand and aggregates(Concrete)	NON	NON	Construction wastes	Collect and dispose of in designated sites by Sub-county engineer
The Roof	High parapet wall, plastered and painted as directed by SE	NON	NON	Construction wastes	Collect and dispose of in designated sites by Sub-county engineer
Windows	steel frames and is powder coated and fitted with glass	NON	NON	Construction wastes	Collect and dispose of in designated sites by Sub-county engineer

## 2.4.7 Proposed Project Cost

*Construction of the proposed Project will cost Kenya shillings: **2.00 Billion***

# CHAPTER 3: ENVIRONMENTAL AND ECOLOGICAL SETTING OF THE PROPOSED PROJECT LOCATION

## 3.1 Project Location

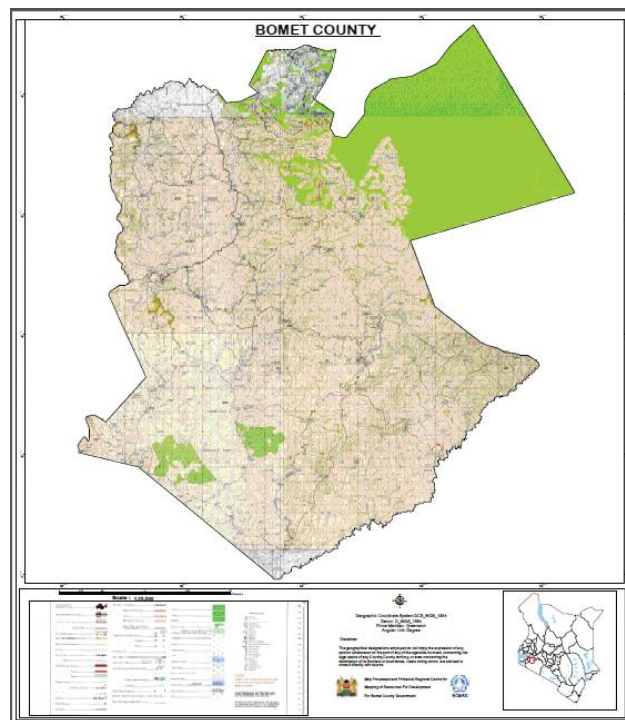
Tenwek is located 240 Kilometres (150 miles) from Nairobi in the Bomet County. The Project itself is located approximately 7 km North-East from the town of Bomet.

### 3.1.1 Map of Kenya





### 3.1.2 Map of Bomet



### 3.1.3 Map of Bomet County-Physical Map

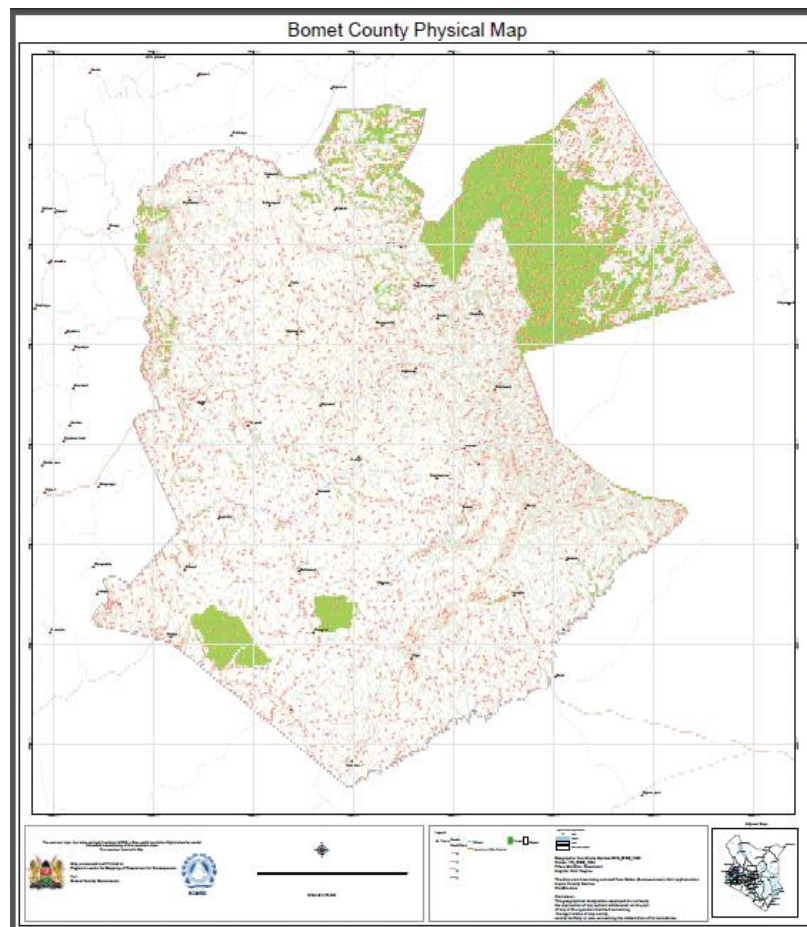


Figure 6: Bomet County Physical Map



volcanoes to the south west parts and faults along the Mau escarpment bordering Narok County.

The higher altitudes in the north eastern parts of the County are particularly suitable for tea and dairy farming. The middle part of the County which lies 2,300 m above sea level is suitable for tea, maize, pyrethrum and coffee. In the southern parts of the County such as Sigor and parts of Longisa, the main economic activity is livestock production while milk production is a major economic activity in Sotik sub-County. Areas between 1,800 m and 2,300 m above sea level are mostly suitable for maize, pyrethrum, vegetables and beef production.

### **3.2.2 Ecological Conditions**

The County borders a long stretch of Mau forest which is an indigenous forest and home to different species of animals and plants. However, due to human encroachment, animal life is threatened and certain species of wild animals, birds, insects and plants are extinct. Public sensitization on environmental conservation and the need for people to co-exist with other organisms is necessary if this trend is to be reversed. In addition, economic empowerment of the residents is needed to ensure they are able to meet their basic needs and thus promote environmental conservation.

### **3.2.3 Climatic Conditions**

Rainfall in the County is highest in the lower highland zone with a recorded annual rainfall of between 1000 mm and 1400 mm. The upper midland zone which lies west of the rift valley experiences uniform rainfall while in the upper midland zone on the southern part of the County, rainfall is low.

Rainfall is evenly distributed except for the short dry season in January and February. The wettest months are April and May. Overall, there is little break between short and long rains in the whole County. In the extreme south, rains start in November and continue intermittently until June. June to November is the dry season. In the extreme north, rains start towards the end of March and continue intermittently up to the end of December. The temperature levels range from 160 C to 240 C with the coldest months between February and April, while the hot seasons fall between December and January.

There are abundant water sources and even distribution of rain almost throughout the year. This explains why agriculture and livestock production are main economic activities of the County.

### 3.3 Administrative and Political Units

#### 3.3.1 Administrative Sub-Divisions

The County is divided into five (5) Sub-Counties (Constituencies), 25 wards, 67 locations and 176 sub-locations as shown in Table 1. The locations and sub-locations are administrative units of the National Government. The County will pass legislation to create villages which are the lowest Administrative Units of the County as provided by the County Governments Act, 2012.

**Table 4: Administrative Units and Area by Sub-County/Constituency**

Sub-county (Constituencies)	Wards	Area in Km <sup>2</sup>	No. of Locations	No. of Sub-locations
<b>Bomet Central</b>	Silibwet, Singorwet, Ndaraweta, Chesoen and Mutarakwa	266	8	23
<b>Bomet East</b>	Longisa, Kembu, Chemaner, Merigi and Kiprerres	311.3	10	27
<b>Chepalungu</b>	Sigor, Kongasis, Chebunyo, Nyongores and Siongiroi	535.8	15	42
<b>Sotik</b>	Ndanai/Abosi, Kipsonoi, Kapletundo, Chemagel and Manaret/Rongena	479.2	17	36
<b>Konoin</b>	Kimulot, Mogogosiek, Boito, Embomos and Chepchabas	445.1	16	37
<b>Total</b>		<b>2037.4</b>	<b>67</b>	<b>176</b>

Chepalungu Sub-County is the largest in acreage covering an area of 535.8 Km<sup>2</sup>, followed by Sotik (479.2 Km<sup>2</sup>), Konoin (445.1 Km<sup>2</sup>) and Bomet East (311.3 Km<sup>2</sup>). Bomet Central is the smallest with an area of 266 Km<sup>2</sup>.

### 3.4 Demographic Features

#### 3.4.1 Population Size and Composition

Kenya's Population was estimated at 38.6 million in 2009 Population and Housing Census growing at about 2.9 per cent per annum. The implication of this high population growth rate is a large increase in the section of the population below 25 years. This makes the

country classified as youthful with two-thirds of the population constituting people under 30 years and only 5 per cent above 60 years.

The population of Bomet County was estimated at 723,813 in 2009 Population and Housing Census and has similar features as that of the national population but different demographic indicators. The population was estimated to be 782,531 in 2012 and projected to reach 846,012 in 2015 and 891,168 by 2017 at an estimated population growth rate of 2.7 per cent.

The rapid population growth exerts pressure on the existing infrastructure and provision of services in the County, including pre-primary schools (ECD), primary, secondary and tertiary institutions. It requires greater investments in basic social services and hence exerts pressure on the economy thus limiting prospects of savings and production in a setting where a large population lives below poverty line. A large proportion of labour force is not in gainful employment. The population projections by sex and age cohorts for the period 2009–2017 for Bomet County are as shown in Table 4 below.

Age Cohort	2009			2012			2015			2017		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	61,929	58,982	120,911	66,953	63,767	130,720	72,384	68,940	141,324	76,248	72,619	148,867
5-9	58,779	57,004	115,783	63,547	61,628	125,176	68,702	66,628	135,330	72,369	70,184	142,554
10-14	50,000	50,147	100,147	54,056	54,215	108,271	58,441	58,613	117,054	61,561	61,742	123,302
15-19	41,279	41,011	82,290	44,628	44,338	88,966	48,248	47,935	96,183	50,823	50,493	101,317
20-24	32,296	39,256	71,552	34,916	42,441	77,356	37,748	45,883	83,632	39,763	48,333	88,096
25-29	26,335	27,302	53,637	28,471	29,517	57,988	30,781	31,911	62,692	32,424	33,615	66,039
30-34	21,626	20,800	42,426	23,380	22,487	45,868	25,277	24,312	49,589	26,626	25,609	52,235
35-39	17,466	16,550	34,016	18,883	17,893	36,775	20,415	19,344	39,759	21,504	20,377	41,881
40-44	11,157	11,003	22,160	12,062	11,896	23,958	13,041	12,861	25,901	13,737	13,547	27,284
45-49	10,484	11,214	21,698	11,334	12,124	23,458	12,254	13,107	25,361	12,908	13,807	26,715
50-54	7,718	7,697	15,415	8,344	8,321	16,666	9,021	8,996	18,017	9,503	9,477	18,979
55-59	5,794	5,737	11,531	6,264	6,202	12,466	6,772	6,706	13,478	7,134	7,063	14,197
60-64	4,637	4,818	9,455	5,013	5,209	10,222	5,420	5,631	11,051	5,709	5,932	11,641
65-69	2,720	3,268	5,988	2,941	3,533	6,474	3,179	3,820	6,999	3,349	4,024	7,373
70-74	2,401	2,901	5,302	2,596	3,136	5,732	2,806	3,391	6,197	2,956	3,572	6,528
75-79	1,760	2,221	3,981	1,903	2,401	4,304	2,057	2,596	4,653	2,167	2,735	4,901
80+	3,150	4,371	7,521	3,406	4,726	8,131	3,682	5,109	8,791	3,878	5,382	9,260
Total	359,531	364,282	723,813	388,697	393,834	782,531	420,229	425,782	846,012	442,659	448,509	891,168

**Table 4: Population Projections by Sex and Age-Cohort**

From table 4, the population of the County has been grouped into three broad economic groups: 0-14 years constitute children, 15–64 years the working or economically active group and 65 years and above constitute the aged. There is a high concentration of the population in the age group 0-14, necessitating the need to provide services to support the children.

However, half of the population (50.3 per cent) falls within the working age group indicating a rationally high potential for labour force and a fairly low dependency ratio.

The population projections of the County for the special categories of age groups data are useful in analysing the challenges facing the groups and in formulating recommendations to address the challenges.

### 3.4.2 Population Density and Distribution

Table 7 shows the population size and density by Sub-County. The population density of the County was 384 per square kilometres in 2012 and is expected to grow to 415/Km<sup>2</sup> and 437/Km<sup>2</sup> in 2015 and 2017, respectively.

Sub County	Km <sup>2</sup>	2009		2012		2015		2017	
		Pop	Density	Pop	Density	Pop	Density	Pop	Density
Bomet Central	266	131,527	494	142,197	535	153,732	578	161,938	609
Bomet East	311.3	122,273	393	132,192	425	142,916	459	150,544	484
Sotik	479.2	167,214	349	180,779	377	195,444	408	205,876	430
Konoin	445.1	139,040	312	150,319	338	162,514	365	171,188	385
Chepalungu	539.8	163,759	303	177,044	328	191,406	355	201,622	374
<b>Total</b>	<b>2037.4</b>	<b>723,813</b>	<b>355</b>	<b>782,531</b>	<b>384</b>	<b>846,012</b>	<b>415</b>	<b>891,168</b>	<b>437</b>

Source: KNBS (2009) Housing and Population Census

**Table 7: Population Density and Distribution by Sub County/Constituency**

In 2009, Bomet Central with a density of 494 people per Km<sup>2</sup>, had the highest density followed by Bomet East, Sotik, Konoin and Chepalungu, respectively as shown in Table 7. The population density in Bomet Central is high due to higher land/soil potential in the sub-County; including rich agricultural land, commercial activities, and the largest urban centre (Bomet town). Table 8 shows the population projections by Sub-County for the period 2012–2017.

Sotik Sub-County had the highest population (167,214) in 2009 housing population census followed by Chepalungu (163,759), while Bomet East Sub-County was the least populated with a population of 122,273 people. The female to male ratio is almost 1:1 in all the sub counties.

## **3.5 Infrastructure and Access**

### **3.5.1 Roads and Airstrips**

The County is well endowed with a road network which is mainly gravel and earth surface. A small portion of the road network is made of bitumen. The total number of kilometres of road in the County is 7000Km out of which 237Km is under bitumen and 1577.5 Km is under gravel and earth surface. The bitumen surface is only 3.3 per cent of the total road network in the County. Given the heavy rains across the County, road network particularly gravel and earth surface becomes impassable. In the past few months, the County government has ensured that majority of the roads are passable. More roads need to be opened up to enhance access to markets at lower costs since the economy of the County is agriculture based. The County has an air strip located near Bomet Town which is in need of repairs and expansion.

### **3.5.2 Posts and Telecommunications (Post Offices, Mobile Telephony and Landline)**

The County has 11 post offices all of which are based in the urban centres of Bomet, Chepalungu, Konoin and Sotik. Mobile telephone is growing fast and approximately 95 per cent of the County is covered by mobile service providers. The areas that have inadequate coverage are mostly the border centres between Chepalungu and Transmara East sub-counties.

Landline connectivity in the County has been declining due to availability of the mobile phones and the services are now confined to office use in the major towns.

### **3.5.3 Financial Institutions (Banks, SACCOs and Micro Finance Institutions)**

The banking services are available with a total of six banks having opened business in the last few years. These banks also have several agents spread across the County. Other financial services supporting the community are SACCOs and MFIs. Bomet County is home to many SACCOs whose main focus is agriculture and micro trade. Most of the existing SACCOs, however, deal in agricultural based businesses such as tea and cereals. The County has three tea SACCOs in Bomet, Konoin and Sotik and one for teachers. The presence of these SACCOs has enabled farmers to access credit cheaply leading to increased tea production and trade.

There are three MFIs in the County which target the micro-enterprises and women-run enterprises. Membership to these MFIs is through groups and many such groups have been formed to tap into this important resource. Funds from such institutions have given financial empowerment to many people in the county.

### **3.5.3 Education Institutions (Primary and Secondary Schools, Polytechnics, Colleges and Universities)**

Bomet County has 739 primary schools, 153 secondary schools and 22 youth polytechnics. There is one Teachers Training College in Bomet town and several mid-level colleges across the County. There are no universities in the County but University of Nairobi and Maasai

Mara University each has a satellite campus in Bomet town while University of Kabianga has one in Sigor, Chepalungu Sub-County. A number of universities have also shown interest in collaborating with middle colleges in the County.

#### **3.5.4 Energy Access**

The main source of energy in the County is electricity and wood fuel. Approximately 91 per cent of households in the County use wood fuel compared to 64.6 per cent at the national level. Electricity coverage in the County is over 60 per cent with all the townships such as Sotik, Bomet, Mogogosiek, Sigor and Longisa having been connected to the national grid. Other sources of energy include kerosene, solar energy and lately there is a marked increase in use of biogas especially in Bomet Sub-County.

Increased supply of electricity to different parts of the County will make many people able to access it. Electrification within the urban centres is bound to encourage growth in investment and trade especially in the small and medium enterprises.

#### **3.5.5 Markets and Urban Centres**

Bomet and Sotik are the major market centres in the County. Others include Silibwet, Sigor, Mulot and Chebunyo markets. Smaller markets such as Kapkwen, Mogogosiek, Siongiroi, Kaplong, Ndanai, Chebole and Longisa are famous for their open air markets operating on specific days of the week. It is important to note that none of the County's existing market centres qualify as towns as per the Urban Areas and Cities Act, 2011.

### **3.6 Housing**

According to the Population and Housing Census (2009), housing was classified according to ownership, main walling, floor and roofing materials. Under ownership, 85 per cent of the County's population have their own houses compared to the national figure of 68 per cent. Only 15 per cent of the County population reside in rented houses compared to the national figure of 32 per cent.

About 65.1 per cent of the residents of the County have used mud and wood as their main walling materials against a national figure of 36.7 per cent. Only 4.2 per cent used stone. Under the main floor material, 75.5 per cent of the County residents used earth against the national figure of 56.5 per cent. Under the roofing materials, 72.2 per cent of the houses are constructed using corrugated iron sheets against the national figure of 8 per cent.

### **3.7 Land and Land Use**

The total land area in Bomet County is 2037.4 Km<sup>2</sup>. A total of 1,716.6 Km<sup>2</sup> of this land is arable land suitable for farming. There are also gazetted forests such as Tinet in Konoin Sub-County and Chepalungu in Chepalungu Sub-County that occupy about 483.1 Km<sup>2</sup>.

Approximately 230.1 km<sup>2</sup> is non-arable land while the area coverage for the market centres is 2 Km<sup>2</sup>.



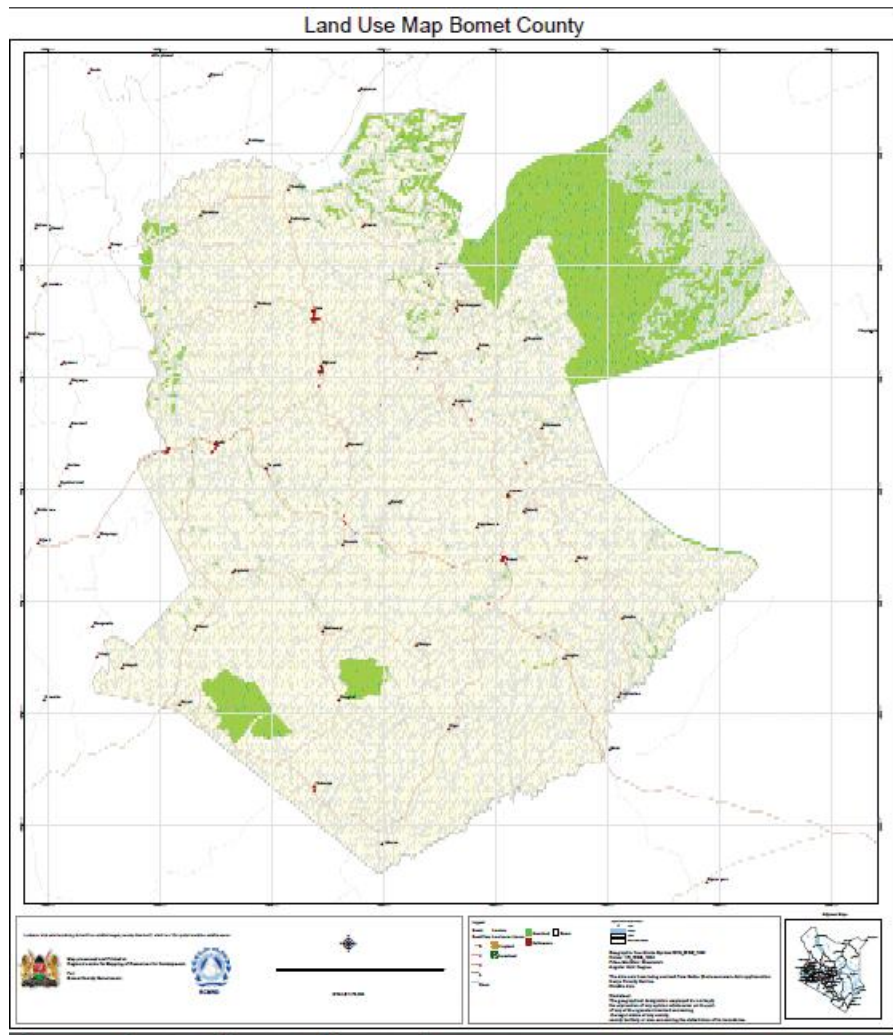


Figure 8: Land Use Map of Bomet County

- **Mean Holding Size**

Population size in the County has grown rapidly over the years leading to high population densities. This scenario has led to reduced mean holding size which stands at 2 ha per household from a high of 5 ha per household in the 1980s.

- **Percentage of Land with Title Deeds**

Approximately 86 per cent of the households have acquired titles for their pieces of land and this has enabled many of them to participate actively in gainful economic activities as they can easily access credit for development. The people displaced from the forest in Konoin Sub-County are among the households without title deeds.

- **Incidence of Landlessness**

The incidence of landlessness in the County currently stands at two per cent. This came about as a result of the displacement during the Mau forest conservation exercise. These Internally Displaced People (IDPs) are located at Kusumek and Chebugen camps in Konoin Sub-County.

## **3.8 Community Organizations/**

### **3.8.1 Co-operative Societies**

Bomet County has a total of 257 registered co-operative societies of which 80 are active, 141 dormant and 18 have collapsed. The total number of registered membership is 115,771 and a turn-over of Ksh. 208,679,445. Most of these co-operative societies are tea-based with a few others concentrating on the dairy sub-sector and other informal sectors such as the transport sub-sector.

### **3.8.2 Non-Governmental Organizations**

There are a total of 20 Non-Governmental Organizations (NGOs) in the County. However, more than half of them are local and mostly inactive. Most of these NGOs are involved in HIV/AIDS activities and others in addressing issues of environment, poverty alleviation and protection of livelihoods. The major NGOs are World Vision (WV), Walter Reed Project (WRP) and African Medical Research Foundation (AMREF).

### **3.8.3 Self Help Women & Youth Groups**

The registered groups in Bomet County are 1,912 women groups, 3,989 mixed groups, 2,229 youth groups and 57 special groups. The women groups participate actively in table banking, merry-go rounds, microfinance activities and environmental conservation. Most youth groups benefit from government funds such the Youth Enterprise Fund, Women Enterprise Fund and HIV/AIDS funds while others undertake business ventures.

## **3.9 Crop, Livestock Production**

### **3.9.1 Main Crops Produced**

Majority of the farmers in the County practice mixed farming; with tea, maize and dairy taking the lead. Although tea takes a smaller area it leads in income earnings followed by milk and maize respectively. There exists a huge potential for coffee production in several areas of the County

### **3.9.2 Acreage under Food Crops and Cash Crops**

The total County acreage under food and cash crops is 74,755 ha and 33,222.5 ha respectively.

Konoin Sub-County is conducive for agricultural production as witnessed by the large tea plantations in the area. This has attracted a large migration of people into the Sub-County since the late 1960s seeking employment in the tea plantations.

### **3.9.3 Average Farm Sizes**

The agricultural land area is estimated at 1.5 ha per household. Given that land size per household is small, most of the land is used for crop and livestock production while the remaining land is utilised for construction of homesteads.

### **3.9.4 Main Storage Facilities**

Approximately 80 per cent of the farmers rely on improved raised on-farm grain storage stores of various capacities depending on their farm production. The National Cereals and Produce Board (NCPB) has three silos in the County located at Bomet, Ndanai and Sotik

towns. The capacity of the Bomet depot is 180,000 bags while the remaining two have capacities of 100,000 bags each.

### **3.9.5 Main Livestock Bred.**

Livestock production contributes between 30 and 45 percent of the total household income depending on the Sub-County. The main livestock bred are Friesian and Ayrshire cows, beef animals and poultry. Rabbit farming is slowly picking up in the County.

### **3.9.6 Main Forest Types and Size of Forests**

Bomet County has two forests, one gazetted and the other un-gazetted, with the gazetted forest covering an area of approximately 481.1 Km<sup>2</sup>. There are two types of forests in Bomet, that is indigenous and plantation forests. The major forests include Mau forest, Chepalungu forest and private forests.

## **3.10 Promotion of Agro-Forestry and Green Economy**

Agro forestry is widely practiced in Bomet County due to reduced land sizes and the benefits that accrue from the practice. The demand for wood fuel by tea factories in the County has resulted in most farmers combining both trees and crops in their farming activities. The gains made from agro-forestry are immense as the decomposition of tree litter and pruning can substantially contribute to maintenance of soil fertility. Agro-forestry also controls runoff and soil erosion, thereby reducing losses of water, soil material, organic matter and nutrients.

Growing of fruit trees is also being encouraged by various agricultural stakeholders so as to enhance the tree cover to the desired national standard of 10 per cent by the year 2030.

### **(i) Income Generating Activities (including farm forests)**

The Kenya Forest Service (KFS) has assisted farmers in establishing over 1,370 ha of farm forest. However, the demand for wood products is too high as opposed to production and this has contributed to environmental degradation as farmers have cut down indigenous trees to meet their demand for wood product. There is great potential for farm forests to increase the forest cover and to meet the high demand of wood fuel by the tea factory.

### **(ii) Protection of Water Catchment Areas**

A total of 820 ha of water catchment areas have been protected. However, dams in the area have been eroded due to lack of vegetation cover, proper fencing and designated cattle troughs. There is need for proper fencing and rehabilitation of dam sites to control further erosion and the resulting siltation. The culture of tree planting in Bomet County must, therefore, be encouraged.

### **(iii) Prevention of Soil Erosion**

A total of 120 ha of hilltops have been afforested to reduce the effect of soil erosion down hills and improve soil fertility. There is need to sensitize the community on the issue of prevention of soil erosion by avoiding cultivation of hilltops which increases erosion due to run-off during heavy rains. The community further need to be encouraged to plant trees on

all the remaining hilltops and river banks as a way of diversifying their income sources as well as preventing soil erosion. Other methods of soil erosion prevention such as use of gabions and cover crops ought to be incorporated into the sensitization effort.

**(vi) Provision of Wood Fuel and Generation of Energy (for industries e.g., Tea Estates)**

Kenya Tea Development Agency (KTDA) Factories' demand for fuel wood is high. Most of the tea estates plant their own trees for wood fuel but this is not sufficient. Hence they opt to buy extra wood fuel from farmers. This is a good opportunity for the farmers to market their tree products and improve their livelihood. However, the factories have also accelerated the rate of deforestation because they also buy wood from fruit trees and indigenous trees for wood fuel and irrespective of their maturity status, without replenishment by farmers, and hence environmental degradation is accelerated.

**(v) Improvement of Soil Fertility by Growing Fertilizer Trees**

Industrial fertilizer is expensive and out of reach for most farmers and as such use of nitrogen fixing tree species such as *leucaena leucocephala*, *sesbania sesban* and *Kajianas kajian* are an alternative to improvement of soil fertility.

**(vi) Growing of Fruit Trees for Improved Nutrition (both for domestic use and surplus for markets)**

A total of 3,600 fruit trees mainly mangoes, passion fruits and avocados were distributed to farmers in 2012 to improve their nutrition status and for commercial purposes to alleviate poverty in the County. However, this is still too low compared to the population's nutritional needs and calorie intake. There is a serious need for fruit tree farming in the area to improve nutrition and for sale as income generating activity. Grafted fruit trees being issued to farmers are purchased from outside the County. Thus, there is potential for establishment of fruit nurseries, commercial orchards and a fruit processing plant in the region.

**(vii) Provision of Carbon Sinks (e.g., carbon trading)**

There are no projects under carbon trading and no initiatives have been introduced so far. However, there are opportunities for such carbon-related projects and programmes in Bomet County given the large vegetation cover in the Mau and Chepalungu forest and private forests.

**(viii) Beautification Activities in Towns, Highways, Schools, Homes and other Public Places**

All urban centres, highways, schools and recreation places within the County need beautification. The County government is currently implementing a pilot programme within Bomet town and its environs.

**(ix) Animal Feeds Production Ventures**

Bomet being a livestock production area, growing of fodder tree species is of paramount importance. Fodder trees are more nutritious, drought resistant and could supplement grass during the dry season.

### **(x) Growing and Processing Herbal Plants for Medicinal Purposes (value plants and products)**

Most indigenous trees have been cut down indiscriminately leading to destruction of medicinal tree species. This calls for promotion and propagation of medicinal trees species in the County. This could be achieved through planting of the trees in the protected areas like schools, public institutions, and public land and also by encouraging farmers to plant them in their private lands.

## **3.11 Environment and Climate Change**

### **3.11.1 Major Contributors to Environmental Degradation**

The major contributors of environmental degradation in the County are quarrying activities carried out in Bomet Town as well as Koiwa and Kyogong areas of Konoin and Chepalungu Sub-Counties respectively. People have also encroached on gazetted forests for grazing and illegal logging. Due to these illegal activities, some forests like Chepalungu are near extinction and this is causing threat to the human and animal lives as water catchment areas are destroyed and subsequent loss of bio diversity. Lack of sewerage systems and proper waste management in most urban centres in Bomet County has led to pollution of the environment and increase in waterborne diseases have been witnessed across the County.

### **3.11.2 Effects of Environmental Degradation**

Environmental degradation has led to reduced and erratic rainfall, poor sanitation in urban centres, increased river siltation, low agricultural productivity and loss of biodiversity. This has led to lose of livelihoods in terms food security, water shortages and water borne diseases, hence escalating poverty.

### **3.11.3 Climate Change and its Effect**

Climate change has resulted in unpredictability in rainfall patterns in terms of amount and distribution and rise in temperatures over time, which has resulted in food insecurity as farmers are unable to prepare well for planting and harvesting seasons.

### **3.11.4 Climate Change Mitigation Measures and Adaptation Strategies**

Climate change requires urgent measures to mitigate its effects on the environment. These measures include rehabilitation of degraded forests, public education and information, encouraging agro-forestry and ensuring adherence to the 10 per cent tree cover policy Countywide.

## **3.12 Mining**

### **3.12.1 On-going Activities**

The County has no known mineral or precious stones but has a number of rocks which are of economic value to the community. The important ones which are currently under exploitation are murrum, ballast and building stones. Local sand is found in Koiwa location in Konoin Sub-County and at Kyogong area of Chepalungu Sub-County. Building stones are also found at Chepkositonik area of Bomet Sub-County.

### **3.12.2 Mining Potentials**

Other minerals that have some economic potential but have not been exploited include limestone (cement raw materials) found in Sigor. Mining prospecting can be undertaken to discover other minerals and their economic value to be exploited in the County.

## **3.13 Tourism**

### **3.13.1 Main Tourist Attractions, National Parks/Reserves**

Although there are no major tourist attraction activities in the County, there exists a potential for tourism. Part of Bomet County is within the expansive Mau forest which is home to different tree species, wildlife and birds which can easily be exploited for tourism. There are also caves in Konoin Sub-County and waterfalls along Itare and Chepkulo rivers in Konoinand Bomet Central sub-counties respectively.

### **3.13.2 Wildlife**

A section of Mau forest is within Bomet County and is home to rare animal species like bongo, giant forest hogs, cooper tailed monkeys, black and white Columbus monkeys, elephants, leopards, buffalos and abundant birdlife. It is the only National reserve in the County and has all the potential to be a leading tourist attraction and lead destination for the County.

### **3.13.3 Tourist Class Hotels/Restaurants, Bed Occupancy**

The County has one tourist-class hotel in Bomet town with more than 70 bed capacity. However, due to the high tourism potential more investors are venturing into the development of tourist class hotels.

## **3.14 Industry**

The industrial base in Bomet County is very small yet the County is endowed with various agricultural raw materials which can be processed for value addition. The County has three tea processing industries and a milk processing plant in Sotik. The County also has a modern maize milling plant in Bomet town which is ready for operation and there is a high potential for the development of other industries given the strong agricultural base of the County. Additionally, the County has a thriving *jua kali* sector with many small scale entrepreneurs spread across all the urban centres of the County such as auto mechanics, carpenters, market vendors and many others. The County has three *jua kali* associations namely Bomet, Sotikand Ndanai *jua kali* associations with over 200 artisans.

## **3.15 Employment and other Sources of Income**

### **3.15.1 Wage Earners**

Agriculture is the mainstay of Bomet County where over 80 per cent of the residents are farmers and many of the large scale farmers have hired labour to work in their farms. Some of the residents work in small hotels and shops in urban centres while many youths earn incomes by engaging in '*boda boda*' businesses. Wage earners in the County include the teachers, civil servants and private sector employees.

### **3.15.2 Self-employed**

A big number of the County residents are self-employed and are engaged mainly in agricultural activities and marketing farm products while others have opened retail and wholesale shops as well as *Jua Kali* business in urban centres. The County has 1,340, 103 and 321 registered retail, wholesale and *Jua Kali* artisans respectively.

### **3.15.3 Labour Force**

A total of 390,196 residents form the County's labour force. This represents 50.2 per cent of the total County population projections for the year 2012. This indicates that the County is well endowed with abundant labour which ought to be tapped in the economic development of the County.

#### **▪ Unemployment Levels**

Unemployment in Bomet is prevalent mostly among the youth. A total of 160,583 persons are unemployed, representing 44 per cent of the total labour force. The major cause of unemployment in the County is low investment in the manufacturing sector and lack of entrepreneurial skills among the youths. Job opportunities should be created through innovation and partnership across all sectors in the County.

## **3.16 Water and Sanitation**

### **3.16.1 Water Resources and Quality**

The main rivers within the County include Nyongores, Kipsonoi, Itare, Kiptiget, Chemosit Amala, Mara and Sisei. These are permanent rivers although the latter is fast diminishing due to intensified cultivation along its banks and catchment area. Degradation and plenty of blue gum trees along the river banks have also played a major role in fast diminishing of those rivers. Wetlands are numerous, but they are unprotected.

Roof water harvesting is also practiced by the households that have corrugated iron roofs. Most public and private institutions have tapped rain water for their own use in areas where there are no nearby water supplies and springs. Generally, the County is well endowed with water sources that can be tapped for the development. Water quality depends on sources. Water from roof catchment, springs and streams are better in quality than that from ponds and small dams. However, there is declining water quality resulting from water pollution and extensive cultivation along the river banks and water catchment areas.

### **3.16.2 Water Supply Schemes**

The existing water supply schemes which are managed by Bomet Water Company Ltd are Itare, Sotik, Bomet, Longisa, Sigor, Olbutyo, Kamureito, Yaganek and Ndanai water supply. There are also several community water projects in various stages of completion funded mainly by the County Government, CDF, Community Development Trust Fund (CDTF), national institutions such as Water Service Trust Fund (WSTF) and State department of water, and other development partners such as African Development Bank (ADB). These include Kaporuso, Simoti, Sergutiet, Segutiet, Mogombet, Nyagombe, Taboino, Cheptalal, Tegat, Chebang'ang' and Kaptebeng'wet water projects among others.

### **3.16.3 Water Sources**

Average walking distance to the nearest water point in the County is about 2 Km. This distance varies with season, source of water and area. During dry seasons, the lower parts of the County namely Chepalungu and Bomet East sub-counties/constituencies where the main source of water is from dams and pans, the distance covered to the water point increases considerably to about 5 Km.

### **3.16.4 Sanitation**

Sanitation in the County is mainly by use of pit latrines at household level and septic tanks in institutions and urban centres with access to piped water supplies. A total of 91.4 per cent of the County households use pit latrines in comparison to 0.3 per cent who use the toilets and mostly in the urban centres. Although a sewerage system has been planned for the Bomet Town, construction work is yet to start. The development cost outlays one probability and therefore there is need to forge partnership with donors to undertake such projects.

## **3.17 Health Access and Nutrition**

### **3.17.1 Health Access**

The County has a total number of 136 health facilities comprising three hospitals of which two are mission hospitals, 10 health centres, 30 private clinics and 93 dispensaries. There are 14 doctors, 287 nurses giving a doctor/population ratio of 1:55,895 and a nurses/population ratio of 1:2,727. There is, therefore, need to initiate doctor training programme in the County.

### **3.17.2 Morbidity**

Disease prevalence varies from one Sub-County to another, but the five common diseases in order of prevalence are malaria, upper respiratory tract infection, skin infections, pneumonia and intestinal worms. Upper respiratory tract infections are common in cold areas of the County such as Ndaraweta, Chemaner and Kiromwok locations and some locations of Konoin and Sotik sub-counties. Malaria is common across the County and it affects adults and children but its impact has been reduced due to increased promotion of preventive healthcare by the Ministry of Health/County's Health Department. Its prevalence is at 47 per cent followed by skin diseases at 28 per cent while other diseases account for the remaining percentage.

### **3.17.3 Nutritional Status**

Bomet County nutritional status can be described as average even though no recent surveys on the same have been conducted. No cases of malnutrition have been recorded in the County. The percentage of children who have an adequate weight for age in County is 60.2 per cent.

### **3.17.4 Immunization Coverage**

Immunization coverage in the County is at 83 per cent and has been improving due to increased outreach by the ministry personnel and community health workers. The main



challenges preventing 100 per cent coverage is the small number of personnel and long distances to health facilities where immunization services are offered. The fully immunised children (less than 1 year) are 58 per cent in the County.

### **3.17.5 Access to Family Planning Services/Contraceptive Prevalence**

Access to family planning services stands at 38 per cent in the county while contraceptive acceptance stands at 40 per cent. The main service providers are the Sub-County hospitals in collaboration with the Family Planning Association of Kenya (FPAK) and selected community health units/workers.

## **3.18 Education and Literacy**

### **3.18.1 Pre-School Education**

The total enrolment in pre-school education is 42,116 of whom 21,771 are boys and 20,345 are girls giving a gross enrolment rate of 57.2 per cent against 62.6 per cent at the national level. There have been improvements in enrolment in pre-school as more schools are established, recruitment of ECDE assistants and increased emphasis by the government on early childhood education. The dropout rates have also fallen significantly.

### **3.18.2 Primary Education**

The enrolment for boys in primary schools is 117,834 while that of girls is 114,402. The population level by age bracket between 6 and 13 years as per the 2012 projections is 185,700 this represents a gross enrolment rate of 117.3 per cent against 110.8 per cent at the national level. The government initiative to provide compulsory free education and support in educational infrastructure has gone a long way in surpassing the targets for this level and has even encouraged the boys and girls who are beyond this age bracket to go back to school hence the enrolment being higher than the actual population projections.

### **3.18.3 Literacy Level**

Literacy level in the County is approximately 61.5 per cent and there is a potential for this figure to go up as many residents of the County are enrolling in various learning institutions. There are 150 adult classes in the County with an overall enrolment of about 6,000. The literacy level among this group is 76 per cent for the females and 64.7 per cent for the males.

### **3.18.4 Secondary Education**

The total enrolment in secondary schools within the County is 43,159 representing gross enrolment rate of 56.9 per cent as compared with the national which stands at 51.4 per cent with the boys' enrolment being 23,947 while that of girls is 19,212. The population of the secondary school age bracket (14–17) is 75,426 of which 37,865 are boys and 37,561 are girls. This indicates that the transition rate from primary to secondary schools is still low especially for the girl-child. This is because of incidences of early marriages that force the girls to drop out of primary schools. The high cost of secondary education is another factor contributing to the low transition rate from primary school to secondary school. However, with financial support from the County government, especially through establishment of

public day secondary schools and provision of bursaries, the transition rates are expected to improve significantly.

### **3.18.5 Tertiary Education**

The main tertiary institutions in Bomet County are village youth polytechnics that are mostly funded by CDF, Ministry of Youth Affairs and contributions from the community. There are a total of 22 youth polytechnics in the County. University satellite campuses of The University of Nairobi and Maasai Mara University have been established in Bomet town while a learning centre of Moi University has been set up at Sigor. Teachers colleges do exist in the County as well as a Medical Training Centre, which is now operational at Longisa ward

## **CHAPTER 4: ANALYSIS OF THE PROPOSED PROJECT ALTERNATIVES**

### **4.1 Introduction**

This Chapter analyses the proposed Project alternatives in terms of site and technology. It describes the relocation alternative, no Project alternative and the proposed development alternative. It also analyses the alternative construction materials and technology.

### **4.2 Identification of Alternatives**

The principle alternatives studied in the context of the proposed project are:

- **Alternative 1:** The no project alternative - the Project site remains as it is;
- **Alternative 2:** Construction of the proposed Project at the proposed site; and
- **Alternative 3:** Construction of the proposed Project at another location.

#### **4.2.1 Alternative 1: No Project Alternative**

The no project expansion alternative in respect to the proposed Project implies that the status quo is maintained. Under the no project expansion alternative, the existing land use will not change and will also continue functioning at the site and the land owner will continue not to make any good value of the land.

In addition the Proponent's proposal would not receive the necessary approval from NEMA. The proposed Project would not be constructed and the expectations attached to the Project would not be met.

The no project construction alternative is the least preferred from the socio-economic perspective due to the following factors:

- The existing land use is not profitable to the optimum;
- The existing agricultural practices are not as profitable as compared to the proposed Project once its complete and has been occupied;
- The amenities and facilities within the proposed Project area need a face lift
- No employment opportunities will be created from the proposed CTC Project.

From the analysis above, it becomes apparent that the "no project alternative" is not a viable alternative to the Proponent.

#### **4.2.2 Alternative 2: Proposed Construction Alternative**

Under the proposed construction alternative, the Proponent would be issued with an EIA License.

In issuing the license, NEMA would approve the Proponent's proposed construction of the proposed project provided all environmental measures are complied with during the planning and design construction, operation and decommissioning phases.

Due to NEMA approval, construction and operation of the proposed project, the following will be experienced:

- It will enhance cancer and chest treatment at TENWEK HOSPITAL
- The Proponent will be able to put the available modern technologies in cancer and chest treatment a better use and benefit more from it;
- Employment opportunities will be created from the construction and operation;
- The resident community in the area will benefit as a result of increased socio-economic activities hence more revenue; and
- The land value of the proposed Project site and of the surrounding area will increase.

#### **4.2.3 Alternative 3: Relocation Alternative**

Relocation alternative to a different site is an alternative available for the Project implementation. However, at present, the Proponent has already identified and acquired the land.

The Proponent has also spent money on the proposed Project during the planning and design phase. Relocation alternative would mean that the Proponent would have to identify another land and purchase as an alternative site.

This will cost the Proponent a large sum of money. Whatever has been done and paid to date will be counted as a loss to the Proponent.

The proposed Project is also in line with the Bomet County government Health Sector Policies and priorities in providing Quality Health care to all its residents.

In consideration of the above concerns and assessment of the current proposed site, relocation of the proposed Project to a different site is not a viable alternative.

#### **4.3 Analysis of Alternative Materials and Technology**

The proposed CTC project will be constructed using modern, locally and internationally accepted materials and technology to achieve public health safety, security and environmental quality requirement.

The structures will be made using locally sourced stones, cement, sand, metal bars and fittings that meet the Kenya Bureau of Standards requirements.

Heavy use of timber during construction is discouraged. Equipment that saves energy and time will be given first priority.

## CHAPTER 5: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

### 5.1 Environmental Policy Framework

The Kenya Government's environmental policy is geared towards sound environmental management for sustainable development. This is envisaged in the principle of prudent use, which requires that the present day usage should not "compromise the needs of the future generations". The policy emphasis is on environmental protection in order to ensure sufficient supplies for the present and future generations. The policy envisages the use of the "polluter pays principle", where one is expected to make good any damage made to the environment.

The Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development; and
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

#### 5.1.1 National Environment Action Plan (NEAP), 1994

The NEAP for Kenya was prepared in mid 1990s. It was a deliberate policy effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectorial approach to develop a comprehensive framework to ensure that environmental management and the conservation of natural resources are an integral part of the societal decision-making.

#### 5.1.2 Kenya Health Services Policy

The Kenya Health Policy was developed with the aim of ensuring the attainment of: *"the highest possible standard of health in a responsive manner"*. The health sector aims to achieve this goal by *supporting equitable, affordable, and high-quality health and related services at the highest attainable standards for all Kenyans*. The sector will be guided by the

primary healthcare approach, which remains the most efficient and cost-effective way to organise a health system

In the implementation of the Health Policy, the health sector will embrace the following principles:

- i) Equity in distribution of health services and interventions;
- ii) Public participation, in which a people-centred approach and social accountability in planning and implementation shall be encouraged, in addition to the multi-sectorial approach in the overall development planning;
- iii) Efficiency in application of health technologies; and
- iv) Mutual consultation and cooperation between the national and county governments and among county governments.

### **5.1.3 Kenya Public Health and Sanitation Policy**

The Kenya Environmental Sanitation and Hygiene Policy (KESHP) provides broad guidelines to both state and non-state actors at all levels to work towards universal access to improved sanitation leading to improved quality of life for the people. Primarily, the KESH policy aims *to ensure universal (100%) access to improved sanitation, clean and healthy environment and ensure a clean and healthy environment for all in Kenya by 2030.*

The KESHP proposes a range of complementary activities including the provision of sanitation services and maintenance of sanitary facilities for proper collection, treatment and environmentally sound disposal of liquid and solid wastes, water treatment and safety, promotion of hygiene practices, public education, sanitation marketing, regulation and legislation supported by clearly mandated institutions, sustainable financing and research and development.

The KESH policy emphasises the systematic collection of data on wastes from all sectors of the economy to support research and development to meet the challenges of managing wastes associated with Kenya's growing economy, rapid urbanization and the rapidly changing lifestyles. The policy supports building of international, national, county and community partnerships with the private sector and civil society through effective public sector facilitation, coordination and investment.

### **5.1.4 National Water Policy, 2000**

The National Water Policy which was promulgated in April 1999 as Sessional Paper No. 1 of 1999 calls for decentralization of operational activities from the central government to other sectors, including local authorities, the private sector and increased involvement of

communities in order to improve efficiency in service delivery. It also tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector. According to the policy, in order to enable sustainable water supply and sanitation services, there is need to apply alternative management options that are participatory through enhanced involvement of others in the provision of these services but particularly the private sector.

The overall objective of the National Water Policy is to lay the foundation for the rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social well-being of the people through sustainable water resource management.

## **5.2 Legal Framework**

There are several provisions under the Kenyan Constitution as well as various Acts of Kenyan Parliament that protect the environment and human health. These include:

### **5.2.1 Constitution of Kenya 2010**

The Constitution of Kenya 2010 is the overarching legal framework for matters on environment and recognizes the environment as part of the country's heritage, which must be safeguarded for future generations.

**In Article 42;** the constitution provides for the right to a clean and healthy environment for every person, obligating the state to enact legislation to protect that right as well as to establish systems of environmental impact assessment, environmental audit and monitoring of the environment.

**Article 69** imposes on the State, other obligations including, to:

- ✓ Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- ✓ Encourage public participation in the management, protection and conservation of the environment;
- ✓ Eliminate processes and activities that are likely to endanger the environment; and
- ✓ Utilize the environment and natural resources for the benefit of the people of Kenya.



Article 69 (2) similarly imposes a conservation obligation on parties such as the Kenya Hospital Association.

The proponent is thus obligated to cooperate with State organs and other persons to protect and conserve the environment.

### **5.2.2 Environmental Management and Coordination Act (EMCA), 1999 (Revised 2015)**

Environmental Management and Co-ordination Act No. 8 of 1999(revised 2015), provide a legal and institutional framework for the management of the environmental related matters. It is the framework law on environment, which was enacted on the 14th of January 1999 and commenced in January 2002.

Topmost in the administration of EMCA is National Environment Council (NEC), which formulates policies, set goals, and promotes environmental protection programmes. The implementing organ is National Environment Management Authority (NEMA). EMCA comprises of the parts covering all aspects of the environment.

The Second Schedule to the Act specifies the projects for which an EIA and Environmental Audit (EA) must be carried out.

The **Replaced 2nd Schedule** (Legal Notice No.150 dated 19th August, 2016); specifies that: Construction of Tenwek Hospital Cardiothoracic Centre in Bomet County falls under:

*“High Risk Projects —; (3) Urban Development including —; (e) establishment of hospitals”*

Therefore it shall be required that an environmental impact assessment study report be prepared and submitted to NEMA, under section 58(2) of the Environmental Management and Co-ordination Act, 1999(revised 2015

According to the Act, Section 68, all projects listed in the Second Schedule of the Act must undertake an environmental audit, keep accurate records and make annual reports to NEMA or as NEMA may, in writing, require.

The Environmental (Impact Assessment and Audit) Regulations, 2003, provide the basis for procedures for carrying out Environmental Impact Assessments (EIAs) and Environmental Audits (EAs).

The main objectives of the Act are to:

- Provide guidelines for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya;
- Provide a framework legislation for over 70 statutes in Kenya that contain environmental provisions; and
- Provide guidelines for environmental impact assessment, environmental audit and monitoring, environmental quality standards and environmental protection orders.

### **5.2.3 EMCA Related Regulations**

#### ***Legal Notice No.101: Environmental (Impact Assessment and Audit) Regulations, 2003***

The Environmental (Impact Assessment and Audit) Regulations, 2003 state in Regulation 3 that *“the Regulations shall apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act”*.

**Regulation 4 (1)** further states that:

*“...no Proponent shall implement a project:*

*(a) likely to have a negative environmental impact; or*

*(b) for which an environmental impact assessment is required under the Act or these Regulations, unless an environmental impact assessment has been concluded and approved in accordance with these Regulations...”*

#### ***Legal Notice No.120: Environmental Management and Coordination (Water Quality) Regulations, 2006***

Regulation 8 of these regulations provides for compliance with water quality standards. It states that *“all operators and suppliers of treated water, containerised water and all water vendors shall comply with the relevant quality standards in force as may be prescribed by the relevant lead agencies”*.

Regulation 9 of these regulations provides for water quality monitoring. It states that the *“Authority in consultation with the relevant lead agency, shall maintain water quality monitoring for sources of domestic water at least twice every calendar year and such monitoring records shall be in the prescribed form as set out in the second schedule to these regulations”*. The table shows the quality standards for sources of domestic water.

**Table 5: Quality standards for sources of Domestic Water**

<b>Parameter</b>	<b>Guide Value (Maximum allowable)</b>
pH	6.5 – 8.5
Suspended solids	30 (mg/l)
Nitrate – NO <sub>3</sub>	10 (mg/l)
Ammonia – NH <sub>3</sub>	0.5 (mg/l)
Nitrite – NO <sub>2</sub>	3 (mg/l)
Total dissolved solids	1200 (mg/l)
<i>Ecoli</i>	Nil/100ml
Fluoride	1.5 (mg/l)
Phenols	Nil (mg/l)
Arsenic	0.01 (mg/l)
Cadmium	0.01 (mg/l)
Lead	0.05 (mg/l)
Selenium	0.01 (mg/l)
Copper	0.05 (mg/l)
Zinc	1.5 (mg/l)
Alkyl benzyl sulphonates	0.5 (mg/l)
Permanganate Value (PV)	1.0 (mg/l)

***Legal Notice No. 74 Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations, 2006***

These regulations came into operation on 1<sup>st</sup> February 2007. Regulation 4 (1) states that *“any internal combustion engine is subject to inspection under these regulations and shall, as a condition of compliance with the inspection, pass such tests as may be required to demonstrate that the internal combustion engine complies with any standards and requirements for the control of air pollution or contamination as may be prescribed”*. Regulation 4 (2) further states *“that the emission standards to be complied with by any internal combustion engine shall be those set out in the First Schedule to these regulations”*.

Regulation 5 of these regulations provide for Environmental Inspectors. It states that *“the Authority may appoint such number of environmental inspectors as it may deem appropriate for purposes of carrying out emissions inspection under these regulations and may, without prejudice to the foregoing, appoint any employee of a lead agency conducting inspection of internal combustion engines on behalf of the Government”*.

Regulation 7 (1) states that *“the Authority may approve any substance to be used as a fuel catalyst if, in the opinion of the Authority, the substance improves fuel economy, enhances combustion and reduces harmful emissions that adversely affect human, animal and plant health and degrade the environment”*.

***Legal notice No.121: Environmental Management and Coordination (Waste Management) Regulations, 2006***

Part II of regulations, regulation 4 (1) states that no person shall dispose of any waste on a public highway, street, road, recreational area or in any place except in a designated receptacle. Regulation 4 (2) further states that a waste generator shall collect, segregate and dispose such waste in the manner provided for under these regulations.

Regulation 5 (1) provides for cleaner production methods. It states that *“a waste generator shall minimize the waste generated by adopting the following cleaner production methods:*

- (a) Improvement of production process through:*
  - (i) Conserving raw materials and energy;*
  - (ii) Eliminating the use of toxic raw materials; and*
  - (iii) Reducing toxic emissions and waste.*
- (b) Monitoring the product cycle from beginning to end by:*
  - (i) Identifying and eliminating potential negative impacts of the product;*
  - (ii) Enabling the recovery and re-use of the product where possible; and*
- (c) Incorporating environmental concerns in the design and disposal of a product”*.

Regulation 8 of the regulations provides for responsibility of waste transporters. It states that *“any person granted a license to transport waste shall ensure that:*

- (1) The collection and transportation of such waste is conducted in such a manner that will not cause scattering of the waste;*
- (2) The vehicles and equipment for the transportation of waste are in such a state that shall cause scattering of, flowing out of waste or emission of noxious smells from such waste;*
- (3) The vehicles for transportation and other means of conveyance of waste follow the scheduled routes approved by the Authority from the point of collection to the disposal site or plant and*
- (4) He or his agent (s) possess at all times during transportation of the waste, a duly filled tracking document as set out in Form III in the first schedule to these regulations and shall produce the same tracking document on demand to any law enforcement officer”*.

**Legal notice No.61: Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**

Regulation 4 of Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 provides for excessive vibrations. Regulation 4(1) states that “Except as otherwise provided in these regulations, no person shall –

- a. make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or
- b. cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source”.

Regulation 5 of these regulations provides for permissible noise levels. The regulation states that “No person shall cause noise from any source which exceeds any sound level as set out in the applicable column in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property”.

The table below shows the permissible noise levels as set in the First Schedule to these Regulations.

**Table 6: Maximum permissible noise levels**

Zone		Sound Level Limits dB(A)		Noise Rating Levels (NR)	
		(Leq, 14h)		(Leq, 14h)	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B	Places of worship	40	35	30	25
C	Residential: Indoor	45	35	35	25
	Outdoor	50	35	40	25
D	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

**Time Frame**

Day: 6.01 a.m. – 8.00 p.m. (Leq, 14 h)

Night: 8.01 p.m. – 6.00 a.m. (Leq, 10h)

Regulation 13 of these Regulations provides for construction at night. Regulation 13 (1) states that “Except for the purposes specified in sub-Regulation (2) hereunder, no person

*shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair works so as to emit noise in excess of the permissible levels as set out in the Second Schedule of these regulations”.*

Regulation 13 (2) states that *“This Regulation shall not be deemed to prohibit-*

- 1. any work of an emergency nature;*
- 2. work of a domestic nature on buildings, structures or projects being undertaken by a person residing in such premises; or*
- 3. public utility construction, or, with respect to construction of public works, projects exclusively relating to roads, bridges, airports, public schools and sidewalks:*

*Provided that, if any domestic power tool, including but not limited to mechanically powered saws, sanders, grinders and lawn and garden tools used outdoors, is operated during the night time hours, no person shall operate such machinery so as to cause noise within a residential building or across a residential real property boundary where such noise interferes with the comfort, repose, health or safety of members of the public within any building or outside of a building, at 30 metres or more from the source of the sound”.*

Regulation 14 of these Regulations provides for noise, excessive vibrations from construction, demolition, mining or quarrying sites. Regulation 14 (1) states that:

*“Where defined work of construction, demolition, mining or quarrying is to be carried out in an area, the Authority may impose requirements on how the work is to be carried out including but not limited to requirements regarding-*

- a. machinery that may be used, and*
- b. the permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations”.*

Regulation 14(3) further states that *“Any person carrying out construction, demolition, mining or quarrying works shall ensure that the vibration levels do not exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from the moving source”.*

Regulation 15 of these regulations states that *“Any person intending to carry out construction, demolition, mining or quarrying work shall, during the Environmental Impact Assessment studies-*

- (a) identify natural resources, land uses or activities which may be affected by noise or excessive vibrations from the construction, demolition, mining or quarrying;*

- (b) determine the measures which are needed in the plans and specifications to minimize or eliminate adverse construction, demolition, mining or quarrying noise or vibration impacts; and
- (c) incorporate the needed abatement measures in the plans and specification”.

The table below shows the contents of the second schedule of these regulations.

**Table 7: Maximum permissible noise levels for construction sites (measurement taken within the facility)**

Facility		Maximum Noise Level Permitted (Leq) in dB (A)	
		Day	Night
(i)	Health facilities, educational institutions, homes for disabled etc.	60	35
(ii)	Residential	60	35
(iii)	Areas other than those prescribed in (i) and (ii)	75	65

**Time Frame**

Day: 6.01 a.m. – 6.00 p.m. (Leq, 14h)

Night: 6.01 p.m. – 6.00 a.m. (Leq, 14 h)

***Legal Notice No.160: Environmental Management and Coordination (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 biological diversity and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties

***Legal Notice No. 34: Environmental Management and Coordination (Air Quality) Regulations, 2014***

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).

The contractor and proponent will be guided by provisions of this act, during construction and operation phase respectively. Air quality monitoring will be guided by the standards stipulated thereof.

### **5.3 Other Environment, Health and Safety, Physical Planning Related Laws**

#### **5.3.1 Occupational Health and Safety Act, 2007**

The Act makes provision for the health, safety and welfare of persons employed. The provision requires that all practicable measures be taken to protect persons employed from any injury. The provisions of the act are also relevant to the management of hazardous and non-hazardous wastes, which may arise at the project site during construction and operation.

The act provides that all measures should be taken to ensure safety, health and welfare of all the stakeholders in the work place.

Workers and occupants' safety will be given priority during both construction and operation phases of the project. It shall be the duty of the contractor and proponent respectively in this case to ensure safety and health of workers during construction phase.

The construction sites for different contractors shall be registered as workplace with the directorate of occupational safety and health services under the ministry of labour social security and services. A fire audit, risk assessment and safety and health audit has to be conducted for the sites at least once every year. All provisions of this Act relevant to the project activities shall be adhered to. All plants shall be subjected to periodical examinations as provided by law.

#### **5.3.2 The Physical Planning Act of 1996 CAP 286**

The Act provides for the preparation and implementation of physical development plans, and for connected purposes.

In part V on control of development, Even though The Nairobi Hospital Expansion master plan has been approved, the proponent will be required to apply for development permission granted by the local authority under section 33 to the start of any developments. Failure to do so is an offence and shall be liable to a fine not exceeding one hundred thousand shillings or to an imprisonment not exceeding five years or to both. In addition the development, development shall be discontinued.



Any application for development permission for development activities which are likely to have injurious impact on the environment shall be submitted together with an environmental impact assessment report, as stipulated in section 36.

### **5.3.3 National Construction Authority Act 2011 (NCA)**

The Act provides that the National Construction Authority has the following mandates:

- (a) Promote and stimulate the development, improvement and expansion of the construction industry;
- (b) Advise and make recommendations to the Minister on matters affecting or connected with the construction industry;
- (c) Undertake or commission research into any matter relating to the construction industry;
- (d) Prescribe the qualifications or other attributes required for registration as a contractor under this Act;
- (e) Assist in the exportation of construction services connected to the construction industry;
- (f) Provide consultancy and advisory services with respect to the construction industry;
- (g) Promote and ensure quality assurance in the construction industry;
- (h) Encourage the standardization and improvement of construction techniques and materials;
- (i) Initiate and maintain a construction industry information system;
- (j) Provide, promote, review and co-ordinate training programmes organized by public and private accredited training centers for skilled construction workers and construction site supervisors;
- (k) Accredite and register contractors and regulate their professional undertakings;
- (l) Accredite and certify skilled construction workers and construction site supervisors;
- (m) Develop and publish a code of conduct for the construction industry; and
- (n) Do all other things that may be necessary for the better carrying out of its functions under the Act.

### **5.3.4 The Penal Code CAP 63**

Chapter XVII on “Nuisances and offences against health and convenience” contained in the penal code strictly prohibits the release of foul air into the environment which affects the health of the persons. It states “Any person who voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhood or passing along a public way is guilty of a misdemeanour” Waste disposal and other project related activities shall be carried out in such a manner as to conform to the provisions of the code. It is the responsibility of the contracted licensed waste handler to ensure that all kinds’ of wastes are disposed appropriately as per the legal

provisions. Quite apart from fear of health hazards, the general public is very sensitive about the visual impact of anatomical waste. In no circumstances is it acceptable to dispose of anatomical waste inappropriately, such as on a landfill or together with other bio medical solid wastes.

### **5.3.5 Radiation Protection Act, Cap 243**

The Radiation Protection Act, Chapter 243, aims to control the import, export, possession and use of radioactive substances and irradiating apparatus. Under this Act in section 9, a license is required to handle any radioactive substances or irradiating apparatus from the National Radiation Protection Board. Handling here includes the method of disposing of radioactive waste products, transportation of radioactive materials, storage, use and maximum working hours that employees are expected to work with radioactive materials. Under this Act also, institutions generating this category of waste shall be expected to apply for a license from the same board.

The provisions of this act will guide the proponent on the use of radiation and its control, if there will be use of any radiation apparatus.

### **5.3.6 The Standards Act Cap 496**

This Act promotes the standardization of the specification of commodities, and provides for the standardization of commodities and codes of practice to ensure public health and safety. It establishes the Kenya Bureau of Standards (KBS) and defines its functions as related to:

- Promotion of standardization in industry and commerce; and
- Making arrangements or provision of facilities for the testing and calibration of precision instruments, gauges and scientific apparatus, for the determination of their degree of accuracy by comparison with standards approved by the Minister on the recommendation of the Council, and for the issue of certificates in regard thereto.

This means the Proponent has to ensure all materials and equipment in use during construction as well as operation of the facility adheres to the highest standards and do not pose any human health and safety risk.

## **5.4 National Guidelines and Policies**

### **5.4.1 Health Care Waste Management Strategic Plan 2015-2020**

The National Health Care Waste Management Plan of Action is a document intended for use by health managers and programme officers across the health sector (including those in the private health sector). The purpose of developing this plan was to provide a tool that gives

health managers guidance in planning, implementing and monitoring the activities of health care waste management in health facilities.

This plan describes the situation of health care waste management on the basis of a survey which was conducted in order to document the situation of waste management in Kenya. A holistic approach has been recommended to include, clear delineation of responsibilities, occupational health and safety programmes, waste minimization and segregation.

This document is designed to provide viable options to address the challenges encountered in planning for health care waste management in Kenya.

#### **5.4.2 National Infection Prevention and Control Guidelines for Health Care Services in Kenya, 2010**

These guidelines were formulated by the Ministry of Medical Services and Ministry of Public Health and Sanitation to provide comprehensive and standardized information regarding the prevention and control of transmissible infections.

These guidelines are intended to act as a central reference for all health care facilities and healthcare workers.

Additionally, these guidelines are intended to provide administrators and Health Care Workers with the necessary information and procedures to implement Infection Prevention Control (IPC) core activities effectively within their work environment in order to protect themselves and others from the transmission of infections.

They provide information on the following topics:

- ✓ The infrastructure, equipment, and supplies that are necessary to implement standard and additional (transmission-based) precautions for IPC
- ✓ Procedures for cleaning, disinfecting, and reprocessing reusable equipment
- ✓ Managing health care waste
- ✓ Protecting health care workers from transmissible infections
- ✓ IPC practices in special situations

### **5.5 Relevant International Safeguards**

#### **5.5.1 WHO National Guidelines on Safe Disposal of Pharmaceutical Waste, 2001**

The provisions of these guidelines describe a series of steps that need to be followed in order to dispose waste and or expired pharmaceuticals. The steps required include identification of pharmaceutical waste, sorting of pharmaceutical waste by category, filling the relevant forms to seek authority from the authorities in charge of disposing such waste. Upon obtaining all the relevant approvals, the disposal of the pharmaceutical waste shall be

effected under the supervision of the local Pharmaceutical Waste Disposal Team or the Waste Management Team.

The recommended methods for disposing of unwanted pharmaceuticals include:

- ✓ The use of either medium temperatures incineration at a minimum of 850°C or high temperature incineration exceeding 1200°C with two chamber incinerator for solids, semisolids and powders for controlled substances e.g. anti-neoplastics.
- ✓ Engineered sanitary landfill to be used for disposal of expired or unwanted pharmaceuticals.
- ✓ Sewer disposal for diluted liquids, syrups, intravenous fluids, small quantities of diluted disinfectants and antiseptics.
- ✓ These guidelines are relevant in informing the generator of pharmaceutical wastes on safe disposal methods.
- ✓ The proponent shall however contract a licensed waste handler who disposes the pharmaceutical wastes in the manner provided by the Kenya legal framework and the best international practice and guidelines.

#### **5.5.2 World Bank Group (WBG) Guidelines:**

##### ***Environmental, Health, and Safety Guidelines General EHS Guidelines, 2007***

The Environment, Health and Safety (EHS) Guidelines contain performance levels and measures for development of industrial projects that are considered to be achievable in new facilities at reasonable costs by existing technology.

Under these guidelines, the World Bank has several guidelines many of which are applicable to various components of the proposed project namely:

- ✓ EHS Guidelines - Air Emissions and Ambient Air Quality
- ✓ EHS Guidelines - Waste Management
- ✓ EHS Guidelines - Health Care Facilities
- ✓ EHS Guidelines - Hazardous Materials Management
- ✓ EHS Guidelines - Construction and Decommissioning

##### **(i) WBG EHS Guidelines: Air Emissions and Ambient Air Quality**

These guidelines are meant for all types of projects with “significant” emissions, sources of air emissions, and potential for significant impacts to ambient air quality to prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards.

They require the application of national legislated standard, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources. Kenya currently

has Environmental Management and Coordination (Air Quality) Regulations, 2014 applicable to this project.

In this project, there will be fugitive air emissions which are expected during construction and operation phases of the project. These guidelines are useful as they give control and monitoring measures.

**(ii) WBG EHS Guidelines: Waste Management**

The guidance applies to the management of non-hazardous and hazardous waste. This project is will be a major generator of both hazardous and non-hazardous waste. These guidelines provide categories of various wastes and a summary of treatment and disposal options. These guidelines provide good guidance on waste on-site handling, collection, treatment and disposal for both the proponent and the contractors during construction and operation phases respectively. This report greatly adopts the guidance while formulating the environmental management plan.

**(iii) WBG EHS Guidelines: Noise**

This section addresses impacts of noise beyond the property boundary of the facilities.

These guidelines are applicable during construction phase whereby construction equipment and activities are expected to emit noise. Our local regulations, EMCA (Noise and Excessive Vibration Pollution Control) Regulations, 2009 give permissible levels during construction works. The proponent therefore has adequate guidance to ensure noise levels are maintained as low as reasonably practicable.

**(iv) WBG EHS Guidelines: Occupational Safety and Health**

These guidelines guide employers and supervisors in fulfilling their obligation to implement all reasonable precautions to protect the health and safety of workers. The guidelines provide guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. The guidelines also describe how facility operation workplace design should be undertaken to prevent occupational health and safety risks and hazards. The guidelines also give examples of internationally published exposure guidelines which may be used to measure occupational health and safety performance examples, to include the Threshold Limit Value, occupational exposure guidelines and Biological Exposure Indices

published by American Conference of Governmental Industrial Hygienists, the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety ,Permissible Exposure Limits published by the Occupational Safety and Health Administration of the United States, Indicative Occupational Exposure Limit Values

**(v) WBG EHS Guidelines: Construction and Decommissioning**

These provide additional and specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

**5.5.3 WHO: Safety in Healthcare Laboratories, 1997**

This is a manual intended for healthcare laboratories workers and those responsible for laboratory administration and planning. It provides key guidelines for health and safety in the laboratory activities. It offers a pragmatic approach to problems encountered in routine practice. These guidelines will be useful during operation phase of the project

## **CHAPTER 6: ENVIRONMENTAL HEALTH AND SAFETY POLICY FOR THE HEALTH SECTOR IN KENYA**

### **6.1 Introduction**

#### **6.1.1 Background**

The government of Kenya is seriously concerned about the quality of the environment and has enacted the Environmental Management and Coordination Act No.8 of 1999 (EMCA 1999) thereby establishing the legal framework within which to ensure that strict observance of clean production and consumption processes in the economy. Section 3 of EMCA 1999 entitles every person in Kenya to a clean and healthy environment and bestows upon every individual the responsibility of safeguarding and enhancing the environment.

The government commitment to maintaining a quality environment is in keeping with the principles of sustainable development as espoused by the Bruntland Commission: *“ensuring the needs of the present generation without compromising the ability of the future generations to meet their own needs”*

The concept of sustainability is more than just an environmental issue; it is also social as well as an economic issue. It is today accepted that sustainability is built on three pillars: economic prosperity, environmental quality and social equity. It is incumbent upon Nations of the world, Kenya included to ensure that economic growth is not attained at the expense of ecological balance and social equity.

#### **6.1.2 Rationale**

Occupational Safety and Health Management Governance (OSHMG) for effective safety management are a common phenomenon in industries. However, the same cannot be said of the hospital settings especially in many developing countries (Subhani 2010). The general feeling is that hospitals and health institutions work environments are safe and are meant to be “healthy” as health is considered a core objective of such institutions.

OSH-based management systems not only reduce accidents and injury rates but also improve the business productivity of an organization (Subhani 2010).

The National Human Resource for Health (NHRH) Strategic Plan 2009-2012 clearly defines health and safety policies and procedures to reduce occupational hazards as a key strategy

in improving work climate for health workers in Kenya. The OSHA 2007 offers a comprehensive legal framework for implementing actions that are likely to improve safety and health at the workplace.

All health facilities being places of work need to be compliant with basic safety requirements in respect to building design, maintenance and provision of basic safety equipment and safety principles in service provision since a healthy workplace is not only free of hazards, but also provides an environment that is stimulating and satisfying for those who work there.

### **6.1.3 Scope and Purpose of OSH Policy Guidelines**

The OSH policy guideline should primarily provide guidance to:

- All employees within the health sector (National government, County governments, quasi-government, private as well as NGOs);
- Prospective employees of the health sector;
- Clients, contractors, and visitors at any health facility in Kenya
- Health institutions including training institutions

The provisions of this policy and technical guidelines apply to all health institutions and administrative units within the health sector. The provisions are meant to aid managers of health sector facilities in the implementation of the Kenyan OSH policy and other international OSH protocols in full view. Implementation of the policy and guidelines will as a result ensure compliance with the requirements of the safety and health laws of the country. Safety and health inspectors and practitioners seeking to secure compliance with the OSHA 2007 may refer to this guidance to illustrate good practice. They are also intended to serve as a reference guide to the health worker.

### **6.1.4 Objectives**

The objectives of this policy guideline are:

- To provide a framework for implementing safe and healthy work practices in the Kenya's health sector
- Promote a safe and healthy work environment, work practices and procedures for all staff of the health sector in order to minimize work-related injuries and occupational diseases.
- Promote a culture of safe and healthy attitudes and practices.
- Ensure that health and safety management in the workplace constitutes a core management function of health sector institutions that is on-going and promotes a culture of co-operation between the major stakeholders.



- Promote the incorporation of OSH educational programmes aimed at reducing workplace hazards and risks into the work plans of health facilities.
- Facilitate compliance to OSH policy and legislation by clients, contractors, and visitors at any health facility in Kenya
- Provide guidance for minimum OSH requirements for various tiers of health facilities in Kenya.
- Provide OSH risk assessments guidance and tools for use in the health sector.
- Provide Guidance on OSH training and capacity building in the health sector.
- Provide suggested tools for OSH monitoring, evaluation and documentation.

### **6.1.5 General Policy Statements**

The manager within the health sector and other employees should support the implementation of this policy in accordance with their roles and responsibilities as in OSHA 2007. They shall:

- Implement and maintain a risk management program.
- Establish measurable objectives and targets to continually improve occupational health and safety in the work place and reduce work related illnesses and injuries.
- Provide information, training and facilities to enable staff, clients, contractors, visitors and stakeholders carry out their duties safely.
- Involve staff and stakeholders about decisions that may affect their health and safety in the work environment.
- Provide adequate human and financial resources to ensure effective implementation of OSH guidelines.
- Document and communicate OSH responsibilities for all levels of staff.
- Communicate this policy through public displays and trainings in all health facilities in Kenya.
- Ensure that procedures are in place for accident, incident and occupational diseases reporting and management
- Integrating OSH requirements in planning and decision making processes at all levels.
- Provide effective occupational health and hygiene programs.
- Provide, maintain and test contingency plans and resources for effective handling of emergencies.

### **6.2 Organization Structure**

The Occupational Safety and Health Act 2007 require that employers, in consultation with their employees, break up their workforce into groups (Designated Work Groups – DWGs) and appoint a Safety and Health Representative (SHR) for that group. The Act gives Safety and Health Representatives specific functions and powers.

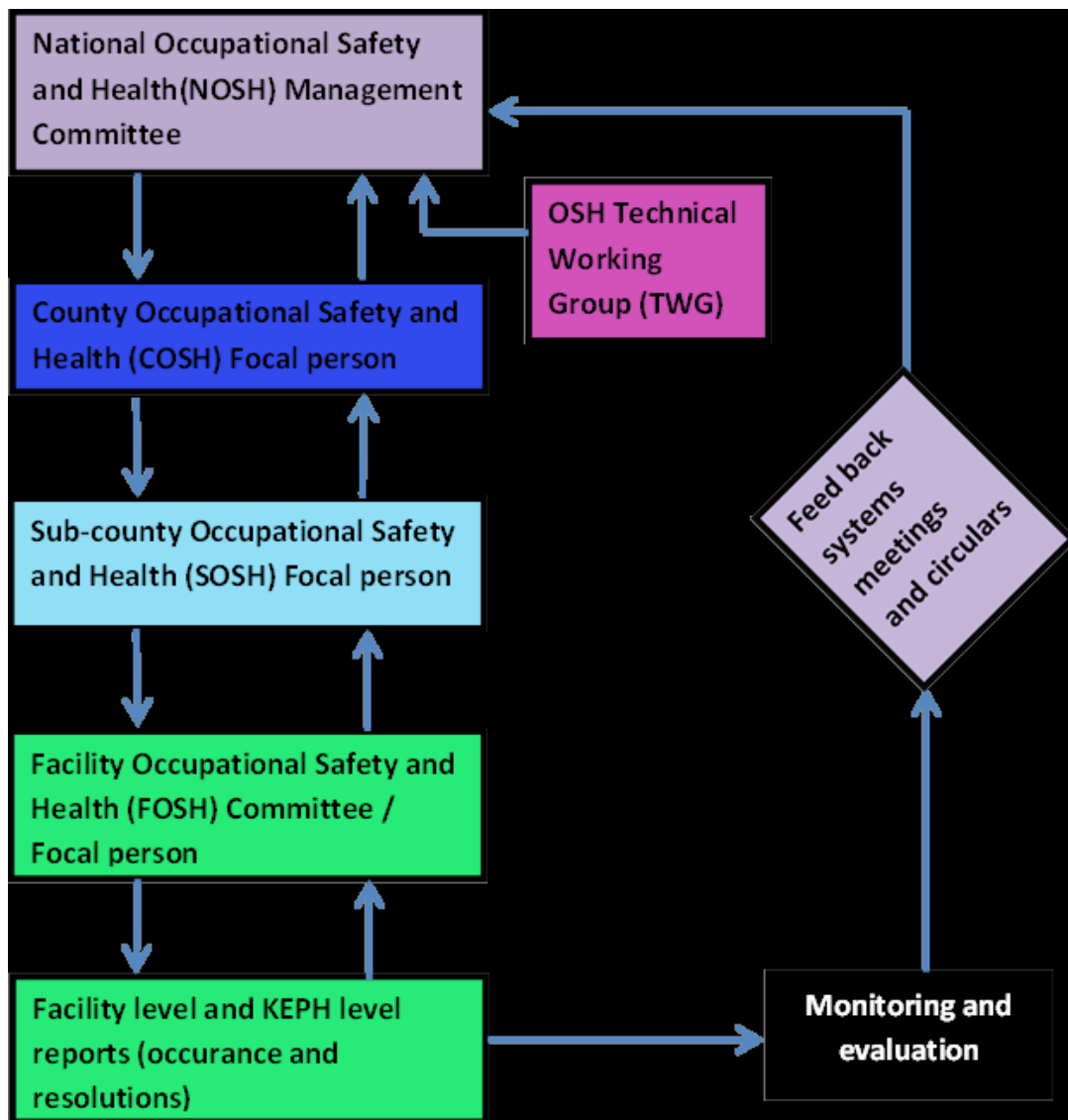


Figure 9: Organization Structure for OSH Designated Work Groups (DWG)

### 6.2.1 Facility Occupational Safety and Health (FOSH) Committee

At the Facility (Hospital) level Occupational Safety and Health (FOSH) committee will be responsible for OSH at the facility. OSH committee membership and operations will be guided as stipulated by the **OSHA 2007** and the **Legal Notice no 31**.

However, this committee can integrate other existing committees e.g. Infection Protection and Control committee and Bio Safety / Biosecurity committee.

The FOSH will be chaired by the Facility Head or nominee, and composed of facility members in the clinical and non- clinical departments.

## **6.3 Classification of OSH hazards and mitigation in the Health Sector**

A hazard refers to any agent, situation or condition that can cause an occupational illness or injury. It may produce serious and immediate (acute) effects or long-term (chronic) problems that affect all or only part of the body.

### **6.3.1 Biological Hazards**

Biological hazards, also known as biohazards, refer to biological substances that pose a threat to the health of a worker in health care facilities and community. This can include medical waste or samples of a microorganism, virus or toxin (from a biological source) that can affect human health posing a significant risk to health care and community care workers if not properly controlled.

### **6.3.2 Chemical Hazards**

Health care environment can house a vast array of chemicals. For example; formaldehyde, used for preservation of specimens for pathology; ethylene oxide, glutaraldehyde, and paracetic acid used for sterilization; anaesthetics gases, laboratory reagents and other numerous chemicals used in healthcare. Even some drugs administered to patients can be harmful to staff if not properly handled e.g. cytotoxic drugs.

### **6.3.3 Physical Hazards**

Physical hazards comprise of extremes of temperatures, extremes of pressures, noise, vibration and radiation. All can be found in health care settings. Other physical agents such as ionizing and non-ionizing radiation, or other forms of radiation used on patients can be harmful to workers if not properly controlled.

### **6.3.4 Ergonomics Hazards**

Healthcare personnel are also exposed to many ergonomics risk factors due to the nature of their work. A majority of ergonomic risk factors are found in jobs requiring repetitive, forceful, or prolonged exertions of the hands; frequent or heavy lifting, pushing, pulling, or carrying of heavy objects; and prolonged awkward postures. Vibration and cold may add risk to these work conditions. Jobs or working conditions presenting multiple risk factors will have a higher probability of causing a musculoskeletal problem. Environmental work conditions that affect risk include intensity, frequency and duration of activities.

### **6.3.5 Mechanical Hazards**

A mechanical hazard is any hazard involving a machine or process. Equipment used in healthcare facilities if not properly installed and maintained may pose mechanical hazards. They also include situations resulting in slips, trips and falls such as wet floors, slippery finish to floors, poor handling of needles and other sharps resulting in needle stick and sharps injuries.

### **6.3.6 Psychosocial Hazards**

Violence or aggression from patients, visitors, residents, staff and clients could take the form of physical, emotional and/or mental abuse. Most health care settings require some sort of shift work. Shift work can be very stressful to workers and their families. Additionally working alone, drug and alcohol abuse as well as economic factors are other forms of psychological hazards.

Working with people who are seriously or even terminally ill day in and day out can be emotionally wearing. In our current economic climate, with layoffs and cutbacks, workers everywhere are carrying extra workloads, which can result in “burnout.” Since a number of people working in health care are women, conflicts with competing and changing roles in the family, as well as from work issues, can cause tremendous stress.

## **6.4 Minimum OSH Package for Healthcare Facilities at All Levels/Tiers**

Different tiers of health care are faced by different hazards as evidenced by the OSH risk assessment that was conducted for tier 2 to 4 level 2 to 5. Based on the risk assessment 2012, the Ministry of Health recommended the implementation of OSH by having a participatory all inclusive programs that includes all levels and cadres of staff.

The minimum package of support is based on the risk control known as the hierarchy of controls whose approach pays primary emphasis on controlling the hazard at the source. For a risk that is rated as high, steps should be taken immediately to minimize risk of injury. It is recommended that the minimum packages for all health be utilized.

## **6.5 Risk Assessment and Evaluation**

Risk means the probability of occurrence of an adverse effect from a substance on people or the environment combined with the magnitude of the consequence of that adverse effect (OSHA 2007 section 2).

Risk assessment is a process of making a determination of how safe a situation is and then making judgment of the acceptability of a risk. The following guidelines are recommended:

Risk assessment is done when:

- i. Any time there is new or redeployed/transfer of staff, equipment or method
- ii. Any time there is an accident/ incident or near miss
- iii. At scheduled annual risk assessments
- iv. During maintenance activities
- v. During disposal of equipment
- vi. Use risk assessment tools
- vii. Consider whether to carry out the assessment for the whole facility or department, machinery or specific procedure
- viii. Identify the gaps
- ix. Analyze the data generated
- x. Determine if the risk is high, moderate or low
- xi. Develop mitigation plans and budget

Risk assessment is conducted by:

- OSH committee at different facility level
- COSH Focal person
- Sub County OSH representative
- DOSHS approved auditors
- Constitute a risk assessment team which should include the user in specific cases.

## **6.6 OSH Reporting**

All OSH committee secretaries in health facilities shall establish and maintain records of OSH events in the facility.

The OSH documents shall include the following:

- Accident Reporting and Follow-up Reports
- Dangerous Occurrences
- Incidents and Near Misses
- Occupational Diseases

## **6.7 Safety Equipment (OSH-Supplies)**

Safety equipment comprises all articles, substances, equipment or materials that are used as a protective measure to individuals exposed to specific hazardous agent. The supplies include the vaccines, drugs, personal protective equipment (PPE), other safety equipment, devices and commodities.

The facility OSH committee shall determine the annual budget for OSH supplies and safety equipment. The committee shall plan and coordinate trainings on safety equipment.

**Table 8: Safety Equipment (OSH Supplies)**

**A. Biological Safety Cabinets (BSCs)**

Name	Use
class I BSC	provides operator protection but no product protection. The exhaust air from the cabinet is filtered by a high-efficiency particulate air (HEPA) filter.
Class II BSCs	<p>Class II biosafety cabinet will provide personnel, environment and product protection</p> <p><b>Types of Class II Cabinets:</b></p> <p>Class II, type A: this does not have to be vented, which makes it suitable for use in laboratory rooms which cannot be ducted</p> <p>Class II, type B1 Biosafety Cabinet: this cabinet must be vented, with 30% of the air exhausted from the cabinet while 70% is recirculated back into the room.</p> <p>Class II, type B2 Biosafety Cabinet: this cabinet must be totally exhausted, with 100% of the air exhausted through a dedicated duct.</p> <p>Class II, type B3 Biosafety Cabinet: this must be vented. 70% of the air is exhausted from the cabinet while 30% is recirculated.</p>
class III BSC	<p>Class III Biosafety Cabinet provides maximum protection of the environment and user when working with highly infectious microbiological agents. Both supply and exhaust air are HEPA filtered.</p> <p>(used mainly with highly pathogenic agents that usually do not have prophylaxis) )</p>
Cytotoxic drug safety cabinets	Provides a barrier to the operator and environment
Laminar Flow or Clean Bench cabinets	Provide product protection only (must not be used where operator protection is required)
Pharmaceutical isolators	Provide protection to operator, product and work environment
Fume cupboards	Provide protection to operator only

## **6.8 Compliance to OSH Guidelines**

To ensure compliance to the safety and health policy and adherence to OSH guidelines, the MOH has set up a National Occupational Safety and Health (NOSH) Committee with the human resources department as secretariat.

The County has appointed an Occupational Safety and Health focal person (COSH) and subsequently the sub county has a Sub County (SOSH) Focal person.

At the Facility level, the following tools shall be used to ensure compliance with the OSH Guidelines:

1. The facility OSH committee shall ensure that a quarterly facility OSH inspection is conducted using an Inspection checklist
2. The facility shall come up with an Action plan to mitigate the identified OSH gaps with timelines and a responsible person for each gap to be closed.
3. Every facility shall submit a quarterly OSH report to the SOSH Focal person. The sub county SOSH Focal person shall compile the facility reports and submit to COSH Focal person.
4. The COSH focal person and SOSH Focal person shall provide support to facilities on OSH compliance.
5. The COSH Focal person shall coordinate the County OSH annual Audits as per OSHA 2007 and submit the audit report to county health director who shall upload to the District Health Information System (DHIS) website.

## **6.9 OSH Monitoring and Evaluation**

### **6.9.1 Monitoring**

#### ***National Level***

- NOSH committee will ensure that OSH indicators are included in the DHIS. NOSH through the technical support from the unit of OSH shall monitor the indicators and report to the Principal Secretary.
- The Principal Secretary shall ensure a Management review of the OSH indicators is done annually.
- The indicators shall be used to set national objectives and targets

#### ***County Level***

- The COSHR shall coordinate the development, review and approval of county objectives and targets with reference to national targets and indicators and facility targets and indicators. The COSHR shall then develop a county yearly implementation plan for the objectives and targets to be achieved.
- The COSHR shall monitor the implementation of the objectives and targets and report to the NOSH committee through the MoH reporting system.

- The COSHR shall coordinate quarterly review of the county objectives and targets at county levels

### ***Facility Level***

- The facility OSH committee shall review and adopt OSH targets and indicators
- The facility OSH committee shall develop annual implementation work plans to be integrated into facility operational plan.
- The facility OSH committee shall monitor implementation of OSH targets and indicators and report to sub county OSH representative who subsequently report to the County OSH representative.

### **6.9.2 Evaluation**

Evaluation tools shall be designed and reviewed by the NOSH at national level to determine the impact of OSH activities on creating OSH culture at the facility level.

- Unit of OHS will disseminate the evaluation tool to COSH focal person.
- The COSH focal person shall coordinate evaluation at facility level and compile county evaluation report.
- The COSH focal person shall submit the report to the County Health Management Committee at the county level.

### **6.10 Facility Designs**

All facility designs and layout should be in compliance with the **Building code 1968, PHA cap 242** and **OSHA 2007 Part V1** and any other relevant laws.

On health, general provisions and the inputs of the user should be put into consideration by ensuring OSH committee is involved in the facility design for approvals and ensuring safety compliance.

The following general requirements should be observed as a minimum:

#### **6.10.1 Facility**

##### ***Facility Cleanliness***

Every work place should be kept in a clean state with good drainage, convenient sanitary facilities and without nuisance.

##### ***Overcrowding***

Health care workers and patients should not be overcrowded in a room where there is risk of disease transmission through contact or respiratory route. Effort should be made to separate people with suspected infectious diseases. Some of the efforts include cough monitoring, and triaging so that such patients are attended to first.



### ***Ventilation***

Each workstation should have circulation of fresh air with adequate ventilation such as cross and through ventilation. In specialized units you can have engineered ventilation systems e.g. Negative pressure and Vacuum air conditioning. The facility has to comply with OSHA 2007 ventilation guidelines

### ***Lighting***

There should be sufficient and suitable lighting whether natural or artificial in every part of the workplace.

### ***Drainage of Floors***

Floors should be drained to ensure they are dry to avoid slips and falls. Floors should be easily washable.

### ***Sanitary Conveniences***

There should be a sufficient number of clean sanitary facilities with sufficient lighting for both sexes. Sanitary facilities should have hand washing areas with running water, soap/ detergent and changing rooms with accommodation for clothing not worn during working hours.

### ***Fire Prevention***

All work rooms should be provided with appropriate fire fighting appliances and adequate means of escape, in case of fire for employees.

## **6.10.2 Isolation**

Isolation is a creation of barrier mechanical or spatial to prevent transmission of infectious diseases to or from patients, health workers and visitors. The units are generally provided with barriers that minimize spread of infectious diseases to the environment and the public. Adequate ventilation can also be used to reduce the transmission of airborne infections. Cohorting can also be used in health facilities that do not have isolation wards (IPC Guidelines)

## **6.10.3 Work flow**

Facilities should be designed or redesigned to ensure patients move in a unilateral direction to avoid crisscrossing.

When a facility is being designed, the OSH committee should be involved to review the patient flow. Special units should be placed appropriately within the facility master plan, e.g. theatre, morgue, laundry among others.

## **6.10.4 Equipment**

Appropriate consideration should be made for equipment lay out within the facility. A full list of current and anticipated equipment and their placement should be provided and considered in the facility design or redesign.

Special equipment requirements should be considered during facility design and redesign e.g. bio safety cabinets and equipment mapping and human flow should be reviewed during the design and redesign stage.

## **CHAPTER 7: SOLID AND WASTE WATER DISPOSAL METHODS**

### **7.1 LEGAL FRAMEWORK RELEVANT TO SOLID WASTE MANAGEMENT IN KENYA**

The legal frameworks highlighted below are relevant to solid waste management in Kenya;

#### **7.1.1 Constitution of Kenya:**

In the Constitution of Kenya, Article 42 on the Environment provides that-

**(1)** Every person has the right to a clean and healthy environment, which includes the right

- (a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and ,
- (b) to have obligations relating to the environment fulfilled under Article 70, Article 69 on Obligations to the Environment, the Constitution provides that –

(1)The State shall—

- (d) encourage public participation in the management, protection and conservation of the environment;
- (f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- (g) eliminate processes and activities that are likely to endanger the environment; and
- (h) utilise the environment and natural resources for the benefit of the people of Kenya.

**(2)** Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

**(3) Part 2 of the fourth Schedule in the Constitution of Kenya** also explicitly provides that the County Governments shall be responsible for; refuse removal, refuse dumps and solid waste disposal.

#### **7.1.2 Vision 2030**

In Vision 2030, one of the flagship projects is the Solid waste management initiative which calls for relocation of the Dandora dumpsite and the development of solid waste management systems in five (5) leading municipalities and in the economic zones planned under vision 2030.

#### **7.1.3 The Environmental Management and Coordination Act (EMCA), 1999**

Section 3 of EMCA, 1999 stipulates that - —Every person in Kenya is entitled to a clean and Healthy environment and has a duty to safeguard and enhance the environment.

**7.1.3.1 Section 9 of EMCA, 1999 further states that –**

“(1) The object and purpose for which the Authority is established is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment.

(2) Without prejudice to the generality of the foregoing, the Authority shall –

(a) co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilization of environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya;

**7.1.3.2 Section 86 of EMCA, 1999 provides that –** —The Standards and Enforcement Review Committee shall, in consultation with the relevant lead agencies, recommend to the Authority measures necessary to:-

(2) prescribe standards for waste, their classification and analysis, and formulate and advise on standards of disposal methods and means for such wastes; or

(3) issue regulations for the handling, storage, transportation, segregation and destruction of any waste.

**7.1.3.3 Section 87 of EMCA 1999 states that –** (1) No person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such manner as to cause pollution to the environment or ill health to any person.

(2) No person shall transport any waste other than –

(a) in accordance with a valid licence to transport wastes issued by the Authority; and

(b) to a wastes disposal site established in accordance with a licence issued by the Authority.

(4) No person shall operate a wastes disposal site or plant without a licence issued by the Authority.

(5) Every person whose activities generate wastes shall employ measures essential to minimize wastes through treatment, reclamation and recycling.

**7.1.4 Environmental Management and Coordination (Waste Management) Regulations of 2006**

**7.1.4.1 In the Responsibility of the Generator, Regulation 2 states that – —**“Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed off such waste in the manner provided for under these Regulations.

**7.1.4.2 Regulation 5 on the Segregation of waste by a generator states that – —**(1) Any person whose activities generate waste, shall segregate such waste by separating hazardous waste from non-hazardous waste and shall dispose of such wastes in such facility as is provided for by the relevant Local Authority”.

### **7.1.5 The Occupational Safety and Health Act, 2007**

The Occupational Safety and Health Act, 2007 Part IX, Chemical Safety, Section 83 Subsection IV states that at every workplace where chemicals or other toxic substances are manipulated, the employer shall develop a suitable system for the safe collection, recycling and disposal of chemical wastes, obsolete chemicals and empty containers of chemicals to avoid the risks to safety, health of employees and to the environment.

### **7.1.6 The Public Health Act, 2012**

#### ***7.1.6.1 The Public Health Act Revised Edition 2012, Part 126.***

**Rules under Part 126,** The Minister, on the advice of the board, may make rules and may confer powers and impose duties in connection with the carrying out and enforcement thereof on local authorities, magistrates, owners and others as to—(d) the drainage of land, streets or premises, the disposal of offensive liquids and the removal and disposal of rubbish, refuse, manure and waste matters

#### ***7.1.6.2 Section 134 - Rules for protection of food,***

The Minister, on the advice of the board, may make rules regarding all or any of the following matters—(h) the establishment, locality, supervision, equipment, maintenance and management of slaughterhouses and the disposal of the waste.

#### ***7.1.6.3 Section 118 - What constitutes nuisance-1.***

The following shall be deemed to be nuisances liable to be dealt with in the manner provided in this;

**Part—(c)** any street, road or any part thereof, any stream, pool, ditch, gutter, watercourse, sink, water-tank, cistern, water-closet, earth-closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil-pipe, waste-pipe, drain, sewer, garbage receptacle, dust-bin, dungpit, refuse-pit, slop-tank, ash-pit or manure heap so foul or in such a state or so

situated or constructed as in the opinion of the medical officer of health to be offensive or to be injurious or dangerous to health.

**Part (e)** states that any noxious matter, or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any street, or into any or watercourse, irrigation channel or bed thereof not approved for the reception of such discharge constitutes to be a nuisance.

#### ***7.1.6.4 Section 126 - Rules under Part,***

The Minister, on the advice of the board, may make rules and may confer powers and impose duties in connection with the carrying out and enforcement thereof on local authorities, magistrates, owners and others as to—**part (d)** the drainage of land, streets or premises, the disposal of offensive liquids and the removal and disposal of rubbish, refuse, manure and waste matters.

#### ***7.1.6.5 The County Governments Act, 2012***

Section 120, Tariffs and pricing of public services, subsection (3) A tariff policy adopted under subsection (1) shall reflect following guidelines — **part (h)** promotion of the economic, efficient, effective and sustainable use of resources, the recycling of waste, and other appropriate environmental objectives.

#### **7.1.7 The Environmental (Impact Assessment and Audit) Regulations, 2003**

This regulation defines "waste" includes any matter prescribed to waste and any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or deposited in the environment in such volume composition or manner likely to cause an alteration of the environment.

**7.1.7.1 Part II - The Project Report, 7. (1)** A proponent shall prepare a project report stating

—

(e) The materials to be used, products and by-products, including waste to be generated by the project and the methods of their disposal.

(f) The products, by-products and waste generated project.

**7.1.7.2 Part V - Environmental Audit and Monitoring 36, (2)** an environmental audit report compiled under these Regulations shall contain - (b) an indication of the various materials, including non-manufactured materials, the final products, and by products, and waste generated.

### 7.1.8 Relevant MEAs:

Basel Convention on the control of trans-boundary movements of hazardous wastes and their:

- Disposal
- Ban Amendment to the Convention on the Control of trans boundary movements of hazardous
- Wastes and their disposal
- Convention on persistent organic pollutants

### 7.1.9 Legislative Framework for Healthcare Wastes

The legal basis for the formulation and implementation of the Health Care Waste guidelines is provided for by the Public Health Act Cap. 242 and the following:

#### ✓ ***OSHA 2007***

This Act applies to all work places in which any person is either temporarily or permanently and lawfully at work. It stipulates the provisions for securing the health, safety and welfare of persons at work. The Act also protects other persons not at work against risks to safety and health arising out of or in connection with activities of the persons at work.

#### ✓ ***EMCA 1999***

This Act provides a framework for ensuring that environmental considerations are successfully integrated to the country's overall economic and social development. Regulations made under the Act stipulate specific requirements regarding the issues addressed in the parts, some which are summarized as follows:

- ✓ ***Legal Notice No. 101: Environmental (Impact Assessment and Audit) Regulations, 2003:*** It provides for identification and management of waste likely to be produced from proposed projects including health care facilities. It also makes provision for monitoring and evaluation of waste management through environmental audits.
- ✓ ***Legal Notice No. 121: Waste Management Regulations, 2006:*** These regulations focus on the management of solid waste, industrial waste, hazardous waste, pesticides and toxic substances, biomedical wastes and radioactive substances; and provide details on the responsibility of the waste generator, adoption of cleaner production principles, waste handling and transportation, waste treatment and disposal.
- ✓ ***Legal Notice No. 120: Water Quality Regulations, 2006:*** These regulations address pollution of water resources as well as their conservation. They provide effluent discharge control standards for both surface and underground water.

#### ✓ ***Food Drugs and Chemical Substances Act (Cap 254, Laws of Kenya)***

This Act makes provision for the prevention of adulteration of food, drugs and chemical substances and for matters incidental thereto and connected therewith. This Act prohibits disposal of chemical substances in a manner likely to cause contamination of food or water

for human consumption or in a manner liable to be injurious or dangerous to the health of any person.

## 7.2 The Challenges Associated with Waste Management Systems

### 7.2.1 Challenges

**Table 9: Challenges associated with waste management systems**

Aspect	Challenge	Root cause
<b>Waste generation</b>	Increased generation of waste	Increase population, change of consumption patterns
<b>Collection and transportation</b>	Low coverage of waste collection services	Inaccessible roads, lack of payment for waste services, lack of zoning of waste collection areas; Inadequate transportation trucks, poor scheduling of waste collection and transportation, low budgetary allocation for operations ; Low investment in acquisition of compliant waste trucks
	Irregular collection	
	In appropriate transportation trucks	
	Un regulated waste collection fees	
<b>Disposal method</b>	Open dumping	Lack of a clear policy on waste management Services; Lack of appropriate waste disposal infrastructure; Irregular or lack of collection service; Long distances to the existing dump-sites; Proximity to environmentally sensitive areas, conflict with standards of existing establishments (airports, designated wildlife corridors), Lack of acceptability by the host communities, unavailability of land
	Inappropriate sitting of dump sites	
<b>Waste recovery</b>	Lack of segregation	Lack awareness and negative attitude towards waste segregation, lack of proper waste management systems to support segregation, lack of linkage between the waste pickers and the formal recycling facilities; Contamination due to mixing of waste
	Poor quality of recovered materials	
<b>Legal requirements and enforcement</b>	Lack of appropriate technology; Low compliance to Environmental Legislation	Lack of intermediate technologies(cleaning, pelleting etc) Weak enforcement and lack of awareness on the legislations

**Source:** The National Solid Waste Management Strategy, February, 2015



## 7.3 Minimum Requirements developed by NEMA

**Table 10: Minimum requirements for Solid Waste Management**

### **Minimum requirements for Solid Waste Management**

The County Governments are expected to implement the minimum requirements across the waste management cycle;

#### **Waste collection**

1. Ensure waste collection areas are zoned
2. .Ensure timely and regular collection of all solid wastes either through door to door collection or from centralized collection points
3. Ensure waste collection facilities such as skips, bulk containers and waste cubicles are regularly emptied and do not become eye sores

#### **Waste transportation**

1. Ensure that all collected wastes is transported using NEMA licensed vehicles to designated disposal sites

#### **Waste disposal sites**

1. Ensure there is a designated disposal site for waste disposal
2. Ensure that the disposal area is secured with a fence and a gate manned by a county government official to control dumping and spread of waste outside the disposal site
3. Ensure all incoming wastes is weighed or estimated and the quantities recorded in tones
4. Develop and maintain motorable roads inside the site to ensure ease of access during disposal
5. Ensure the waste is spread , covered and compacted at regular intervals
6. Put in place appropriate control measures for the management of dumpsites fires
7. Ensure security and control measures for the disposal sites so that illegal activities are contained

#### **Requirement for licensing**

1. Ensure waste transportation vehicles have NEMA licences
2. Obtain licences to operate waste disposal sites

The County government will strive to ensure continuous improvements of collection methods , transportation and disposal facilities .Effective waste management systems will deliver a clean and healthy environment for all as granted by the constitution of Kenya

**Source:** The National Solid Waste Management Strategy, February, 2015

## **7.4 COLLECTION AND DISPOSAL OF WASTES FOR THE PROPOSED PROJECT**

### **7.4.1 WASTES GENERATED DURING CONSTRUCTION PHASE**

#### ***7.4.1.1 Solid wastes***

**During the construction phase;** demolition wastes will be generated when the proposed site is cleared to create space for the new construction works. These wastes will comprise mainly soil debris.

Secondly construction wastes will be generated and will comprise to a large extent the soils and debris from excavations for foundations; unused construction materials such as timber, cement, wrapping materials and unused items. There will also be other solid wastes comprising materials brought in by casual construction workers.

#### ***7.4.1.2 Waste water and human wastes***

**During the construction phase;** there will be an influx of construction work force and this will result in increased water use, washroom use and increased human waste which will require the proponent to construct washrooms and toilets. There will be waste water from cleaning and washing and human wastes from use of toilets and wash rooms by the workers and management staff.

### **7.4.2 WASTES GENERATED DURING OPERATIONAL PHASE**

#### ***7.4.2.1 Solid wastes***

**During the operational phase;** the following types of solid wastes will be generated:

**From offices and training centre:** used paper waste, general office wastes

**From Kitchen and Canteen:** Food scraps and domestic wastes

**From operating theatres and wards:** healthcare and sanitary wastes

**From Dormitory:** Trash and domestic wastes

**From Compound and Parking yard:** Trash and general compound wastes

#### ***7.4.2.2 Waste water and human wastes***

**During the operational phase;** the following types of wastes will be generated:

**From general cleaning of the premises:** Waste water during cleaning of the CTC floor

**From toilets and washrooms:** Human wastes and waste water from wash rooms

**From Kitchen and Canteen:** Waste water from kitchen and Canteen

**From operating theatres and wards:** Waste water from Cleaning the theatres and wards

**From Dormitory:** Human wastes and waste water from wash rooms

**From Compound and parking yard:** Storm water from rainfall

**From showers for patients and workers:** Waste water from bus shower

## **7.5 WASTES DISPOSAL METHODS**

### **7.5.1 Solid Waste Disposal during the Construction Phase**

Solid Waste Disposal during the Construction Phase should be guided by the following:

#### ***(i) Construction wastes management***

These are measures to minimize negative impacts of construction activities on local communities and the natural environment to reduce the impacts of camp sites, to prevent pollution and ensure that hazardous materials are stored properly without risks to the environment:

- No environmental accidents from release of hazardous substances eg pollution of water ways from spill
- Training in environmental incident and spill response provided to all relevant site based project personnel
- Prevention of reoccurrences of incidents by appropriately implementing corrective and preventive actions and planning

#### ***(ii) Disposal of construction wastes***

Daily site clean-up procedures will be established and enforced, including maintenance of adequate disposal facilities for construction debris. Debris generated due to the dismantling of the existing structures shall be re used suitably to the best extent possible (e.g. as fill material for embankments) the disposal of the remaining debris shall be carried out only at sites identified and approved by Bomet County Engineer. The contractor shall ensure that these sites:

- do not impact natural drainage courses
- do not impact endangered/rare flora

Under **no circumstances** shall the contractor dispose of any material in environmentally sensitive areas

#### ***(iii) The site manager will ensure the following are complied with:***

- Solid waste bins will be installed at specific designated locations inside the construction site and the surrounding areas.

- The bins will be separately labelled Green for Biodegradable solid wastes; Yellow for Non-biodegradable solid wastes and Red for Glass and metallic wastes
- The workers and other site users will be advised to drop solid wastes into separate bins as designated;
- The Solid wastes will be collected from the bins on a regular basis by **NEMA Registered waste disposal trucks** and disposed off at the recommended dump site in the County.
- Wet waste bins will be installed at specific designated locations inside the construction site for the wet wastes;

### **7.5.2 Waste water and Human wastes Disposal during Construction Phase**

Waste water and Human wastes Disposal during Construction Phase should be guided by the following:

- The site manager will construct pit latrines for use by the construction workers
- The Site manager will construct septic tank for disposal of human and waste water
- Waste water will be directed to the receptors of constructed soak pits.

### **7.5.3 Wastes Disposal during Operational Phase of the Proposed Project**

#### ***7.5.3.1 Disposal of Solid wastes during Operational phase***

- **General solid wastes**
- ✓ During the operational phase of the proposed project both biodegradable and non-degradable wastes will be generated. This type of waste is also referred to as garbage, refuse or trash and consists mainly of Bio-degradable waste which is food and kitchen waste, green waste paper and non-biodegradable wastes such as plastics, glass bottles, cans, metals and wrapping materials.
- ✓ The CTC management will provide waste bins at strategic location in every office, ward and theatre and within the compound and each bin will be marked specifically for each type of waste as indicated here below:

**BIN 1:** Steel (metallic) waste;

**BIN2:** Glass waste;

**BIN3:** Fibre waste;

**BIN3:** Aluminium waste;

**BIN4:** Plastics waste;

**BIN 5:** Fabric/Foam waste, and,

**BIN 6:** Paper waste.

- ✓ These wastes will be collected by TENWEK HOSPITAL trucks and disposed at the INCINERATOR located at the main Hospital Campus.

- **Hazardous and Industrial wastes:** will be collected in bins located at various locations within the CTC and will be collected and deposited in the **INCINERATOR** located at the far corner of the main Hospital Campus.

### ***7.5.3.2 Waste water and human waste disposal during the Operational Phase***

The proponent will construct a holding waste tank at the CTC premises. The tank will hold waste water and human waste for some time before being released to the **EFFLUENT TREATMENT PLANT** for full treatment.

### ***7.5.3.3 Disposal of HealthCare Solid wastes:***

- **Health care waste generated** during the operational phase will be; infectious wastes, pathological wastes ,sharps, pharmaceutical wastes, radio-active wastes, genotoxic /Cytotoxic, chemical wastes, waste with heavy metals content, Non- infectious/general wastes
- ✓ Hospital management will provide waste bins in each ward and theatres. Hospital staff will collect these bins all day long and deposit the wastes in larger bins located at designated sites within the CTC. The large bins will be collected and emptied into the **INCINERATOR**.

### ***7.5.3.4 DISPOSAL OF WASTE WATER FROM HEALTH CARE ESTABLISHMENTS***

#### **✓ Waste Water Management**

The basic principle underlying effective wastewater management is a strict limit on the discharge of hazardous liquids to sewers. Only in an outbreak of acute diarrhoeal diseases should excreta from patients be collected separately and disinfected.

Where water use is commonly high, sewage is usually diluted.

For effluents treated in treatment plants, no significant health risks should be expected, even without further specific treatment of these effluents.

#### **✓ Connection to Sewer Treatment Plant**

It is acceptable to discharge the sewage of health-care establishments to sewers without pre-treatment, provided that the following requirements are met:

- ✓ The municipal sewers are connected to efficiently operated sewage treatment plants that ensure at least 95% removal of bacteria;
- ✓ The sludge resulting from sewage treatment is subjected to anaerobic digestion, leaving no more than one helminth egg per litre in the digested sludge;
- ✓ The waste management system of the health-care establishment maintains high standards, ensuring the absence of significant quantities of toxic chemicals, pharmaceuticals, radionuclides, cytotoxic drugs, and antibiotics in the discharged sewage;
- ✓ Excreta from patients being treated with cytotoxic drugs may be collected separately and adequately treated (as for other cytotoxic waste).

- ✓ In normal circumstances, the usual secondary bacteriological treatment of sewage, properly applied, complemented by anaerobic digestion of sludge, can be considered as sufficient.
- ✓ During outbreaks of communicable diseases, effluent disinfection by chlorine dioxide (chlorine powder) or by any other efficient process is recommended.
- ✓ If the final effluent is discharged into coastal waters close to shell fish habitats, disinfection of the effluent will be required throughout the year.
- ✓ **Pre-treatment of Waste Water**

Health care establishments in particular those that are not connected to any municipal treatment plant, should have their own sewage treatment plants e.g. septic tanks.

Efficient on-site treatment of sewage should include the following operations:

- a) **Primary Treatment**
- b) **Secondary Biological Purification:** Most helminths will settle in the sludge resulting from secondary purification, together with 90-95% of bacteria and a significant percentage of viruses; the secondary effluent will thus be almost free of helminths, but will still include infective concentrations of bacteria and viruses.
- c) **Tertiary Treatment:** The secondary effluent will probably contain at least 20 mg/litre suspended organic matter, which is too high for efficient chlorine disinfection. It should therefore be subjected to a tertiary treatment, such as lagooning. If no space is available for creating a lagoon, rapid sand filtration may be substituted to produce a tertiary effluent with a much reduced content of suspended organic matter (<10mg/litre).
- d) **Chlorine Disinfection:** To achieve pathogen concentrations comparable to those found in natural waters, the tertiary effluent will be subjected to chlorine disinfection to the breakpoint. This may be done with chlorine dioxide (which is the most efficient), sodium hypochlorite, or chlorine gas, chlorine powder.
- e) Another option is **ultraviolet light disinfection.**

Disinfection of the effluents is particularly important if they are discharged into coastal waters close to shell fish habitats, especially if local people are in the habit of eating raw shell fish.

#### ✓ **Sanitation**

Human excreta are the principal vehicle for the transmission and spread of a wide range of communicable diseases, and excreta from hospital patients may be expected to contain far higher concentrations of pathogens, and therefore to be far more infectious, than excreta from households.

Adequate sanitation in every health-care establishment should be provided. The faecal-oral transmission route-and other routes such as penetration of the skin-must be interrupted to prevent continuous infection and re-infection of the population.

#### ✓ **Safe Management of Wastewater**

The health-care establishment should ideally be connected to a sewerage system.

Where there are no sewerage systems, technically sound on-site sanitation such as the simple pit latrine, ventilated pit latrine, and pour-flush latrine, and the more advanced septic tank with soak-away or the aqua-privy should be provided.

In temporary field hospitals during outbreaks of communicable diseases, other options such as chemical toilets may also be considered.

In addition, convenient washing facilities (with warm water and soap available) should be available for patients, personnel, and visitors in order to limit the spread of infectious diseases within the health-care establishment.

## 7.6 Handling, Labelling, Containment and Storage of Wastes

**Table 11: Options of Health Care Waste Treatment and Disposal as per Level of Care**

Facility Level	Level 1&2	Level 3	Level 4	Level 5	Level 6
Type of Waste					
<b>Sharps</b>	Incineration and/or deep Burial in pits	Incineration and Burial in deep pit	Incineration	Autoclave; Microwave; Incineration	Autoclave; Microwave; Incineration
<b>Infectious</b>	Deep Burial	Incineration and Deep Burial	Incineration, and Dispose Residue in Municipal Landfill	Incineration, and Dispose Residue in Municipal Landfill	Incineration, and Dispose Residue in Municipal Landfill
<b>Highly Infectious</b>	Deep Burial	Deep Burial / Incineration	Deep Burial / Incineration	Grind and Discharge to Sewer; Incineration and Residue to Landfill	Pulverize and Discharge to Sewer; Incineration and Dispose Residue in Landfill
<b>Pharmaceutical</b>	Return to District	Return to District	Incinerate; Inertization;	Incinerate; Inertization;	Incinerate; Inertization;

	Hospital	Hospital	Encapsulation; Return to Source or Manufacturer	Encapsulation; Return to Source or Manufacturer	Encapsulation; Return to Source or Manufacturer
<b>Glass</b>	Recycle; Crush and Bury	Recycle; Crush and Bury	Recycle; Crush and Bury	Recycle; Crush and Bury	Recycle; Crush and Bury
<b>Cytotoxic</b>	Not Applicable	Not Applicable	Incinerate; Waste Inertization; Encapsulation	Incinerate; Waste Inertization; Encapsulation	Incinerate; Waste Inertization; Encapsulation
<b>Chemical</b>	Deep Burial	Deep Burial	Encapsulation and Land Filling	Encapsulation and Land Filling	Encapsulation and Land Filling
<b>Radioactive</b>	Not Applicable	Not Applicable	Not Applicable	Consult Radiation Protection Board; Store in Lead-lined Containers (short half-life); Re-export to Source/ Manufacturer	Consult Radiation Protection Board; Store in Lead-lined Containers (short half-life); Re-export to Source/ Manufacturer



## **CHAPTER 8: IDENTIFICATION OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS**

### **8.1 Introduction**

This Chapter identifies and discusses both positive and negative impacts associated with the construction and operation of the proposed CTC for Tenwek Hospital. On-site and off-site impacts can occur due to project location, and during construction, operation and decommissioning phases of the proposed Project. Identification and assessment of impacts depend on the nature and magnitude of the activity being undertaken and also on the type of pollution control measures that are envisaged as part of the Project proposal. The impacts are identified according to phases namely: Impacts during construction, operation and decommissioning phases.

### **8.2 Positive Impacts during Construction Phase**

#### **8.2.1 Employment Opportunities**

The proposed Project will directly and indirectly create employment for a number of workers, especially casual workers within Tenwek area and Bomet County at large. However, the exact number cannot be predetermined at this stage. All in all, the services of the following groups of people will be required during the construction phase:

- Contractor;
- Casual labourers;
- Site manager;
- Foremen;
- Masons;
- Carpenters;
- Electricians;
- Plumbers;
- Painters;
- Transporters;
- Security agents; and Landscapers.

Though the employment will be temporary, those who will be employed will earn income hence use the money to satisfy some of their needs.

#### **8.2.2 Provision of Market for Supply of Building Materials**

The Project will require supply of large quantities of building materials most of which will be sourced locally in Bomet County and in the surrounding areas. Producers and suppliers of materials such as building stones, timber, electrical cables, paint, sand, and cement will thus

get market for their goods. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials. However, the hard rocks that will be excavated from the site during construction will also be reused.

### **8.2.3 Provision of Market for Food Vendors and Owners of Nearby Business Premises**

The construction workers will attract food vendors in the area to supply food to the construction workers. The food vendors will therefore increase their sales and income as a result of selling food to the construction workers. In addition, the owners of the nearby business premises are also likely to benefit as a result of the construction workers purchasing some of the items from their shops.

## **8.3 Negative Impacts during Construction Phase**

### **8.3.1 Local Increase of Construction Traffic**

The construction of the proposed Project will make local increase of construction traffic inevitable. This is as a result of the movement of the construction vehicles and machines in and out of the construction site as the construction site is about 6km from Bomet town. However, there is unlikely to be significant increased traffic jam along the Tenwek – Silibwet Road as a result of the construction vehicles turning to the proposed Project site.

### **8.3.2 Noise Pollution and Vibration**

Noise pollution and vibration is likely to occur due to site excavation, grading and offloading of construction materials at the proposed site. Noise pollution and vibration is also likely to occur as a result of excavation activities, use of pocker vibrator, use of mixers and communication from construction workers on site. However, since excavation will be manual and explosives are not likely to be used, adverse impacts to the construction workers and neighbouring premises will not be experienced.

### **8.3.3 Occupational Health and Safety**

Construction sites always present an element of danger. Construction workers are likely to encounter accidental injuries as a result of the intensive engineering and construction activities including erection and fastening of materials, metal grinding and cutting, concrete work, steel erection and welding among others. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. Deaths have also

been experienced as a result of poor construction activities leading to occupational health and safety concerns.

Workers are also likely to be exposed to diseases from building materials during the construction phase of the Project. It is therefore recommended that before the construction phase of the proposed Project commences, building materials will be inspected according to the occupational health and safety standards.

Occupational health and safety of the workforce will have to be monitored by the respective contractor's supervisors and foremen. As long as proper procedures are followed and personal protective equipment (PPE) provided and their use enforced, risks of accidents and incidents can be substantially reduced.

#### **8.3.4 Impact on Air Quality**

Potential impacts on the air quality during construction phase will be due to exhaust and dust emissions generated in and around the construction site by the construction equipment. Motor vehicles used to mobilize materials for construction and operating of construction vehicles and equipment would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions. The sources of air emission can be grouped into three categories namely:

- Point Source;
- Area Source; and
- Line Source

A point source is a single source of emission with an identified location; an area source is when the sources of emission are many widely distributed point sources having relatively comparable significance; and a line source is when the sources of emission from a number of fixed or moving facilities have relatively comparable significance, such as roads.

Dust emission is likely to occur during demolition of any existing structures and site clearance, excavation and spreading of top soil during construction of the proposed Hydropower Plant especially if the activities are taking place during dry seasons. However, there will be very small possibility of particulate matter (PM) suspended and settled particles affecting the site workers and even neighbours health, since construction method of minimum excavation and nil cart away of soil will be applied and only residual material and debris carted away.

During the period of maximum construction activity, the fuel consumption at the Project site is expected to rise significantly and the background concentrations of Suspended Particulate Matter (SPM), Respiratory Particulate Matter (RPM), Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>) and both Carbon Monoxide (CO) and Lead (pb) are also expected to rise.

These emissions can have significant cardio-pulmonary and respiratory effects on the local population; the health effects may range from subtle biochemical and physiological changes to difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac condition. The impact of such emissions can be greater in areas where the materials are sourced and at construction site. Activities associated with site clearance, excavations, spreading of the top soil during construction, frequent vehicle turning and slow vehicle movement loading and off- loading areas can be implicated in this process.

Even then, dust and exhaust gas emissions from construction machineries will be small and temporary. Therefore, no adverse impacts, except for those close to the construction site, are likely to be affected. On completion of construction, the adverse impacts of SPM, RPM and engine emissions on ambient air close to the construction site will be eliminated.

### **8.3.5 Disposal of Solid Waste**

Construction activities create solid wastes that need to be disposed. Such wastes include:

- Excavated materials from the earth works;
- Timber from used formwork;
- Paints, lubricants and petroleum wastes;
- Containers, cement paper bags and other packaging materials;
- Metal, glass, plastic containers and other unwanted materials; and
- Food remains

Soils will be excavated at the proposed Project site; the excavation works to level the site and to come up with the basement will result in the generation of the excavated material.

These wastes may have a direct impact on the neighbouring premises. Disposal of the same solid wastes off-site could also be a social inconvenience if done in wrong places. The off-site effects could be un-aesthetics view, pest breeding, unhygienic conditions, chocking of nearby drains and stream and pollution of physical environment. Proper waste management will however be taken into consideration and proper dumping done according to the requirements and directions of the County council and NEMA.

### **8.3.6 Increased Water Demand**

During the construction phase, the construction works will create additional demand for water in addition to the existing demand at the project area. Water will mostly be used in the following activities:

- Concrete works including curing;
- Controlling dust on site;
- Washing of machinery and equipment;
- Preparing of mixtures, including water based emulsion paints;
- Washing and drinking by construction workers;
- General cleaning; and
- Landscaping.

Increased water demand could result in increased Project costs, increased health risks due to shortage, and increased soil erosion if not properly managed.

### **8.3.7 Energy Consumption**

The proposed Project will consume fossil fuels to run transport vehicles and construction machinery. The machinery will include: construction vehicles and compactors. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. Electricity will also be used during the construction of the proposed Project. It should be noted also that manual labour as a source of energy will mainly be used during construction of the proposed Project. Efficient management of energy consumption is therefore required for optimal performance of the Project and to control Project costs.

### **8.3.8 Increased Storm Water Runoff from New Impervious Areas**

Construction of the proposed Project and access driveway could result in additional runoff through creation of impervious areas. These areas generally have higher runoff coefficients than natural area, and increased flood peaks are a common occurrence in developed areas. The storm water runoff is likely to increase the flooding along access roads and low-lying areas.

### **8.3.9 Extraction and Use of Building Materials and Procurement**

Building materials such as hard core, ballast, cement, rough stone and sand required for the construction will be obtained from quarries, hardware shops and sand harvesters. These materials are mainly extracted from natural resource bases such as river banks, and forests among others. Since substantial quantities of these materials will be required. The

availability and sustainability of such resources at the extraction sites will be negatively affected as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

#### **8.3.10 Oil and Fuel Spills**

The machinery to be used in the Project will have moving parts which will require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil on site are real. Likewise, combustion processes would require fuels, which may lead to fuel spills. Irrespective of these possibilities, no significant adverse effects are expected as a result of fuel and oil spills given the scope, nature and duration of time to be taken on the operation of the proposed Project.

### **8.4 Positive Impacts during Operation Phase**

#### **8.4.1 Specialised Medical/Treatment Facility**

The proposed project shall establish a Centre that will provide specialized surgical theatres supported by clinical and inpatient spaces in a multi-story facility. It will increase the Hospital's capacity to perform critical heart & chest surgeries and other pressing procedures. This will increase the Hospital's capacity by a 100-bed facility and six new operating theatres and will serve patients within Bomet County, including those from different parts of the Country, across East Africa and beyond.

#### **8.4.2 Employment Opportunities**

Employment creation is one of the major impacts of the proposed Project during its operational phase. Doctors, nurses, pharmacists and lab technicians, and other medical personnel will be needed. Technicians and operators will be employed in the project. Those contracted or employed will generate income as a result of being employed or contracted.

#### **8.4.3 Optimal use of Land**

The Proposed CTC Project will enhance economy of land through intensification of land use through economic activity. This will be significant since the facility shall attract associated economic activity that will give an opportunity to the local community to get involved and generate income.

#### **8.4.4 Increase in Revenue to the National and County Government.**

The operation of the proposed Project will result in positive gains for numerous authorities:

– The local County Government, Kenya Revenue Authority (KRA), Medical Services sector Authorities and Associations, through payment of relevant taxes, rates and fees to respective institutions.

#### **8.4.5 Improved Amenities**

The development of the proposed project shall bring along new infrastructure development and the improvement of existing amenities, e.g. Paved Road, Water Supply System, Effluent Discharge (Sewerage) System.

The neighbours of the project and the community at large are likely to benefit from such infrastructural development and improved amenities.

### **8.5 Negative Impacts during Operation Phase**

#### **8.4.6 Increased Storm Water Flow**

Upon completion, the building roofs and pavements of the Project will lead to increased volume of storm water or run-off flowing across the area covered by the proposed Project.

#### **8.4.7 Generation of Solid Waste**

The operation of the facility will lead to the generation of solid waste. There shall be general and hazardous medical waste. Hazardous medical wastes comprises of biohazards and different kinds of chemicals and reagents. Improper disposal of such waste shall pollution of the air, surface and groundwater resources water and soils. This will cause a public health risk.

#### **8.4.8 Occupational Health and Safety Risks**

Medical services personnel and hospital staff shall be exposed to various health and safety risks in their line of work. Some of the hazards include: biological hazards (contamination and infection), physical hazards, radiation hazards, chemical hazards, and hazardous devices and instruments, among others.

#### **8.4.9 Accidents, Injuries and Falls**

The Hospital workers are likely to encounter slip and trip hazards and, accidental injuries as a result of the operation activities. Such injuries can result from accidental falls from wet or slippery floors, injuries from hand tools and operation equipment.

#### **8.4.10 Impacts of Health care wastes**

#### **8.4.10.1 Health care solid wastes disposal**

- **Health care solid waste generation:** during the operational phase will be; infectious wastes, pathological wastes ,sharps, pharmaceutical wastes, radio-active wastes, genotoxic /Cytotoxic, chemical wastes, waste with heavy metals content, Non- infectious/general wastes
- ✓ Hospital management will provide waste bins in each ward and theatres. Hospital staff will collect these bins on a regular basis and empty the bins in larger containers located at designated sites within the CTC. The large containers will be collected and transported to the **INCINERATOR.**

#### **8.4.10.2 Healthcare wastewater disposal**

**Healthcare Wastewater generation:** Healthcare wastewater will be generated from the treatment rooms, wards and theatres during regular medical procedures in the facility. The basic principle underlying effective wastewater management is a strict limit on the discharge of hazardous liquids to sewers.

**Healthcare Wastewater disposal:** Healthcare wastewater will be directed from all the operational units in the facility to the receptors of a large pre-treatment tank located in the compound. After the pre-treatment, the wastewater will be released to the Effluent Treatment Plant located on the main hospital campus.

### **8.5 Positive Impacts during Decommissioning Phase**

#### **8.5.1 Restoration of Site to Original Status**

Upon decommissioning of the proposed Project, rehabilitation of the Project site will be carried out to restore the site to its original status or to a better state than it was originally. This will include replacement of topsoil and re-vegetation which will lead to improved visual quality of the area.

#### **8.5.2 Employment Opportunities**

For demolition to take place properly and in good time, several people will be involved. As a result several employment opportunities will be created for the demolition staff during the decommissioning phase of the proposed Project.

### **8.6 Negative Impacts during Decommissioning Phase**

#### **8.6.1 Noise and Vibration**

The demolition works will lead to significant deterioration of the acoustic environment within the Project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing the proposed Project.

#### **8.6.2 Solid Waste Generation**



Demolition of the proposed Project and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment.

In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

### 8.6.3 Occupational Health and Safety Impacts

During decommissioning phase, risks of accidents and ill health as a result of demolition activities are likely to take place. Demolition workers, neighbouring premises are also likely to be affected by the dust generated and other fumes generated by the demolition machines.

## 8.7 Summary of Anticipated Impacts

**Table 12: Summary of Anticipated Impacts**

S/No	Impacts	Activity/ area and pollutant source	Negative impacts		Positive Impacts		No Impacts
			Short Term	Long Term	Short Term	Long Term	
<b>A</b>	<b>Construction Phase</b>						
1	Employment opportunity	Skilled labour, unskilled and semi skilled labour.			√	√	
2	Provision of market for supply of building materials	Making available the raw materials needed for construction of the proposed Project.			√		
3	Provision of market for food vendors and owners of the nearby business premises	Supply of food to the construction and purchase of items from the nearby business premises.			√		
6	Local increase of construction traffic	Transportation of construction materials to site and disposal of demolished material from site.	√				
7	Noise pollution and vibration	Use of compactors, vibrators and communication from construction workers.	√				

S/No	Impacts	Activity/ area and pollutant source	Negative impacts		Positive Impacts		No Impacts
			Short Term	Long Term	Short Term	Long Term	
8	Occupational health and safety	Accidental fall, injuries from falling objects and hand tools etc.	√				
9	Impact on air quality	Emissions from DGs, SO <sub>2</sub> , NOX, SPM, CO, PM etc.	√				
10	Disposal of solid and liquid waste	Earth from excavations, food remains and waste water.	√				
11	Increased water demand	Water used for mixing of concrete and other construction works.	√				
12	Energy consumption	Use of manual labour, and fuel used in the DGs and other construction machines including transportation vehicles.	√				
13	Increased storm water runoff from new impervious areas	Storm water runoff from the pavements.	√				
14	Extraction and use of construction materials and procurement	Extraction of sand, ballast, cement etc.	√				
15	Oil spills	From construction machines within the proposed Project site.	√				
<b>B</b>	<b>Operation Phase</b>						
1	Employment opportunity	Skilled and semi-skilled labour, including security guard and landscapers.				√	
2	Increase in revenue to national and local authorities	Through tax paid.				√	
3	Increase aesthetic value of the surrounding area	Aesthetic of the surrounding area.				√	
4	Solid waste generation	Industrial waste					√
6	Energy consumption	KPLC main					√
7	Increased water use	Industrial water use					√
9	Disposal of waste water	Water for use in sanitation		√			

S/No	Impacts	Activity/ area and pollutant source	Negative impacts		Positive Impacts		No Impacts
			Short Term	Long Term	Short Term	Long Term	
10	Increased storm water flow	Rainfall.		√			
<b>C</b>	<b>Decommissioning Phase</b>						
1	Rehabilitation	Landscaping				√	
2	Employment opportunities	Skilled, semi skilled and unskilled labour.			√		
3	Noise and vibration	Demolition activities.	√				
4	Solid waste generation	Demolition activities.	√				
5	Occupational health and safety impacts	Accidental fall, injuries from falling objects and hand tools and dusts emissions which can lead to respiratory diseases.	√				
6	Reduction of industrial facilities	Demolition of hydro power generating equipment		√			

## **CHAPTER 9: MITIGATION MEASURES AND MONITORING PROGRAMMES**

### **9.1 Overview**

This Chapter highlights the mitigation measures for the anticipated negative impacts of the proposed Cardiothoracic Centre project for Tenwek Hospital. The potential impacts and the possible mitigation measures have been analysed under three categories: Construction phase, Operational phase and Decommissioning phase.

### **9.2 Mitigation of Construction Related Impacts**

#### **9.2.1 Reduction of Local Construction Traffic**

The proponent through the contractor will put measures in place to mitigate the local traffic jam that will occur in the project as a result of the construction vehicles turning to offload the raw materials to the site and after offloading the raw materials. To minimize the local construction traffic, construction vehicles will enter and leave the site at appropriate times. The contractor will also use signs and barriers to direct vehicles and pedestrian traffic as needed around the construction site. Some activities may also be scheduled in off-peak traffic times to minimize impacts.

#### **9.2.2 Minimization of Noise and Vibration**

The Proponent of the proposed Project shall put in place several measures that will mitigate noise pollution and vibration arising during the construction phase. The following noise-suppression techniques will be employed to minimize the impact of temporary construction noise at the Project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Prescribe noise reduction measures if appropriate e.g. restricted working hours, transport hours and noise buffering.
- Consult with the surrounding community on the permissible noise levels and best working hours.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all construction activities in the Project area.
- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Construct mainly during the day. The time that most of the neighbours are out working.

#### **9.2.3 Minimization of Occupational Health and Safety Impacts**

To reduce the occupational health and safety impacts during the construction phase of the proposed Project, the Proponent through the Contractor is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Safety and Health Act, 2007. In this regard, the Proponent is committed to provision of appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the Environmental Management Plan (EMP).

Construction Workers accidents especially in deep trenching operations and elevated areas shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition, safety education and training shall be emphasized.

#### **9.2.4 Minimization of Air Quality Impacts**

Air quality impacts are generated from exhaust and dust emissions. The following measures shall be implemented during construction to minimize the emissions:

The engine size of the construction equipment shall be the minimum practical size;

- The number of construction equipment operating simultaneously shall be minimized through efficient management practices;
- Vehicle idling time shall be minimized; and
- Equipment shall be properly tuned and maintained as per the manufacturer's specifications

Dust emissions from construction sites can also pose health risk to workers, and sensitive receptors surrounding the site, if not managed properly. It is the responsibility of the contractor to provide appropriate safety training, information equipment, signage, security and emergency response plans on site. To mitigate the impact of SPM (dust), the following measures are recommended for implementation:

- Applying water to at least 80% of all inactive accessible disturbed surface areas on a daily basis when there is evidence of wind driven dust;
- Watering all roads used for any vehicular traffic at least twice per day of active operations or road used for any vehicular traffic once daily and restrict vehicle speed to 15 mph;
- Down wash of trucks ( especially tyres) prior to departure from site;
- Cover stockpiles of sand, soil and similar materials or surround them with wind breaks;
- Cover trucks hauling dirt and debris to reduce spillage on to paved roads surface or have adequate free board to prevent spillage;
- Post signs that limit vehicle speeds onto unpaved roads and over disturbed soils; and
- Rapid onsite construction so as to reduce duration of traffic interference and therefore reduce emissions from traffic delays.

#### **9.2.5 Minimization of Solid Waste during Construction Phase**

The Proponent through the Contractor shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal. It is further recommended that the Proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

Additional recommendations for minimization of solid waste include: -

- Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time;
- Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements;
- Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste;
- Use of construction materials containing recycled content when possible and in accordance with accepted standards; and
- Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.

The proponent through the contractor will also make sure that the construction wastes generated are disposed by the private waste management company that will be contracted to an approved dump site.

### **9.2.6 Minimization of Increased Water Demand**

The Proponent of the proposed Project shall ensure that water is used efficiently at the site by sensitizing construction workers so as to avoid irresponsible water use. The contractor should also harvest rainwater and use in the construction activities. In addition the contractor should:

- Install water conserving taps;
- Promote recycling and reuse of water as much as possible;
- Promptly detect and repair of water pipes and tank leaks; and
- Install discharge meter to determine and monitor total water usage.

However, it should be noted also that apart from the negative impacts likely to be caused by mismanagement of water, increased water demand is inevitable during construction of the proposed Project.

### **9.2.7 Reduction of Energy Consumption**

The Proponent through the Contractor shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the Contractor shall monitor energy use during construction and set targets for reduction of energy use. The Contractor will also develop energy management plan.

#### **9.2.8 Reduction of Increased Storm Water Runoff from New Impervious Area**

The proponent of the proposed Project will put in place some measures aimed at minimizing soil erosion and associated sediment release from the Project site during construction. These measures will include levelling the Project site to reduce run-off velocity and increase infiltration of rain water into the soil. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

#### **9.2.9 Reduction of Impacts at Extraction Sites and Impacts Associated with Construction Materials and Procurement**

The Proponent of the proposed Project shall ensure that all building materials such as sand ballast hard core are extracted from registered quarry and sand mining firms whose facilities have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are presumably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the Proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the Proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the Proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw

materials extracted from natural resources as well as reducing impacts at the extraction sites.

The following should also be taken into consideration:

- The tender documents should specify required standards and certification for procurement of all materials and appliances;
- As far as possible, environmentally friendly and sustainable materials should be used.
- The Contractor should be instructed in the use of all materials that may have negative environmental (including health) effects; and
- If any material or substance is used that is at any point in the future deemed to be deleterious to health, then it must be replaced with an acceptable alternative.

### **9.2.10 Controlling Oil Spills during Construction Phase**

The Contractor shall control dangers of oil and fuel spills during construction by maintaining machinery in specific areas designated for this purpose. Prompt cleaning of oil and fuel spills, and proper disposal of clothing or rags contaminated with oil will also take place.

## **9.3 Mitigation of Negative Impacts during Operation Phase**

### **9.3.1 Storm Water Management**

Rainwater runoff comprises of storm water, which flows into both surface water and ground water. Proper management of this resource ensures that storm water discharge is free from contamination. A good storm water management policy should include:

- Good housekeeping to avoid contamination of storm water;
- Provision of slit traps in storm water drains; and
- Regular inspection and cleaning of storm drains

### **9.3.2 Ensuring Efficient Solid and Liquid Waste Management**

Waste should be managed efficiently through segregation and treatment of the various types of waste that will be produced. These include: Solid Waste, Healthcare Waste, Ablution Waste, and Liquid Waste. Each type of waste should be treated in accordance to the respective management action required.

Healthcare Waste shall be disposed of properly in accordance with the set laws, regulations, and guidelines on healthcare waste management. (*Refer to Volume 2: Guidelines*)

Biomedical waste is classified in various categories; as per EMCA (Waste Management) Regulations, 2006 and National Guidelines for Safe Management of Healthcare Wastes.

Liquid waste from the various hospital processes should go through specialized treatment before being channelled to the sewer system. Having foreseen the increased demand for



waste disposal, the Hospital has made plans to increase the capacity of its effluent discharge plant and extend the service of its sewer system to the proposed project site.

Ablution waste shall be stored in a Sewer Pre-treatment Tank, where the effluent shall be treated before being released to the sewer system to the Tenwek Hospital Effluent Treatment facility.

### **9.3.3 Minimization of Occupational Health and Safety Impacts**

In order to prevent and minimize OSH impacts, the relevant laws, regulations, and guidelines should be implemented and followed. This shall help in identifying and pro-actively avoiding OSH risks. Personal protective equipment and supplies should also be sufficiently provided to hospital staff, at their various duty stations.

### **9.3.4 Safe Management of Healthcare Waste**

Hospital management will provide waste bins in each ward and theatres for healthcare solid waste disposal. Hospital staff will collect these bins on a regular basis and empty the bins in larger containers located at designated sites within the CTC. The large containers will be collected and transported to the **INCINERATOR**.

Healthcare wastewater will be directed from all the operational units in the facility to the receptors of a large pre-treatment tank located in the compound. After the pre-treatment, the wastewater will be released to the Effluent Treatment Plant located on the main hospital campus.

National and international guidelines on safe management of healthcare wastes will be a good guide for the management of the waste that will be generated from the facility.

## **9.4 Mitigation of Negative Impacts during Decommissioning Phase**

### **9.4.1 Minimization of Noise and Vibration**

The Proponent of the proposed Project shall put in place several measures that will mitigate noise pollution and vibration arising during the decommissioning phase. Noise-suppression techniques to be employed to minimize the impact of temporary demolition noise at the Project site can be found in *section 9.2.2* of this report.

### **9.4.2 Efficient Solid Waste Management**

The proponent through the contractor will make sure that the demolition wastes generated are disposed by the private waste management company that will be contracted to an approved dump site.

Materials containing recycled content should be recycled when possible or handed over to a recycling company.

Waste generated on site should be adequately collected and stored for safe transportation to the disposal sites.

### 9.4.3 Minimization of Occupational Health and Safety Impacts

To reduce the occupational health and safety impacts during the operation phase of the proposed Project, the Proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Safety and Health Act, 2007. In this regard, the Proponent is committed to provision of appropriate personal protective equipment, as well as ensuring a safe and healthy environment for workers as outlined in the Environmental Management Plan (EMP). Workers accidents especially in deep curing operations and elevated areas shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition, safety education and training shall be emphasized.

## 9.5 Monitoring Programmes

**Table 13: Monitoring Programmes**

	Parameters	Monitoring Method	Indicator	Frequency	Responsibility
<b>Catchment conservation</b>	Regulatory activities at the catchment areas	<ul style="list-style-type: none"> <li>• Inspection of development plans from regional authorities</li> <li>• Inspection of monitoring and evaluation programmes</li> <li>• Visual inspections</li> <li>• GIS</li> </ul>	Status on implementation of plans and activities within the catchment areas	Annually	Regional development authorities /Ministry of Water Resources/Catchment Boards /Ministry of Agriculture/Local Authorities. ERB
	Soil Erosion	<ul style="list-style-type: none"> <li>• Visual inspection</li> <li>• Record of periodic assessment</li> <li>• GIS</li> </ul>	Agricultural husbandry practices Vegetation cover on highly erodible sites Re-vegetation of previously eroded sites	Twice a year to cater for seasonal variation	Regional Development Authorities/Ministry of Agriculture/Local Authorities/Local NGOs /ERB
<b>Air Emission /Ambient Air Quality</b>	Dust	<ul style="list-style-type: none"> <li>• Visual inspection</li> </ul>	Airborne particles	Twice during the dry season	Utility

	Climatic Conditions	<ul style="list-style-type: none"> <li>Keeping record of meteorological data from automatic data logger or the nearest KMD station</li> </ul>	Wind speed and direction, temperature, relative humidity, solar radiation, rainfall amounts	Continuous recording	Utility
	Ozone	<ul style="list-style-type: none"> <li>Propriety gas measuring meters</li> </ul>	24 hour averages and daily maximum concentrations	Quarterly for the life of the project	Utility/independent consultant
<b>Water Quality</b>	Effluent Discharge from Facility	<ul style="list-style-type: none"> <li>Samples for laboratory analysis</li> </ul>	Measured levels of: total suspended solids, biological and chemical pollutants, Oil and grease	Quarterly for life of the project	Utility/independent consultant
<b>Noise</b>	Occupational Noise	<ul style="list-style-type: none"> <li>Periodic measurement with noise meter</li> </ul>	Time averaged measurements in dB{A} at work areas within the plant boundary	Weekly	Utility/OHSD [MoL]
<b>Waste Management</b>	Solid & Liquid Waste	<ul style="list-style-type: none"> <li>Tracking all waste</li> </ul>	Waste streams and volumes generated on site Generated quality of Effluent and Sludge	Continuous	Utility/NEMA/ERB/ local authorities
	Healthcare Waste	<ul style="list-style-type: none"> <li>Tracking all hazardous waste and establishing storage, handling and disposal methods</li> </ul>	Generated tracking all hazardous waste and establishing storage, handling and disposal methods Sludge and disposal residue	Continuous	Utility/NEMA/ERB/ local authorities
<b>Health and Safety</b>	Adoption and implementation of EHS policies	<ul style="list-style-type: none"> <li>Annual EHS Audits</li> </ul>	Identified and established targets	Continuous	Utility/ERB
	Employee EHS training	<ul style="list-style-type: none"> <li>Inspection of records of training programs including fire drills, environmental and safety training</li> </ul>	Annual record on status and updates	Continuous	Utility/ERB/OHSD
	Development and maintenance of EHS plans, procedures and manuals	<ul style="list-style-type: none"> <li>Annual EHS audits</li> <li>Inspection of plans, procedures and manuals</li> </ul>	Annual records of staff training programs executed	Annually	Utility

	Occupational health and safety monitoring	<ul style="list-style-type: none"> <li>Reporting of accident and incidents, safety breaches and to equipment</li> </ul>	Annual statistical records and safety reports	Continuous	Utility/ERB/OHSD
	EHS Audits	<ul style="list-style-type: none"> <li>Inspection of previous EHS internal audit records</li> </ul>	Number and type of corrective actions raised Status on implementation of corrective actions	Quarterly for internal audits and annually for external audits	Utility/independent auditor/ERB
<b>Other environmental health and safety issues</b>	Maintenance of fire appliances	<ul style="list-style-type: none"> <li>Inspection of maintenance and servicing records of fire appliances</li> </ul>	Quarterly record of reports by local fire appliance dealers	Quarterly	Utility/fire appliance dealer
	Social Concerns	<ul style="list-style-type: none"> <li>Inspection of record of concerns from the community</li> <li>Review of record of stakeholder consultations</li> </ul>	Number, type of complaints Socio-economic status Implementation of agreed actions	Annually Every six months	Regional development authorities/utility/stakeholders

## **CHAPTER 10: ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)**

### **10.1 Introduction**

This chapter presents an Environmental and Social Management Plan (ESMP) that will need to be implemented by the proponent to prevent or reduce significant negative impacts to acceptable levels. All the project components have been considered when this comprehensive ESMP was developed. Using best practices in other parts of the world, the costs of mitigation measures and of the institutional and training requirements to implement them were estimated. Compensation to the affected parties for impacts which cannot be mitigated will need to be considered where applicable. A comprehensive work program, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measure will be prepared based on the budget guideline.

The aim of the Environmental and Social Management and Monitoring plan (ESMMP) is to provide a road map to the Proponent on how to address the identified environmental and social impacts, requirements for labour specialization (responsibility), frequency of monitoring activities, and estimated cost implications of the Proposed Project.

The following ESMP has been structured in such a manner to provide a basis for implementation of the Environmental Management System (EMS) ISO 14001 principles for the life of the proposed development. It should be further noted that the proposed ESMP is not static; allowance has been made for it to evolve through the life of this project. Such a characteristic is seen to be important to key factors and processes may change through life of the project. It is therefore necessary to alter proposed mitigation and monitoring methodologies in order to determine best approach to deal with such changes. This ESMP include the necessary specialist input to determine, mitigate and manage any environmental impacts that the proposed development may have, relating to bio-physical and socio-economic aspects. Specific attention has been made to ensure that the ESMP conforms to the following criteria:

- Identifies specific quantifiable monitoring regimes;
- Delineates key lines of accountability;

- Associates mitigation and monitoring tasks to specific impacts;
- Gives guiding costs of implementation,
- Where practically possible identifies key indicator, which can be utilized for environmental performance monitoring
- Ensures flexibility to enable incorporation of additional monitoring and mitigation techniques as deemed necessary throughout the life of the project
- Conforms to all best practice principles by acknowledging the existence of both long term and immediate impacts and the resulting mitigation measures necessary to deal with such impacts
- Identifies commitments made by the proponent with regard to its environmental performance.

The following table forms the core of this ESMP for construction and operational phases of the proposed residential apartments. The table provides details of all necessary mitigation measures as well as the person responsible for implementing and monitoring such measures. The table should be used as checklist on site. The table shows impacts, mitigation measures, implementation period, the required resources and responsible persons to take action.

## 10.2 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

**Table 14: Environmental Management Plan for Construction Phase**

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
<b>1. Minimization of noise and vibration</b>					
Noise and vibration	Install portable barriers to shield compressors and other small stationery equipment where necessary.	Contractor	Inspection	<b>One-off</b>	50,000/month
	Prescribe noise reduction measures if appropriate e.g. restricted working hours, transport hours and noise buffering.	Contractor	Inspection and Observation	<b>One-off</b>	1,500/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Consult with the surrounding community on the permissible noise levels and best working hours.	Contractor and Proponent	Meeting	One-off	No added cost
	Use quiet equipment (i.e. equipment designed with noise control elements).	Contractor	Inspection	Throughout construction period	125,000/month
	Co-ordinate with relevant agencies regarding all construction activities in the project area.	Contractor and Proponent	Meeting	One-off	1,500/month
	Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Project Manager and Contractor	Meeting	Throughout construction period	No ad1,500/month
	Sensitize construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, offices, hospitals, residential houses and schools.	Project Manager and Contractor	Meeting	Throughout construction period	1,500/month
	Ensure that construction machinery is kept in good condition to reduce noise generation.	Project Manager and Contractor	Inspection	Throughout construction period	55,000/month
	The noisy construction works will be planned to be during the day.	Project Manager and all site foreman	Observation	Throughout construction period	No added cost
<b>2. Minimize occupational health and safety risks</b>					
Registration of the premises	Registration of the Project as per Section 43 and 44 of the Occupational Safety and Health Act, 2007.	Developer	Observation	One-off	45,000/once

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
General register	A general register should be kept within the facility as stipulated in Section 122 and 123 of the Occupational Safety and Health Act, 2007.	Project Manager and Contractor	Inspection	<b>One-off</b>	2,000/once
Incidents, accidents and dangerous occurrences.	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.  Reporting should also be as stated in Section 21 of the Occupational Safety and Health Act, 2007.	Contractor	Inspection	<b>Throughout construction phase</b>	15,000/once
	Enforcing safety procedures and preparing contingency plan for accident response in addition safety training shall be emphasized.	Contractor	Meeting	<b>Throughout construction period</b>	50,000
Safety, health and environment (SHE) policy	Develop, document and display prominently an appropriate SHE policy for construction works.	Developer and Contractor	Observation	<b>One-off</b>	5,000/once
Health and safety committee	Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented as per Section 9 of the Occupational Safety and Health Act, 2007.	Contractor and Developer	Inspection and Meeting	<b>One-off</b>	15,000/once



Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Sanitary conveniences	Suitable, efficient, clean, well-lit and adequate sanitary conveniences should be provided for construction workers as per Section 52 of the Occupational Safety and Health Act, 2007.	Contractor	Inspection and Observation	<b>One-off</b>	45,000/once
Machinery/equipment safety	Ensure that machinery, equipment, personal protective equipment, appliances and hand tools comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded as indicated in Part VII of the Occupational Safety and Health Act, 2007.	Contractor	Inspection and Observation	<b>One-off</b>	30,000/month
	Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain.	Contractor	Inspection	<b>Throughout construction period</b>	No added cost
	All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury as stated in Section 56 of the Occupational Safety and Health Act, 2007.	Contractor	Inspection and Observation	<b>One-off</b>	40,000/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Arrangements must be in place to train and supervise inexperienced workers regarding construction machinery use and other procedures/operations	Contractor	Meeting	<b>Throughout construction period.</b>	40,000/month
	Equipment such as fire extinguishers must be examined by a government authorised person as indicated in Section 72 of the Occupational Safety and Health Act, 2007. The equipment may only be used if a certificate of examination has been issued.	Contractor	Inspection and Observation	<b>Once every 6 months</b>	5,000 per examination
	Reports of such examinations must be presented in prescribed forms, signed by the examiner and attached to the general register.	Contractor	inspection	<b>Throughout construction period</b>	No added cost
Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse.	Contractor	Inspection and Observation	<b>Throughout construction period</b>	No added value
	Ensure that items are not stored/ stacked against weak walls and partitions.	Contractor	Inspection and Observation	<b>Throughout Construction period</b>	No added cost
Safe means of access and safe place of employment	All floors, steps, stairs and passages of the rooms must be of sound construction and properly maintained.	Contractor	Observation and Inspection	<b>One-off</b>	25,000/month
	Securely fence or cover all openings in floors.	Contractor	Observation	<b>One-off</b>	25,000/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	All ladders used in construction works must be of good construction and sound material of adequate strength and be properly maintained as indicated in Section 77 of the Occupational Safety and Health Act, 2007.	Contractor	Inspection and Observation	<b>One-off</b>	-45,000
Emergency preparedness and evacuation procedures	Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency.	Contractor	Inspection and Observation	<b>One-off</b>	35,000-
	Such procedures must be tested at regular intervals.	Project Manager and Contractor	Inspection	<b>Every 3 months</b>	25,000
	Ensure that adequate provisions are in place to immediately stop any operations where there is an emergency.	Project Manager and Contractor	Inspection and Observation	<b>One-off</b>	No added cost-
	Provide measures to deal with emergencies and accidents including adequate first aid arrangements.	Contractor	Meeting, Inspection and Observation	<b>Throughout construction period</b>	25,000
First Aid	Well stocked first aid box which is easily available and accessible should be provided within the premises as stated in Section 95 of the Occupational Safety and Health Act, 2007.	Contractor	Inspection	<b>One-off</b>	15,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Contractor	Inspection and Observation	<b>One-off</b>	25,000
Fire protection	Firefighting equipment such as fire extinguishers and hydrant systems should be provided at strategic locations.	Contractor	Inspection and Observation	<b>One-off</b>	35,000
	Regular inspection and servicing of the equipment must be undertaken and records of such inspections maintained.	Contractor	Inspection	<b>Every 6 months</b>	5,000
	Signs such as “NO SMOKING” must be prominently displayed within the construction site.	Contractor	Inspection and Observation	<b>One-off</b>	1,000
Ventilation	Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air.	Project Manager and Contractor	Inspection and Observation	<b>One-off</b>	25,000
Lighting	There must be adequate provision for artificial or natural lighting in all parts of the rooms in which persons are working or passing.	Project Manager and Contractor	Inspection and Observation	<b>One-off</b>	No added cost
Electrical Safety	Distribution board switches must be clearly marked to indicate respective circuits and pumps.	Project Manager and Contractor	Inspection and Observation	<b>One-off</b>	-30,000
	There should be no live exposed connections.	Project Manager and Contractor	Inspection and Observation	<b>Throughout construction period</b>	35,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Electrical fittings near all potential sources of ignition should be flame proof.	Project Manager and Contractor	Inspection and Observation	<b>One-off</b>	35,000
	All electrical equipment must be earthed	Project Manager and Contractor	Inspection	<b>One-off</b>	35,000
Chemical Safety	Collection, recycle and dispose chemical wastes, obsolete chemicals and empty chemical containers as per the Environmental Management and Coordination (Waste Management) Regulations, 2006.	Contractor	Inspection and Observation	<b>One-off</b>	45,000
	Ensure that all chemicals used in construction are appropriately labelled or marked and that material safety data sheets are available.	Contractor	Inspection and Observation	<b>One-off</b>	25,000-
	Keep a record of all hazardous chemicals used at the premises, cross-referenced to the appropriate chemical safety data sheets.	Contractor	Inspection and Observation	<b>Throughout construction period</b>	25,000
	There should be no eating or drinking in areas where chemicals are stored or used.	Contractor	Inspection and Observation	<b>Throughout construction period</b>	No added cost
	Provide workers in areas with elevated noise and vibration levels, with suitable ear protection equipment such as ear masks.	Contractor	Inspection and Observation	<b>One-off</b>	25,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Supply of clean drinking water	Ensure that construction workers are provided with an adequate supply of wholesome drinking water.	Contractor	Inspection and Observation	<b>One-off</b>	10,000/month
Washing facilities	Ensure that conveniently accessible, clean, orderly, adequate and suitable washing facilities are provided and maintained within the site.	Contractor	Inspection and Observation	<b>One-off</b>	90,000
Ergonomics	Provision for repairing and maintaining of hand tools must be in place.	Contractor	Inspection and Observation	<b>One-off</b>	85,000
	Hand tools must be of appropriate size and shape for easy and safe use.	Contractor	Inspection and Observation	<b>One-off</b>	90,000
	Height of equipment, controls or work surfaces should be positioned to reduce bending posture for standing.	Project Manager and Contractor	Inspection	<b>One-off</b>	-35,000
<b>3. Minimize impacts on Air Quality</b>					
Dust emission	Downwash of trucks (especially tyres) prior to departure from site.	Contractor	Observation and Inspection	<b>Throughout construction period</b>	1,500/month
	Cover stockpiles of sand, soil and similar materials or surround them with wind breaks.	Contractor	Inspection and Observation	<b>Throughout construction period</b>	1,500/month
	Cover trucks hauling dirt and debris to reduce spillage on to paved roads surface or have adequate free board to prevent spillage.	Contractor	Inspection and Observation	<b>Throughout construction period</b>	1,500/month
	Post signs that limit vehicles speed onto unpaved roads and over disturbed soils.	Contractor	Inspection	<b>One-off</b>	5,000/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Rapid onsite construction so as to reduce duration of traffic interference and therefore reduce emissions from traffic delays.	Contractor	Inspection	Throughout construction period	150,000/month
	Ensure strict enforcement of on-site speed limit regulations.	Project Manager and Contractor	Observation	Construction period	1,500/month
	Avoid excavation works in extremely dry weathers.	Project Manager and Contractor	Inspection and Observation	Throughout construction period	60,000/month
	Sprinkle water on access routes when necessary to reduce dust generation by construction vehicles.	Project Manager and Contractor	Inspection and Observation	Throughout construction period	
	Personal protective equipment to be worn.	Contractor	Observation	Throughout construction period	
Exhaust emission	The engine size of the construction equipment shall be the minimum practical size.	Contractor	Inspection	One-off	No added cost
	Construction equipment operating simultaneously to be minimized through efficient management practices.	Contractor	Inspection and Observation	Throughout construction period	No added cost
	Construction equipment to be maintained properly tuned and maintained as per the manufacturers specifications.	Contractor	Inspection	One-off	120,000/month
	Vehicle idling time shall be minimized.	Project Manager and Contractor	Observation	Construction period	No added cost

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Alternatively fuelled construction equipment shall be used where feasible equipment shall be properly tuned and maintained.	Project Manager and Contractor	Inspection	Throughout construction period	No added cost
	Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off or keep vehicle engines at these points.	Project Manager and Contractor	Meeting	Throughout construction period	No added cost
<b>4. Minimize Solid Waste generation and ensure efficient solid waste management during construction</b>					
Increased solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction; 2. Recycling; 3. Reuse; and 4. Land filling.	Project Manager and Contractor	Observation	Throughout construction period	45,000/month
	Order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials.	Project Manager and Contractor	Inspection and Observation	One-off	1,500/month
	Damaged or wasted construction materials to be recovered for refurbishing and use in other projects.	Project Manager and Contractor	Observation	One-off	1,500/month
	Use of durable, long-lasting materials to reduce the amount of construction waste generated over time.	Project Manager and Contractor	Inspection	Throughout construction period	1,500/month



Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Provide facilities for proper handling and storage of construction materials.	Project Manager and Contractor	Inspection and Observation	One-off	50,000/month
	Use building materials that have minimal or no packaging.	Project Manager and Contractor	Inspection and Observation	Throughout construction period	1,500/month
	Use construction materials containing recycled content where possible and in accordance with accepted standards.	Project Manager and Contractor	Inspection	Throughout construction period	1,500/month
	Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers.	Project Manager, and Contractor	Observation	Throughout construction period	1,500/month
	Dispose waste more responsibly by dumping at designated dumping sites or landfills only.	Project Manager, and Contractor	Inspection and Observation	Throughout construction period	20,000/month
	Waste collection bins to be provided at designated points on site.	Project Manager, and Contractor	Observation	Throughout construction period	40,000/month
<b>5. Minimize water consumption and ensure more efficient and safe water use</b>					
Increased water demand	Harvest rainwater.	Contractor	Observation	Throughout construction period	15,000/month
	Install water conserving taps.	Contractor	Observation	One-off	35,000/month
	Promote recycling and reuse of water as much as possible.	Contractor	Inspection	Throughout construction period	45,000/month
	Install a discharge meter to determine and monitor total water usage.	Project Manager and Contractor	Inspection	One-off	10,000/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Promptly detect and repair of water pipe and tank leaks.	Contractor	Inspection and Observation	Throughout construction period	15,000/month
	Sensitize construction workers to conserve water.	Contractor	Meeting	Throughout construction period	No added cost
<b>6. Minimization of Energy Consumption</b>					
Increased energy consumption	Ensure electrical equipment and appliances are switched off when not being used.	Contractor	Inspection and Observation	Throughout construction period	No added cost
	Install energy saving fluorescent tubes and bulbs at all lighting points instead of bulbs which consume higher electric energy.	Contractor	Observation	Throughout construction period	35,000/month
	Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts.	Contractor	Inspection and Observation	Throughout construction period	No added cost
	Development of energy management plan.	Contractor	Inspection	One-off	45,000/month
	Monitor energy use during construction and set targets for reduction of energy use.	Contractor	Inspection	Throughout construction period	5,000/month
<b>7. Reduce Storm-water from new impervious areas</b>					
Increased storm water run-off	Surface runoff and roof water shall be harvested and stored for reuse.	Proponent	Inspection and Observation	During rainy season	- 25,000/month
	Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water.	Proponent	Inspection	One-off	35,000/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Design a storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure.	Contractor	Inspection	<b>One-off</b>	50,000 for the construction period

**8. Minimize extraction site impacts and ensure efficient use of raw materials in construction**

Demand for raw material	Building materials such as sand ballast, hard core are extracted from registered quarry and sand mining firms whose facilities have undergone satisfactory environmental impact assessment/audit and received NEMA approval.	Contractor	Inspection	<b>Throughout construction period</b>	1,500/month
	Source building materials from local suppliers who use environmentally friendly processes in their operations.	Project Manager and Contractor	Inspection and Observation	<b>Throughout construction period</b>	1,500/month
	Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered.	Project Manager and Contractor	Inspection and Calculation	<b>Throughout construction period</b>	1,500/month
	Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.	Project Manager and Contractor	Observation	<b>Throughout construction period</b>	1,500/month
	Consider reuse of building materials and use of recycled building materials.	Proponent	Observation	<b>Throughout construction period</b>	1,500/month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
<b>9. Minimization of oil spills</b>					
Oil Spills	A designated garage section of the site fitted with oil trapping equipment to be planned for changes.	Contractor	Inspection	<b>Throughout construction period</b>	15,000/period
	Prompt cleaning of oil and fuel spills.	Contractor	Inspection and Observation	<b>When there is oil spills</b>	10,000/month
	Proper disposal of clothing or rags contaminated with oil.	Contractor	Inspection and Observation	<b>Periodically</b>	25,000/month

**Table 15: Environmental Management Plan for the Operational Phase**

Expected Negative Impacts	Recommended Mitigation measures	Responsible Person	Monitoring Means	Time frame	Estimated Costs (KES)
<b>1. Storm water management</b>					
Increased storm water flow	Provision of slit traps in storm water drains.	Proponent	Inspection	One-off	25,000
	Good housekeeping to avoid contamination of storm water.	Operators/ employees	Inspection	Throughout construction phase	12,500
	Regular inspection and cleaning of storm drains.	Operators	Inspection	Throughout operation phase	12,500
<b>2. Minimization of solid waste generation and ensuring more efficient solid waste management</b>					
Solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1.Source reduction; 2.Recycling; 3.Reuse; 4.Combustion; and 5. Sanitary land filling.	Contracted Private Solid Waste Management Company	Inspection and Observation	Throughout operational phase	45,000
	Provide solid waste handling facilities/cubicles.	Proponent	Observation	One-off	35,000

	Ensure that solid wastes generated at the proposed go downs are regularly disposed of appropriately at authorized dumping sites.	Proponent/Contracted Private Solid Waste Management Company	Inspection	Throughout operation phase	65,000
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### 3. Management of waste water disposal

Sewage disposal	Monitor the effluent to ensure that the sewage released from the facility do not pollute the environment and affect the general public during operation of the proposed Project.	Proponent	Inspection and Observation	Throughout operation phase	35,000-
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### 4. Minimization of occupational health and safety impacts

Increased Occupational Health and Safety Risks	Adherence to the Occupational Health and Safety Rules and Regulations stipulated in the Occupational Safety and Health Act, 2007.	Health and Safety Manager	Inspection, Meeting and Observation	Throughout operation phase	25,000
	Provision of appropriate personal protective equipment as well as ensuring a safe and healthy environment for workers.	Proponent	Inspection and Observation	Throughout operation phase	35,000

### 5. Minimization of Accidents, Injuries and Falls

	Adherence to the Occupational Health and Safety Rules and Regulations stipulated in the Occupational Safety and Health Act, 2007.	Health and Safety Manager Proponent	Inspection and Observation	Throughout operation phase	150,000
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**6. Minimization of Impacts of Healthcare Wastes**

Healthcare Solid Waste Disposal	Adherence to Healthcare Waste Management Guidelines	Health and Safety Manager Proponent	Inspection and Observation	Throughout operation phase	250,000
Healthcare Wastewater Disposal	Adherence to Healthcare Waste Management Guidelines	Health and Safety Manager Proponent	Inspection and Observation	Throughout operation phase	250,000

**7. Minimize energy consumption**

High demand for energy	Select the most efficient lighting system design and minimum lighting level appropriate for the required application in various rooms.	Proponent	Inspection	One-off	35,000
	Adopt the most effective lighting programmable time switches.	Proponent	Inspection	One-off	45,000

Maximize the contribution of daylight to reduce the use of artificial lighting.	operators	Observation and Inspection	Throughout operation period	No added cost
Switch off electrical equipment, appliances and lights when not being used.	operators	Inspection and Observation	Throughout operation phase	-No added cost
Install occupation sensing lighting at various locations such as storage areas which are not in use all the time.	Proponent	Observation	One-off	10-40 % higher than ordinary lighting 25,000
Install energy saving fluorescent tubes and bulbs at all lighting points within the apartments instead of bulbs which consume higher electric energy.	Proponent	Observation	One-off	-35,000
Monitor energy use during the operation of the Project and set targets for efficient energy use.	operators	Observation	Throughout operation phase	25,000

**8. Minimize water consumption and ensure more efficient and safe water use**



High water demand	Reduce toilet cistern in single flush models.	Proponent	Inspection	One-off	25,000
	Sweep with a broom and pan where possible, rather than hose down external areas.	Operators	Inspection	Throughout operation phase	12,500
	Quick fixing of leaking pipes and toilet cistern.	Proponent	Inspection and Observation	Throughout operation phase	35,000
	Reduce water delivery in taps, through the installation of low flow devices or aerators on taps.	Proponent	Inspection and Observation	One-off	-45,000
	Install a manually pressed button flush valve which stops on release of button.	Proponent	Inspection	One-off	10-40% higher than ordinary taps 35,000
	Install a discharge meter at water outlets to determine and monitor total water usage.	Proponent	Inspection and Observation	One-off	25,000
	Promote awareness on water conservation and reducing water wastage.	Proponent	Meeting	Throughout operation phase	12,500

	Consider water efficient plumbing fixtures to save water and energy.	Proponent	Inspection	One-off	25,000
<b>9. Ensure the general safety and security of the proposed Project and surrounding areas</b>					
Increased general safety and security impacts	Ensure the general safety and security at all times by providing day and night security and adequate lighting within and around the proposed go downs.	Proponent	Inspection and Observation	Throughout operation phase	35,000
<b>10. Minimization of thermal effects</b>					
Increased heat stress	Use and Monitor the efficiency of mechanical air cooling systems in the building	Health and Safety Manager	Inspection, Meeting and Observation	Throughout operation phase	25,000

**Table 16: Environmental Management Plan for the Decommissioning Phase**

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
<b>1. Demolition waste management</b>					
Demolition waste	Use of an integrated solid waste management system i.e. through a hierarchy of options: Source reduction; Recycling; Reuse; Sanitary land filling.	Project Manager and Contractor	Inspection and Observation	One-off	45,000
	All structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible.	Project Manager and Contractor	Inspection and Observation	One-off	35,000
	All foundations must be removed and recycled, reused or disposed of at a licensed disposal site.	Project Manager and Contractor	Inspection and Observation	One-off	35,000
	Where recycling/reuse is not possible, the materials should be taken to a licensed waste disposal site.	Project Manager and Contractor	Inspection and Observation	One-off	45,000
<b>2. Rehabilitation of project site</b>					
Vegetation disturbance	Implement an appropriate re-vegetation programme to restore the site to its original status.	Project Manager and Contractor	Observation	One-off	45,000-
	Consider use of indigenous plant species in re-vegetation.	Project Manager and Contractor	Observation	One-off	-25,000
<b>3. Minimization of occupational health and safety impacts</b>					

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Increased occupational health and safety risks	Adherence to the Occupational Health and Safety Rules and Regulations stipulated in the Occupational Safety and Health Act, 2007.	Health and Safety Manager	Inspection, Meeting and Observation	Throughout decommissioning period	24,000
	Provision of appropriate personal protective equipment as well as ensuring a safe and healthy environment for demolition workers.	Proponent	Inspection and Observation	Throughout decommissioning period	45,000
	Mitigate demolition workers accidents by enforcing adherence to safety procedures and preparing contingency plan for accident response.	Health and Safety Manager	Meeting and Observation	Throughout decommissioning period	25,000

**4. Minimization of demolition noise and vibration**

Noise and vibration	Sensitize demolition vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Project Manager and Contractor	Meeting	Throughout demolition period	12,500
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Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	Sensitize demolition drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, offices, hospitals, residential houses and schools.	Project Manager and Contractor	Meeting	Throughout demolition period	12,500
	Ensure that demolition machinery is kept in good condition to reduce noise and vibration generation.	Project Manager and Contractor	Inspection	Throughout demolition period	25,000
	Ensure that all generators and other equipments used are insulated or placed in enclosures.	Project Manager and Contractor	Inspection	Throughout demolition period	35,000
	The noisy construction works will be planned to be during the day.	Project Manager and all site foreman	Observation	Throughout demolition period	No added cost

### 10.3 EMERGENCY RESPONSE PLAN (ERP)

Emergencies and disasters can occur any time without warning. More so construction sites are prone to such, thus it is important for the proponent to prepare for them, and be in a good position to act to minimize panic and confusion when they occur. Emergency Response Plans (ERP) will have to be instituted throughout the project cycle.

**Table 17: 10.3 EMERGENCY RESPONSE PLAN (ERP)**

<b>Emergency Response Plan Components</b>	<b>Actions/Requirements</b>	<b>Responsibility</b>
<b>Potential Emergency</b>	Identification of all potential emergencies associated with the proposed project at the project site. Include, Fires, Accidents & Incidents, Security, and Terrorism etc.	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Emergency Operations Coordinator (EOC)</b>	Designate a primary and secondary contact person.	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Emergency Contact Numbers</b>	Give & display contact for Fire station, Ambulance, Police, Hospitals, and others	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Installation of Emergency Equipment</b>	Install: <ul style="list-style-type: none"> <li>• Fire sensors,</li> <li>• Fire alarms,</li> <li>• Fire extinguishers,</li> <li>• Fire hose,</li> <li>• Panic alarm button,</li> <li>• Provision and enforcement of use of PPEs,</li> <li>• Emergency Communication equipment, such as Phone &amp; alarm bells</li> </ul>	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Training for Emergency Response</b>	Regular training for emergency response	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Trained in the Use of Emergency Equipment</b>	Employees training in the use of emergency equipment	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>First Aid</b>	<ul style="list-style-type: none"> <li>▪ Provision of first aid kits,</li> </ul>	<ul style="list-style-type: none"> <li>▪ Contractor during construction</li> </ul>

	<ul style="list-style-type: none"> <li>▪ First aid management training</li> </ul>	<ul style="list-style-type: none"> <li>and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Signage</b>	<ul style="list-style-type: none"> <li>▪ Install Fire sensors</li> <li>▪ Signage, action poster,</li> <li>▪ Alarm bell/ panic button</li> </ul>	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Procedure for Rescue and Evacuation</b>	<ul style="list-style-type: none"> <li>▪ Evacuation plan,</li> <li>▪ Warning system,</li> <li>▪ Assembly site</li> <li>▪ Shelter in place plan.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>
<b>Occupants Emergency Contact Information</b>	List of all occupants, residents & their activities	<ul style="list-style-type: none"> <li>▪ Proponent during operation phase</li> </ul>
<b>ERP Review</b>	Annual ERP review	<ul style="list-style-type: none"> <li>▪ Contractor during construction and Decommissioning phases.</li> <li>▪ Proponent during operation phase</li> </ul>

## **CHAPTER 11: CONCLUSION AND RECOMMENDATIONS**

### **11.1 Introduction**

The proposed CTC Project will be essential for the proponent (Tenwek Hospital ) to provide approximately of 13,000m<sup>2</sup> specialized surgical theatres supported by clinical and inpatient spaces in a multi-story facility with Ground + 4 floors with a 1 No. Basement.

Based on the desk review, site inspection, geotechnical survey of the proposed project location, laboratory analysis of environmental parameters, public consultation and participation as well as assessment of environmental and social impacts, the following conclusions can be made:

### **11.2 Specialized Surgical Theatres**

The proposed project will enable Tenwek Hospital to provide specialized surgical theatres supported by clinical and inpatient spaces.

The completion of the proposed project will boost supply and help Kenya meet the national universal health care coverage as well as economic and social development goals.

### **11.3 Environmental and Social Impacts**

The implementation (construction and operation) of the proposed project will generate both negative and positive environmental and social impacts. The positive impacts will be many and will be beneficial to the local community and Bomet County as a whole.

The negative impacts will be of low magnitude and insignificant and will be easily mitigated by the proponent and the contractors during construction and operational phases.

#### **a) The key negative biophysical impacts during construction phase are:**

- Soil erosion impacts
- Water Quality impacts
- Hydrological impacts
- Air Quality impacts
- Terrestrial flora impacts
- Pollution of soils and ground water impacts
- Pollution of solid wastes
- Possibility of land slides

#### **b) Key negative social impacts during construction phase are:**



- Potential for increasing social tensions and decreased social cohesion
- Increased social pathologies such as STDs.

**(c) Key positive social impacts during construction phase are:**

- Employment opportunities
- Associated economic benefits,
- Opportunity for providing goods and services to the contractors.

**d) A key positive economic impact during operation phase will be:**

- Additional specialized surgical theatres and inpatient bed spaces

## **11.4 Conclusion**

### **11.4.1 Negative Biophysical Impacts**

The negative biophysical impacts will be of relatively short duration and, provided that re-vegetation / rehabilitation commences during and directly after construction, the terrestrial flora cover will re-establish within a short period and habitat fragmentation and visual impacts will be mitigated.

It is therefore concluded that the environmental and social impacts of the proposed CTC project are of such a nature that mitigation will prevent irreversible and long-term damage to the biophysical environment.

However, given the sensitive nature of the terrestrial flora ecosystems, it is essential that the mitigation measures and ESMP are strictly adhered to.

### **11.4.2 Social Impacts**

As far as social impacts are concerned, the key negative impacts are typical of similar construction projects in Kenya.

Provided there is adequate and open communication and co-operation with all stakeholders, these impacts can be mitigated adequately.

The negative impacts also need to be viewed in the context of the employment opportunities open to the local community, which is a significant benefit.

## **11.5 Recommendations**

### **11.5.1 Alternatives**

In terms of alternatives, the following are recommended:

- ***Construction Materials:*** The contractors should use locally available construction materials for all purposes during implementation of the proposed project.

- **Access Road to the Proposed Project Site:** This access road connecting main Hospital Campus should be cabro-paved

### **11.5.2 Key Recommendations**

The following key recommendations are made:

- A license should be issued for the construction of the proposed CTC Project , subject to the recommended alternatives and mitigation measures being made conditions of the license.
- The location of the lay down area and construction workers' camp must be carefully chosen to minimize environmental and social impacts
- The contractor and all sub-contractors must be bound by the ESMP.
- This must be achieved through inclusion of the ESMP in tender and other procurement documents.
- Each contractor must demonstrate to the proponent that they have endeavoured to use the hierarchy of hazard control to design, construct and operate a world class operation.
- Adhere to the formulated Environmental and Social Management and Monitoring Plan (ESMMP) to mitigate the predicted negative environmental and social impacts during construction, operation, and decommissioning phases.
- Conduct statutory Environmental audits, Fire risk assessments and Occupational Safety and Health audits annually through licensed advisors during construction and operations phase.
- Waste, including excavated soil and debris should be properly disposed of by backfilling and landscaping.
- During decommissioning of existing buildings, the contractor should adopt the method of selective demolition as far as practicable.
- This will enable the demolition and removal of wastes of the same category one at a time thus facilitate recycling of wastes for beneficial reuse, and minimizing the burden on dumpsites

## REFERENCES

- Government of Kenya (1994): *National Environment Action Plan*. Nairobi, Government Printer
- Government of Kenya (1999): *National Policy on Water Resources Management and Development*. Nairobi, Government Printer
- Government of Kenya: *Policy Paper on Environment and Development. Sessional Paper No. 6 of 1999*: Nairobi, Government Printer
- HYDROLOGICAL PROCESSES. 26, pg 4038–4049 (2012). Shimelis Behailu Dessu and Assefa M. Melesse *Modeling the rainfall-runoff process of the Mara River Basin using the Soil and Water Assessment Tool (SWAT)*. John Wiley & Sons, Ltd.
- International Standards For Environmental Management Systems*. (e.g. ISO 14000 standard series, life cycle analysis etc.)
- LVBC & WWF-ESARPO (2010). *Assessing Reserve Flows for the Mara River*. Nairobi and Kisumu, Kenya.
- Ministry of Health, *Occupational safety and health policy guidelines for the health sector in Kenya*, July 2014
- Ministry of Medical Services and Ministry of Public Health and Sanitation, Kenya: *National Guidelines for Safe Management of Health Care Waste*, Government of Kenya, January 2011.
- National Environment Management Authority – NEMA (2009): *Bomet District Environment Action Plan – DEAP (2009 – 2013)*
- Ng’eno Edgar (2016). *Impact of Land Use Land Cover Change on Stream Flow in Nyangores Sub-catchment Mara River, Kenya*. Kenyatta University.