TECHNICAL STUDIES, DESIGN AND SUPERVISION OF WORKS PACKAGES 1 AND 2 IN KISUMU CITY AND SATELLITE TOWNS UNDER LVWATSAN PROGRAM

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR KISUMU WATER SUPPLY AND SANITATION PROJECT

DECEMBER 2020

CERTIFICATION

Environmental and Social Impact Assessment- December 2020 Final Report

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EXEUTIVE SUMMARY

1.0 Introduction

In this section, we present general information that summarizes the findings of the Environmental and Social Impact Assessment (ESIA) for the proposed Kisumu Water and Sanitation Project. The objective of this study was to evaluate the environmental and social impacts that are likely to emanate from construction, operation and decommissioning phases of the proposed project. We have, as a way forward suggested ways of minimising the identified adverse impacts and optimizing the positive impacts.

2.0 Proposed Project

The proposed project has two components namely water supply component and sanitation component. For the water supply component, the proposed works will include rehabilitation of existing problematic lines in lower CBD; extension along the bypass highway to connect Nyamasaria lines better from Kibuye reservoir; and reinforcement of existing lines in Kadero area. A total of five kilometres of water pipeline will be layed during the works. With regard to sanitation facilities, the general scope of works will involve rehabilitation of 11.962km of sewer line and extension of 20.927km of the line within Kisumu city. A total of 32.888km will be rehabilitated, replaced or extended. The works for Nyalenda ponds include desludging of the middle treatment line and fencing of the site.

3.0 Objective of the Project

The general objective of this project is to improve the water and sanitation services within Kisumu city for the benefit of residents of the city.

4.0 Scope of works

For the water supply component, the proposed works will include rehabilitation of existing problematic line in lower CBD; extension along the bypass highway to connect Nyamasaria lines better from Kibuye reservoir; and reinforcement of existing lines in Kadero area. A total of five kilometres of water pipeline will be layed during the works. For the wastewater works, the works will include rehabilitation of main trunk sewer line in Manyatta; extension in Migosi; rehabilitation and extension in Manyatta North; rehabilitation and extension in Manyatta South; extension along Auji river; extension along Nairobi Road in Nyamasaria; rehabilitation of main collector to Nyalenda ponds; rehabilitation and extension along ring road; and extension along Nairobi road in city centre. Others include extension and rehabilitation around Kibuye market; rehabilitation and extension around Shaurimoyo high school and Nubian village; rehabilitation and extensions in Kaloleni estate; rehabilitation and extensions in Polyview estate; extension along Ondiek highway; extension next to railway station; rehabilitation within CBD; and rehabilitation and extension next to Kenya Breweries.

5.0 Objective of ESIA study

The general objective of the ESIA investigations is to carry out a systematic examination of the present environmental situation within the project area to determine whether the proposed project will impact adversely on the physical and biological elements of the environment within the project area. This is in line with Section 58 (1) of EMCA 1999 that requires proponents to carry out ESIA on projects that appear in the Second Schedule of the Act.

6.0 Study methodology

The methodologies used in the study include identification, collection, and analysis of environmental baseline data; identification of impacts; analyses and evaluation of impacts; formulation of mitigation measures for significant negative impacts; development and analysis of project alternatives, and development of environmental/social management and monitoring plans.

7.0 Study findings

It was noted during the study that some areas of Kisumu City like lower Migosi are not served by sewerage system. It was also noted that residents in the affected areas release raw sewage into the local storm water drainage systems. This untreated water ends in the local drainage channels and ultimately into Lake Victoria. It was also noted that access roads in most residential areas are earth roads which more often than not get muddy during rainy season. The roads are narrow and have been encroached by private developers who have constructed various business premises within road way leaves. Other issues noted within the project area that may compromise implementation of the proposed project and associated infrastructure include: the encroachment of road reserve by private developers and encroachment of sewer way leaves by development projects. Buildings covering the entire plot areas; release of raw sewer into storm water drainage systems; location of sewerage infrastructure in private compounds; blocked access between buildings; manhole chambers covered underground; blocked manhole chambers; narrow access roads and manholes chambers lacking covers were also noted during this study. With regard to Nyalenda wastewater treatment ponds, it was not that stench from the anaerobic ponds is a major nuisance within the neighbouring area while erosion of walls of the treatment ponds was contributing to sludge load within the ponds. Encroachment of the site by neighbouring community members and lack of appropriate sludge disposal site were also issues noted during this study

8.0 Public Consultation

Public participation in this project was achieved through consultation with the client and the neighbouring community. This was done through direct interviews and questionnaire administration. It emerged from the stakeholders' consultation that the project is welcome in the area as they do not anticipate any negative impacts from its construction and operation.

9.0 Impact Assessment Criteria

The criteria applied in this study are based on industry standards for impact assessment, adopted for use in the assessment of the proposed project impacts. The purpose of impact assessment is to assign relative significance to predicted impacts associated with the project, and to determine the manner in which impacts are to be avoided, mitigated or managed. The rating of impacts assumes that standard construction and operating procedures present in the project description will be implemented. The impact assessment criteria include the spatial context of project impacts; temporal context; and reversibility, magnitude and significance of potential impacts of project construction and operation. The potentially significant environmental and social impacts have been identified based on the nature of the receiving environment, analysis of the proposed activities and analysis of the issues raised by stakeholders during public participation process.

10.0 Environmental and Social Impacts

Environmental and social impacts associated with construction and operation phases of the proposed project include the following:

10.1 Disruption of socio-economic activities within the project area
Impacts on socio-economic front associated with the proposed project have been looked at from the point of view of individual properties that will be affected by project infrastructure. Most of the properties in question include business premises among them kiosks and shop verandas.

10.2 Disruption of services within the project alignment area
Construction of the project and associated infrastructure may lead to disruption of water services due to breakage of underground water pipes by construction machinery. Underground power and optic fibre cables may also be disrupted during excavation and trenching works.

10.3 Impact on fences and perimeter walls
These impacts shall emanate from destruction of individual properties including live fences, barbed wire fences and perimeter walls to provide way leave for project infrastructure.

10.4 Impact on public infrastructure
There are instances where the proposed project infrastructure will cross public roads and rail line thus disrupting traffic flow.

10.5 Blockage of drainage channels
Drainage blockages due to temporary disruption of surface runoff as a result of the construction process will be experienced.

10.6 Impacts of obtaining construction materials
The project will require some amount of materials for construction of project related infrastructure. Extraction and transportation of these materials are associated with various impacts including land degradation, creation of mosquito breeding areas and dust pollution

10.7 Accidents and Injuries to workers and residents
Work at the proposed site may involve hazards such as accidental falls into open trenches, slippery walkways, working at heights, exposure to energized circuits, and heavy equipment which have the potential of causing accidents and injuries.

10.8 Solid waste generation
Construction will result in the generation of various solid wastes, principally surplus aggregates, metal scraps, plastics (wrappings and containers) and wood which will potentially lead to environmental pollution.

10.9 Atmospheric Pollution
The expected air pollutants from the proposed project will include dust, particulate matter and gaseous emissions from construction materials. Dust will be generated from the excavations, batching activities, earth moving and materials delivery. Particulate matter will be generated by dry construction materials including sand, cement, gravel, murram, etc.

10.10 Noise Impact

Use of heavy construction machinery including excavators, water pumps and generators will lead to relative noise levels. Fabrication of site equipment and concrete mixing both at the contractor's workshop and at the construction site will generate significant noise levels.

11.0 Mitigation measures for adverse environmental and social impacts

A number of mitigation measures have been proposed for sustainable management of adverse impacts identified. They include the following:

11.1 Mitigation measures for disruption of socio-economic activities within the project area

(i) Kiosk owners who have constructed their kiosks within road reserves will be advised in advance to remove the kiosks before excavation activities begin. They will be allowed to reconstruct their kiosks after the pipes have been layed and trenches backfilled. The impacts will therefore be short term.
(ii) In situations where the facilities are outside the road reserve but have to be affected by the works, the affected individuals shall be compensated as per provisions of World Bank OP 4.12 and applicable Kenyan legislations.

11.2 Mitigation measures for disruption of services within the project alignment area

(i) The contractor shall liaise with Kisumu Water and Sanitation Company (KIWASCO) and private water service providers to restore all disrupted water services as soon as pipe laying and backfilling of trenched areas are finalised
(ii) The contractor shall liaise with Kenya Power Company to restore power cables cut during excavation activities as soon as pipe laying and backfilling of trenched areas are finalised.

11.3 Mitigation measures for impact on fences and perimeter walls

(i) The destroyed fences will either be restored by the contractor
(ii) Where destruction is significant, owners compensated after resettlement Action Plan are carried out and the properties valued.

11.4 Mitigation measures for impact on public infrastructure

(i) All excavated soil shall be used for backfilling of trenched areas and site restoration.
(ii) Damaged road surfaces shall be adequately restored to pre-excavation conditions.
(iii) Excess spoil materials shall be disposed of in approved tips in compliance with existing laws, rules and regulations

11.5 Mitigation measures for blockage of drainage channels

(i) Working under dry weather conditions and unclogging all blocked storm water drainage channels shall be implemented.

11.6 Mitigation measures for impacts of obtaining construction materials

(ii) Maximise the re-use of excavated materials in the works, as fill.
(iii) Site quarries and borrow pits carefully so as to minimise impacts on existing land uses.
(iv) Strip all available topsoil from borrow pits and quarries and store it safely for use in site restoration.
(v) Close all borrow pits and quarries in accordance with an approved plan to maximise their long-term biological productivity (capacity for plant growth) and minimise health and safety hazards.

(vi) Carry out EIA for quarry site if new quarries are to be opened for purposes of this project

11.7 Mitigation measures for accidents and Injuries to workers and residents

(i) The Contractor shall conform to all the stipulations of the Occupational Health and Safety Act, 2007. The Act requires the designation of a Health and Safety representative when more than 20 employees are deployed;
(ii) The contractor shall provide ample warning signs, guard rails, warning tape, etc., around open excavations, stacks of material, debris, etc. and shall be held liable for all claims as a result of neglect of such precautions and provisions;
(iii) Use of requisite Personal Protective Equipment (PPE) at all times during construction works

11.8 Mitigation measures for solid waste generation

(i) Bins/ receptacles shall be placed at strategic locations within the site as collection centres to facilitate separation and sorting of the various types of wastes;
(ii) Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable to the supervising architect and environmental consultant;
(iii) Construction site management plans will be required for all works. This plan will include a waste management plan for all activities during the construction period.

11.9 Mitigation measures for noise Impact

(i) Schedule road traffic movements to normal working hours (08H00 –17H00).
(ii) Where need be, all exposed workers will be provided with functional ear muffs, whose use is mandatory, and closely enforced, monitored and supervised.

11.10 Mitigation measures for atmospheric Pollution

(i) Impose speed limits (10 km/h in all areas within the site boundaries).
(ii) Damping down of access roads, stockpiles and cleared areas must take place to minimize dust pollution.
(iii) Dust and air pollution due to dust when excavated material is stock piled, should be limited by means of wetting (particularly dry season), covering with foil or working in small sections so that the trenches are backfilled with excavated soil within shortest possible period (maximum 2 days).

7.0 Conclusions and recommendations

It has been recommended that a Resettlement Action Plan (RAP) be carried out since sanitation components are expected to trigger resettlement impacts. Other recommendations made include community mobilisation and sensitisation; regularization of development projects within the project area; opening up of the way leaves for water and sewerage; enforcement of city by laws, rules and regulations; rehabilitation of water supply and sewerage infrastructure; acquisition of land around the treatment ponds; construction of a laboratory for wastewater quality monitoring and diversion of wastewater into the wetland area

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ACRONYMS AND ABBREVIATIONS

AFD	French Development Agency
CBD	Central Business District
DMM	Delegated Demand Management
EA	Environmental Audit
EMCA	Environmental Management and Coordination Act
EMP	Environmental Monitoring Plan
ESAP	Environmental and Social Assessment Procedures
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standard
LTAP	Long Term Action Plan
LVSWSB	Lake Victoria South Water Services Board
LVSWWDA	Lake Victoria South Water Works Development Agency
KIWASCO	Kisumu Water and Sanitation Company
KWSSP	Kisumu Water Supply and Sanitation Project
NEMA	National Environment Management Authority
NHC	National Housing corporation
NEAP	National Environment Action Plan
NRW	Non Revenue Water
O&M	Operation and Maintenance
OP/BP	Operational Policy/ Bank Procedures
OSHA	Occupational Health and Safety Act
PAPs	Project Affected Person
PPE	Personal Protective Equipment
RAP	Resettlement action Plan
STAP	Short Term Action Plan
TOR	Terms of Reference
WSB	Water Service Board
WASREB	Water Services Regulatory Board
WSTF	Water Service Trust Fund
WRMA	Water Resources Management Authority

CHAPTER 1

1.0 INTRODUCTION AND BACKGROUND INFORMATION

1.1 Introduction

Every human being on earth should have access to safe and affordable drinking water. That's the goal for 2030. While many people take clean drinking water and sanitation for granted, many others don't. Water scarcity affects more than 40 percent of people around the world, and that number is projected to go even higher as a result of climate change. If we continue the path we're on, by 2050 at least one in four people are likely to be affected by recurring water shortages. But we can take a new path - more international cooperation, protecting wetlands and rivers, sharing water-treatment technologies - that leads to accomplishing this goal. It is estimated that more than half the world's population now lives in cities, and that figure will go to about two-thirds of humanity by the year 2050. Cities are getting bigger. In 1990 there were ten "mega-cities" with 10 million inhabitants or more. In 2014, there were 28 mega-cities, home to 453 million people. A lot of people love cities; they're centers of culture and business and life. These cities are also often centers of extreme poverty. To make cities sustainable for all, there is need to create good, affordable public housing. There is also need to upgrade slum settlements, invest in public transport, create green spaces, and get a broader range of people involved in urban planning decisions. In this way, we can keep the things we love about cities, and change the things we don't love about them

1.2 Project background and rationale of Environmental and Social Impact Assessment study

The city of Kisumu is located in Western Kenya, on the shores of Lake Victoria, the second largest fresh water lake in the world. Kisumu is the third largest city in Kenya with a population of about 260,000 inhabitants, among 970, 000 at the scale of the County. The public water supply and sanitation services in Kisumu city had deteriorated into a deplorable state of repair by the early 2000's, due to a lack of public investment since the 1980's and subsequent lack of maintenance by the former Kisumu Municipal Council. At this time, almost 50% of the population had no access to the water and sanitation services and were also receiving water of a poor quality at a high cost. Furthermore, only 50% of the residents had uninterrupted services.

Following the inception of the Lake Victoria South Water Works Development Agency (LVSWWDA) as the asset holding and development agency responsible for the water and sanitation services in Kisumu city under the Water Act 2016, the Kisumu Water Supply and Sanitation Project (KWSSP) was initiated by the Ministry of Water and Irrigation to develop the water supply and sanitation systems to adequately serve a projected population in the service area of 663,000 by the year 2031. LVSWWDA was the executing agency with overall responsibility for implementation of the project. In this context, the French Development Agency's (AFD's) intervention in Kisumu began in 2005 with the financing of the Kisumu Water Supply and Sanitation Project (KWSSP). This project was undertaken in two steps namely Short Term Action Plan (STAP) and Long Term Action Plan (LTAP)

Short Term Action Plan was meant to restore the capacity of the existing systems to near design, which was completed in 2007 and mainly consisted in rehabilitation of the Dunga source works (Lake Victoria) to deliver 21,500m^3/day and rehabilitation and extension of the distribution system. These works were implemented between 2006 and 2007. Long Term Action Plan was divided into two phases. Phase 1 consisted of emergency works, to increase the capacity of the

Dunga source to 45,500m³/day. These include construction of a raw water transmission pipeline and associated infrastructure and construction of a 24,000 m³/day Water Treatment Plant including chemical house, storage tank and associated infrastructure). These works were implemented between 2009 and 2011 but were not substantially completed.

Phase two works were split into three works packages. Package 1 consisted of construction of Water Supply Distribution System and Reservoirs. Works commenced in 2011 and were substantially completed in 2013. Most of the Delegated Management Model (DMM) component (in informal settlements) was removed from Package 1 to offset the increased cost of other Package 1 items following the design review. Package 2 consisted of construction of Kajulu Intake, Water Treatment Works and Raw Water Pipelines (with option for construction of Kajulu dam). Works commenced in 2012 and were substantially completed in May 2014, excluding the construction of Kajulu dam which was reported at a later phase in the absence of sound feasibility study justifying these works. Package 3 consisted of construction of Sewerage System, Nyalenda Ponds, and Pumping Stations. For various reasons (budget limitation in relation with changes in the designs related to package 1, low performance from the Package 3 contractor among other reasons), the initial scope of the works included in Package 3 was significantly reduced.

1.3 Need for water and sanitation projects in Kisumu town

Even though some works have been carried out in Kisumu city with regard to water supply and sanitation, it appears that there are strong needs for further investments in water and sanitation sector in Kisumu. In as much as the previous projects significantly improved water and sanitation situation in Kisumu town, it is evident that many low-income residents living in informal settlements and peri-urban areas lack access to both clean water and to safe and environmentally sound sanitation facilities. With regard to water supply, previous projects mainly focused on water intake and treatment works as well as transmissions mains and storage tanks. There is now a stronger need for rehabilitating/renewing the network which is in poor conditions and to extend the secondary distribution system from the various tanks which were built under KWSSP. The present situation is characterized by a reticulation network (including customer connections) that is not yet to the scale of the production potential, still rather unexploited with distribution reservoirs systematically full in Kibuye, despite the high demand in fast-growing areas. A significant proportion of wastewater network is in bad conditions and requires rehabilitation. The coverage rate is still very low and should be extended in order to use to the full existing treatment capacity

1.4 Objective of the project

The general objective of this project is to improve the water and sanitation services to the residents of Kisumu city.

1.5 Scope of Works

For the water supply component, the proposed works will include rehabilitation of existing problematic line in lower CBD; extension along the bypass highway to connect Nyamasaria lines better from Kibuye reservoir; and reinforcement of existing lines in Kadero area. A total of five kilometres of water pipeline will be layed during the works. For the wastewater works, the works will include rehabilitation of main trunk sewer line in Manyatta; extension in Migosi; rehabilitation and extension in Manyatta North; rehabilitation and extension in Manyatta South; extension along Auji river; extension along Nairobi Road in Nyamasaria; rehabilitation of main collector to Nyalenda ponds; rehabilitation and extension along ring road; and extension along

Nairobi road in city centre. Others include extension and rehabilitation around Kibuye market; rehabilitation and extension around Shaurimoyo high school and Nubian village; rehabilitation and extensions in Kaloleni estate; rehabilitation and extensions in Polyview estate; extension along Ondiek highway; extension next to railway station; rehabilitation within CBD; and rehabilitation and extension next to Kenya Breweries. The works for Nyalenda ponds include desludging of the middle treatment line and fencing of the site.

1.6 Significance of the project

The following will be achieved as a result of implementation of the proposed project:

(i) Better access to safe drinking water leading to improved standards of living; and changes in exposure to both communicable and non communicable diseases;
(ii) Improvements in domestic hygiene and a reduction in health risks that have all along been associated with poor water quality or inadequate access to sanitation services;
(iii) Management of cases of burst sewer pipes that currently leads to pollution of surface and ground water resources;
(iv) Local people will be granted the opportunity to channel their wastewater in a properly functioning system;
(v) Promotion of a more sustainable use of water resources with improvements in the infrastructure to reduce losses and introduction of better metering and billing procedures to encourage more efficient use of water;
(vi) A comprehensive metering program (of production and consumers) during expansion of water supply infrastructure is expected to reduce the present rate of Non Revenue Water (NRW) (technical and commercial losses) to a more acceptable level; and
(vii) General improvements in service reliability and pressure levels;

1.7 Background to Environmental and Social Impact Assessment

The initial part of this study required the consultant to review previous ESIA documents, feasibility study reports and design reports in order to determine gaps in the existing documents and studies and therefore allow for the determination of the type and level of environmental and social assessment that would be necessary for the proposed project. The documents reviewed include Environmental and Social Impact Assessment Project Report prepared as part of the feasibility study in 2005 and the ESIA summary contained in the design document that was prepared in 2006/2007. A number of gaps in information and processes were noted in the documents reviewed and this necessitated the need for detailed environmental studies for the proposed project. The gaps noted include lack of proper public consultation and disclosure; inadequate project description; lack of detailed baseline environmental status of the project areas and generalized impact description and mitigation measures. Another significant issue noted during the review of previous ESIA reports includes the generic environmental management and monitoring plan with respect to safeguards implementation, roles and responsibilities of the environmental personnel of the contractor and other stakeholders. The ESIA carried out in 2005 also recommended a separate ESIA for resettlement related impacts related to sewerage project before implementation of the project components that are likely to trigger resettlement impacts. This ESIA has therefore been carried out to address the issues noted and ensure that the proposed project is implemented in a manner that complies with applicable rules and regulations and sector's best practice.

1.8 Objectives of ESIA study

1.8.1 General Objective

The general objective of this environmental and social Impact assessment was to carry out a systematic examination of the present environmental situation within the project area to determine whether the proposed project activities will adversely impact on the physical and biological elements within the project area. This is in compliance with Section 58 (1) of Environmental Management and Coordination Act (EMCA) 1999 that requires proponents to carry out ESIA on projects that appear in the Second Schedule of the Act.

1.8.2 Specific Objectives of ESIA Study

Specific objectives of this ESIA include the following:

(i) To highlight environmental issues of the proposed project with a view to guiding policy makers, planners, stakeholders and government agencies in understanding the implications of the proposed project on environmental elements within the project area;
(ii) To review existing legal, institutional and policy framework relevant to the proposed project;
(iii) To anticipate environmental and social impacts associated with implementation of the proposed project with a view to coming up with mitigation measures for adverse impacts noted;
(iv) To assess the relative importance of the impacts of alternative plans, design and sites;
(v) To generate baseline data for monitoring and evaluation of how well the proposed mitigation measures are implemented during the project operation period;
(vi) Develop an Environmental and Social Management Plan (ESMP) to guide in decision making and for future auditing;
(vii) Raise stakeholder awareness on the impact of the project on the environment; and
(viii) Develop an ESIA report in conformity with the EMCA 1999 and Environmental (Impact Assessment and Audit) Regulations 2003.

1.9 Scope of the study

The study has been conducted to evaluate the potential and foreseeable impacts of the proposed development. The physical scope is limited to the proposed site and the immediate environment as may affect or be affected by the proposed project and associated infrastructure. Any potential impacts have been evaluated as guided by EMCA 1999 and the Environmental (Impact assessment and Audit) Regulations 2003. This report includes an assessment of impacts of the project on the proposed site and its environs with reference to the following key issues:

1.9.1 Review of policy, legal and administrative framework

Several policies, legal and administrative arrangements and protocols that have direct relevance to the proposed development were reviewed. This was in an attempt to establish the frameworks within which the significance of the various impacts anticipated due to implementation of the proposed project can be evaluated. A lot of emphasis has been placed on legal and policy frameworks that have a direct relevance to water and sanitation sector. These include the constitution of Kenya 2010, Kenya Vision 2030, National Environment Policy 2013, EMCA 1999, Water Act 2016 and Water Quality Regulations 2006 among others. International agreements and conventions that are relevant to the water and sanitation sector and which have been reviewed include the Vienna Convention for Protection of Ozone Layer, United Nations Framework Convention on Climate Change, RAMSAR Convention on wetlands of international importance and United Nations Convention on Biological Diversity, 1992. World

Bank guidelines relevant to the proposed project including OP/BP 4.01 on Environmental Assessment; OP/BP 4.04 on Natural Habitats; OP 15.50 on Disclosures; and OP/BP 4.12 on Involuntary Resettlement have also been reviewed. These have formed the basis for the determination of the significance of the various impacts associated with the proposed project.

1.9.2 Description of the proposed project.

The proposed project has been described in terms of location and physical characteristics of the project area; design of the water and sewerage systems; products, by-products , waste and waste management methods. This approach has been pursued since it makes it possible to know the likely sources of impacts, how the impacts relate to one another in terms of being direct, indirect, cumulative, reversible etc. in order to propose sustainable mitigation measures for the management of adverse impacts noted.

1.9.3 Review of the baseline information.

Baseline information forms the basis of degree and magnitude of the impact since they give the conditions of the environment in terms of resources and impacts before implementation of the proposed project and associated infrastructure. This helps in the monitoring exercise and for that matter, brings into focus the extent of the accuracy of the prediction of the impacts in question.

1.9.4 Assessment of the potential environmental impacts.

Assessment of environmental impacts on the biophysical, socio-economic, religious and cultural aspects is the very reason why any ESIA study is carried out. Environmental aspects associated with any project are normally felt on natural or human elements. It is the direction, magnitude and extent of the impacts on these elements that make the impact either positive or negative. These are the various social and physical parameters that are in continuous interplay within the general environment of any project and it is how the project will affect or will be affected by these parameters that eventually lead to positive or negative perception in environmental terms.

1.9.5 Proposition of alternatives.

Any planning activity must work towards giving sustainable alternatives with regard to resource allocation. ESIA as a planning tool must therefore give options that can be pursued in order to get sustainable results. The alternatives in this project have been looked at in terms of product mix, site, technology, design, scale and extent. The comparisons of these with the proposed project option give rise to the best project option.

1.9.6 Development of mitigative measures.

Mitigative and management measures are meant to limit the extent of negative impacts that may arise as a result of a particular development alternative. Potentially negative environmental impacts of a project may be tolerated by both environmental elements and neighbouring populations depending on the mitigative measures proposed for implementation. Measures to manage adverse impacts associated with implementation of the proposed project have been included in this report to promote sustainable development principles.

1.10 Environmental and Social Impact Assessment (ESIA) Team

The ESIA study was conducted by a team of professionals drawn from various disciplines who ensured that all matters relating to the project as it impacts on the neighbouring environment were adequately covered and critical stakeholders consulted. Table 1.1 below gives a summary of ESIA team composition and tasks assigned to each member of the team.

Table 1. 1: ESIA Team Composition and task assignment

No	Name	Position	Task
1	Eng. Caleb Opati	Project Director / Water Treatment Specialist/ Civil Engineer	• Liaise with the Client to ensure that the project is carried out as provided for in the contract; • Define tasks and work programmes for all Consultants; • Maintain quality control of all works; • Prepare all technical documents/reports relevant to the assignment; • Ensure that adequate resources are allocated to the field team; • Liaise with field team to ensure that data collection exercise is carried out as per schedule; • Work in consultation with the Team Leader for expeditious delivery of outputs; • Coordinate report writing; • Chair all review and consultative meetings; • Establish and maintain quality control; • Maintain work standards by ensuring that reporting schedules are adhered to; • Manage the flow of information between Field Team and the Joint Venture; and • Participate in any activity that may require your expertise.
2	Amimo Odongo	EIA Lead Expert and Team Leader	• Review of environmental policies, legislative and institutional frameworks; • Review of data on planned and existing key development projects proposed for implementation within the project area; • Collection of baseline data on environmental conditions; • Assessment of the impacts of future similar projects on the environment within the project area; • Gather data and information on existing environmental problems within the project area; • Propose measures to mitigate existing and future adverse impacts; • Consider options to improve the environmental benefits; • Carry out analysis of alternative means of implementing the projects; • Recommend feasible and cost effective mitigation measures for negative impacts; • Develop an Environmental/Social Management and Monitoring Plan; • Lead field team and ensure that data collection exercise is carried out as per schedule;

			• Coordinate report writing and ensure that all relevant information are included in the report; • Compile Draft and Final ESIA Reports; • Present draft reports to the Client as per schedule; and • Incorporate Comments from the client into the draft report and prepare final report
3	Christine Amondi Ponde	Sociologist	• Review environmental policies, legislative and institutional frameworks; • Review available reports and documents from previous studies; • Asses the impacts of future similar projects on social environment within the project area; • Gather data and information on existing social problems within the project area; • Carry out social analysis of potential impacts using PRA methods; • Carry out analysis of the implications of anticipated emergence of new social challenges with the aim of recommending appropriate mitigation measures; • Consider options to improve social benefits; • Carry out analysis of alternative means of implementing the projects; • Recommend feasible and cost effective mitigation measures for negative social impacts; • Develop a Social Management and Mitigation Plan; and • Develop a monitoring plan;
4	Julius Omondi	Assistant Engineer- Water and Sanitation	• Review of technical drawings to ensure that they meet the required standards for projects of this nature; • Review of data on baseline environmental conditions of the project area including soil to ascertain their suitability for the proposed project; • Review of technical documents related to the project • Stakeholder engagement on technical aspects of the project; • Consideration of options to improve project benefits; • Carrying out analysis of alternative means of implementing the projects; and • Recommending feasible and cost effective mitigation measures to prevent or reduce significant negative impacts identified to acceptable levels.
5	Stephen Ochieng	Environmentalist	• Review of environmental policies, legislative and institutional frameworks; • Review of data on planned and existing key development projects proposed for

			implementation within the project area; • Collection of baseline data on environmental conditions; • Assessment of the impacts of future similar projects on the environment within the project area; • Gather data and information on existing environmental problems within the project area; • Proposition of measures to mitigate existing and future adverse impacts; • Consideration options to improve the environmental benefits; and • Recommendation feasible and cost effective mitigation measures for negative impacts;
6	Cynthia Shitsukane	Assistant Engineer- Water and Sanitation	• Review of technical drawings to ensure that they meet the required standards for projects of this nature; • Review of data on baseline environmental conditions of the project area including soil to ascertain their suitability for the proposed project; • Review of technical documents related to the project • Stakeholder engagement on technical aspects of the project; • Consideration of options to improve project benefits; • Carrying out analysis of alternative means of implementing the projects; and • Recommending feasible and cost effective mitigation measures to prevent or reduce significant negative impacts identified to acceptable levels.

1.11 Environmental and Social Impact Assessment Outputs

The following are the outputs of this Environmental and Social Impact Assessment study:

(i) A detailed Environmental and Social Impact Assessment report outlining baseline environmental conditions, project description, project alternatives, environmental impacts and mitigation measures proposed.
(ii) A comprehensive Environmental Management Plan (EMP) detailing institutional structure with respect to safeguards implementation; roles and responsibilities of the environmental personnel of the contractor and other stakeholders in the project; capacity building requirements, and consultant support required; and costs for implementation of mitigation measures and provisions for monitoring of environmental parameters during construction and operation phases of the project including any capacity building requirements.

CHAPTER 2

2.0 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT METHODOLOGY

2.1 Approaches to the ESIA Study

2.1.1 General

The purpose of conducting the ESIA study was to ensure that the proposed project is environmentally sound and fits well within existing land uses. The study has described and quantified impacts associated with the proposed project on the physical environment and neighbouring populations and land uses. The approach to the ESIA comprised six phases that were pursued by the ESIA consultants to anticipate environmental and social impacts associated with the proposed project. The stages of the study include Screening; Scoping; Studies; Impact Assessment; Disclosure; and Implementation (Figure 1). Stakeholder consultation forms a continuous and important part of the EIA process, occurring in five phases of the ESIA study.

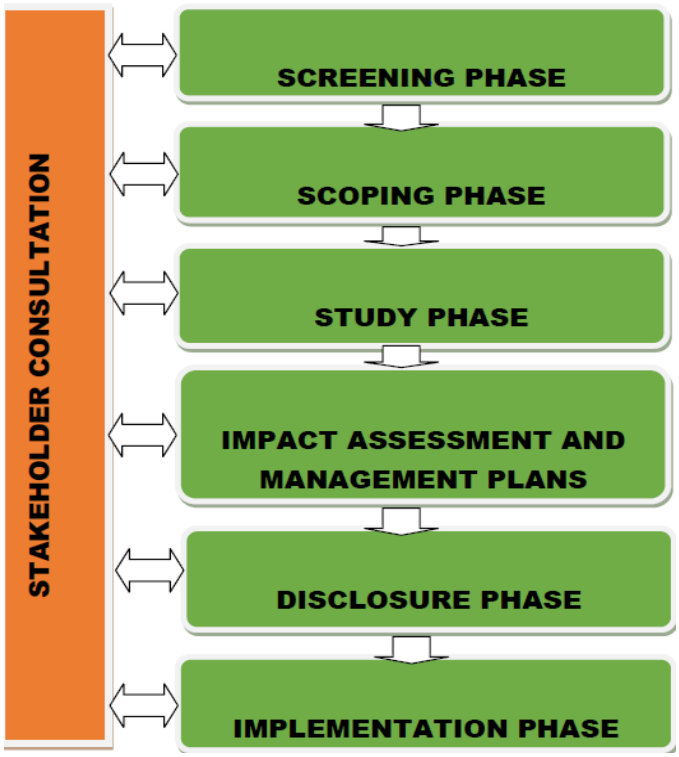

Figure 1: The six phases of ESIA study pursued by the consultants

2.1.2 Screening Phase

Screening is referred to Initial Environmental Examination (IEE) and was carried out to determine whether or not a full ESIA study was required for the project. Screening was done to determine the significance of the project's environmental impacts which was to ultimately inform whether a full ESIA study is required. The significance of the impacts depend on such factors as the sensitivity of the area likely to be affected by the project activities; public health and safety issues; the possibility of uncertain, unique or unknown risks and the possibility of having individually insignificant but cumulatively significant impacts among others. This exercise

involved project and site description; collection of baseline data; data analysis; evaluation of significance of environmental impacts; evaluation of project alternatives; and consultation and public participation.

2.1.3 Scoping Phase and Development of Terms of Reference (ToR) for the study

In the Scoping Phase, key issues to be investigated and assessed during the subsequent phases of the ESIA process were identified and the range and extent of the studies to be conducted determined. The primary Project stakeholders were also identified during the Scoping Phase. Desktop analyses and stakeholder interviews were conducted during this phase to ascertain whether additional information was needed to evaluate baseline conditions and potential impacts within the Project area. The desktop evaluation included reviews of pertinent environmental and social data collected from external sources and previous studies of the Project area. The study team met with stakeholder groups to discuss the scopes of the proposed studies including alternatives and the criteria for the impact assessment and to determine if additional baseline data was required for a comprehensive analysis.

2.1.4 Study Phase

In the Study Phase, desktop and field studies were conducted to evaluate the key issues identified during the Scoping Phase. The goal of this phase was to provide a detailed description of the affected area and establish the environmental and social baseline that will be used in the Impact Assessment Phase. The Study Phase for the Project begun as soon as the Terms of Reference was approved by NEMA.

2.1.5 Impact Assessment Phase

During the Impact Assessment Phase, the effects and impacts of the proposed Project were determined. To identify and assess the magnitude of potential impacts associated with or resulting from Project activities, the ESIA team used professional judgment from specialists, fieldwork, and other desktop analyses to identify potential impacts and their interactions. Impact assessment was undertaken as follows:

(i) Characterization of the baseline conditions – the existing conditions before the Project is undertaken and any effects are generated;
(ii) Identification of sources of impacts and the impacts themselves that are generated by any aspect of the Project;
(iii) Rating impacts before any mitigation (for negative impacts) or enhancement (for positive impacts) is implemented;
(iv) Suggesting mitigation and enhancement measures to address the impact, as appropriate; and
(v) Rating impacts after mitigation to produce a “residual” impact rating.

The activities carried out during the ESIA process included desk studies and fieldwork that included direct interviews, transect walks along the proposed water and sewerage routes and direct observations leading to the preparation of this Study Report. Below is a detailed description of activities undertaken during the study

2.2 Reconnaissance visit

This was the initial site acquaintance visit whose main aim was to understand the project area, identify constraints, and develop impressions on topography, soils, existing developments and practicality of developing water and sanitation infrastructure within the proposed area. It also

marked the major inception meeting with representative of project proponent and local administration offices represented in the area to pave way for further involvement of their officers in subsequent meetings and consultations. The main objective of these meetings was to agree on expectations of the assignment, its execution procedure, focal and reference points of the proposed project and work plan. An inception report for the study was prepared at this stage.

2.3 Literature review

This is an indirect method of data gathering and published data both in the Internet and from physical sources were collected. Both quantitative and statistical information from relevant secondary sources including various documents and reports on project area and Kisumu county in general were collected and reviewed. This helped in the identification of the gaps existing in the available information and enabled the ESIA team to arrange to undertake detailed field investigations. Special emphasis was placed on climate; hydrology; soils; national environmental laws and regulations; human population and settlements; and socioeconomic infrastructure within the project area. Literature review involved review of the following data associated with the project area.

2.3.1 Hydrology and Water Quality

The assessment of hydrological and water quality conditions in the study area were based on review of topographic maps, review of relevant reports, and on-site field inspections. Field inspections included observation of slopes and drainage on the sites. Evidence of slope instability was sought. The potential relationship between drainage courses and adjacent trails was examined, as was the effect of vegetation on surface soil conditions and water quality. The locations of storm drains discharging into natural drainage courses were noted, as were the effects of these discharges on flows and erosion features.

2.3.2 Vegetation

The assessment of the potential effects of project construction on vegetation was considered within the proposed project site, buffer areas and regional area. The Project site includes areas that will be directly disturbed by project construction. Buffer areas (adjacent areas) include a 1 km wide area surrounding the project site. The regional area specified in this assessment includes areas outside the 1km buffer area.

A review of publicly available data, existing information, literature and other data was completed before initiating fieldwork. This office-based review included the examination of maps to determine the extent of natural vegetation on the sites and the variability in vegetation composition. The review also included previously completed reports on the vegetation of the study areas and sensitive ecosystem inventory mapping of the sites. Information about rare and endangered plant species and plant communities was obtained from the State of Environment Report. Information provided through interviews with knowledgeable people from the project area was incorporated into the baseline data.

The initial field visits were conducted within the study area between September 2017 and March 2018 to confirm vegetation composition and distribution of the existing vegetation features of the project sites. The second round of field visits was cried out within the project area in August 2019. This helped in ascertaining changes that may have occurred in vegetation composition since the initial site visits.

2.3.3 Wildlife and Wildlife Habitat

The assessment of the potential effects of project construction on wildlife considered wildlife use, habitat and habitat features. A review of publicly available data, existing reports and literature was completed before initiating field work. Information collected during the office-based review was used to identify potential habitat for rare and at-risk wildlife.

Field surveys were conducted along the proposed pipeline routes and neighbouring areas. Wildlife specialists walked within these areas and documented topography; observed wildlife species; noted wildlife habitat and habitat features (*e.g.*, wildlife trees, stick nests, and perch trees); and searched for signs of use by rare or at-risk wildlife. A "purposeful meander" technique was used to survey the areas and more detailed searches were performed at locations where potentially important habitat or habitat features were observed.

2.3.4 Fish

The proposed water supply and wastewater treatment works is located within Kisumu city which sits at the shores of Lake Victoria. Project activities are therefore likely to have significant impact on fish species. Information on the main water resources within the project area including lakes, rivers, dams and wetlands was gathered. The pollution levels of these water resources were looked at from the point of view of being habitats to various fish species. Information on the variety of fish stocks in these water bodies including native and introduced species were gathered from secondary sources. The impacts of the proposed project on fish stocks within the local water bodies were ultimately assessed.

2.3.5 Land Use

The Land use section of this ESIA builds on information collected for the siting analyses, which included a review of existing planning documents, site visits, and discussions with representatives of the client and government officials to understand existing and planned land uses and potential impacts of the proposed works on these land uses. News articles, media releases, and information on other community initiatives were also reviewed to understand the regional and local context. A lot of data was borrowed from the feasibility study and design documents. Visits to the sites were conducted by the ESIA experts to confirm the use of the sites and adjacent land by property owners and local residents.

2.3.6 Traffic

To determine traffic flow within the project area roads, the ESIA team reviewed relevant traffic flow data, plans, and reports and inspected the relevant routings and road and railway system within the affected neighbourhoods during site visits. This was done to determine the existing vehicular volumes on preferred route to the proposed facility, including accident history where available and also to identify the order of magnitude of current pedestrian and bicycle traffic in the transportation corridors of the preferred routes and how this may be impacted on by construction activities. The data review also helped in forecasting the type and amount of traffic that would be generated by the project during construction period and identifying any relevant transportation and traffic related issues that may arise during construction process. The level of impact of traffic on affected neighbourhoods and road users were noted and potential mitigation measures to reduce or avoid traffic impacts suggested.

2.3.7 Noise, Vibration and Lighting

The Noise and vibration section has been prepared based on facility design information and adjacent land uses. The ESIA experts surveyed the area identifying the existing sources of noise impacts and comparing this with the project situation. Noise and vibration effects during facility construction are assumed to be the same as a typical construction project and to follow all applicable municipal bylaws. Based on the foregoing assumptions, potential effects of noise and vibration on surrounding areas were identified and mitigation measures proposed.

2.3.8 Human Health

The assessment of the potential effects of project construction on human health was considered within project alignment areas. Data on existing baseline information in terms of site conditions, land uses within project alignment areas, neighbouring facilities and their distances from the project site, any other unique feature of the project area that may be affected by project construction and operation activities were collected and analyzed. Information on water quality and access, prevalent diseases within the project area, solid waste and wastewater management, sanitation issues and physical and biotic factors were collected and analyzed. Existing conditions of infrastructure including roads, water supply, noise generating activities and whether there are any pollution sources within project vicinity was analysed. The collected data was used to assess potential impacts on health, safety and the environment both to the workers and the local community during construction and operation phases of the project.

2.3.9 Visual Aesthetics

Visual impacts are changes to the scenic attributes of the landscape brought about by the introduction of visual contrasts (e.g., development) and the associated changes in the human visual experience of the landscape. Visual impacts in this project arise from changes in available view of the landscape due to location of the project and associated infrastructure. Visual impacts in this study were determined through the subjective assessment of the visual receptors (i.e. residents, outdoor recreational areas etc) and the magnitude (scale) of the change in view. Sensitivity were looked at from the point of view of receptors location; the importance of receptor views; their activity (i.e. working, recreation or travelling through); expectations; available view; and the extent of screening of this view. These visual elements were considered in the assessment in comparison with present conditions.

2.4 Field visits

Field studies were undertaken to evaluate the types, mode of action and magnitude of the specific projected effects and impacts, both favourable and detrimental to the environment, natural resources and neighbouring land uses. This encompassed detailed study and analysis of water resources, sensitive ecosystems, proposed water and sewerage pipeline routing, human settlements, health and safety issues as well as general structure of the physical, biological and socio-economic environment. Transect walks were undertaken to review the informal settlements, the existing water supply and sewerage infrastructure and to identify the potential impacts of implementation of the proposed project on existing land uses. Transect walks were also undertaken to gather baseline data through observation of land use in close proximity to and within the proposed project area. Scenes of environmental and social significance were captured through photographs.

Plate 1: Consultation with local stakeholders during field visits

2.5 Key informant interviews

One-on-one interviews with representatives of the client and community members was undertaken to assist in gathering data and analysis of impacts to the local community and land uses within the project area. Key informants drawn from Kisumu Water and Sanitation Company (KIWASCO), County Government of Kisumu and Lake Victoria South Water Works Development Agency (LVSWWDA) were interviewed during the ESIA process. These interviews were conducted to augment and confirm data and information obtained using the other tools and methods.

CHAPTER 3

3.0 PROJECT DESCRIPTION

3.1 Nature of the project

The proposed project has two components namely water supply component and sanitation component. For the water supply component, the proposed works will involve rehabilitation of existing problematic lines in lower CBD; extension along the bypass highway to connect Nyamasaria lines better from Kibuye reservoir; and reinforcement of existing lines in Kadero area. A total of five kilometres of water pipeline will be layed during the works. With regard to sanitation facilities, the general scope of works will involve rehabilitation of 11.962km of sewer line and extension of 20.927km of the line within Kisumu city. A total of 32.888km will be rehabilitated, replaced or extended. The works for Nyalenda ponds include desludging of the middle treatment line and fencing of the site. Main activities associated with the works include geotechnical investigations, demolition of concrete structure, construction of concrete structure / installation of precast concrete culverts, excavations for structures, preparation of landfill site, pumping clear and medium loads water to other treatment lines, construction of track, sludge removal and fencing including installation of two gates

3.2 Existing Water Supply and Sanitation Infrastructure

3.2.1 Existing water supply infrastructure

Most of the water in Kisumu city is obtained from Lake Victoria, with a small percentage extracted from the Kibos River. Other rivers from where water is abstracted include Nyamasaria, Kisian, Kajulu, Mamboleo, Luanda and Lidango. While the city primarily relies on surface water, ground water is also available. Groundwater levels range from 2-5 meters from the soil surface. Efforts to improve water supply have nonetheless focused on surface water, mainly because groundwater is susceptible to contamination by overflowing pit latrines and inadequate drainage. There are currently two raw water intake points on Lake Victoria and one intake at Kajulu. There are also two water supply systems: an electrical pump system, supplying about 92% of the total water, and a gravity system. The water from Lake Victoria is treated at the Dunga Water Treatment Plant, located 0.6 km from the intake, and is then pumped to a storage tank in Kibuye, while water from Kibos River is treated and then flows by gravity to reservoir tanks at Watson, Obwolo and Kanyamedha. A 2008 study reports that Kisumu's water supply facilities had a design capacity of 22,700 m^3/ day, but were operating at a capacity of only 18,700 m^3/day, with Kajulu supplying 1,700 m^3/day and the Dunga Water Treatment Plant producing 17,000 m^3/day (LVSWWDA, 2008). The study estimated that water demand in 2007 was 47,700 m^3/day, leaving Kisumu with a supply deficit for that year of over 29,000 m^3/day.

3.2.2 Existing Sanitation and Wastewater infrastructure

The main sanitation facility used by most of residents in Kisumu city's informal settlements is the pit latrine. However, in black cotton soil areas, pit latrines are often less than six meters deep and therefore tend to fill up quickly and/or overflow. Ventilated Improved Pit (VIP) latrines are a better alternative than unlined pit latrines because they are less odoriferous, but in 2007, only an estimated 7% of residents used these (LVSWSB, 2008). There are relatively few public toilets in Kisumu city, most of which are concentrated in informal settlements such as Bandani, Nyamasaria and Obunga. In the city center, there are public toilets in places like the markets, Bus Park and Jomo Kenyatta grounds. The sewerage system in Kisumu can be classified into three wastewater treatment districts (WTD): the Central WTD, which collects wastewater

generated in the northwest; the Eastern WTD, collecting wastewater from the southeast; and the Western WTD, which covers the area below the airport. There are two types of sewer systems in Kisumu city: a conventional sewer system and a lagoon system. However, the 6,800m^3 sewer system serves less than 10% of the population, and the two sewer systems do not accommodate most of the generated wastewater.

The main sewage treatment plant in Kisumu is the Kisat Conventional Sewage Treatment Plant (STW), built in 1958. In addition, there are three main private industrial wastewater treatment plants, but two of these are pre-treatment facilities only, with just one a full treatment plant. Another plant, serving the eastern part of the city, is the Nyalenda Waste Stabilization Pond (WSP), located adjacent to the Nyalenda low-income area. However, this plant has not been properly maintained and is not fully operational (LVSWSB, 2008). Areas with access to the public sewer network include Lumumba, Makasembo, Milimani, Ondiek and Robert Ouko estates. The capacity of the sewerage infrastructure is 17,800m^3/day (if operating at full capacity), far less than what is required (LVSWSB, 2008). The sewers were built more than four decades ago, and there has been no rehabilitation or extension of the sewer system, except for the Kibos Trunk sewers, which were built in 1980 (LVSWSB, 2008).

Plate 2: Exhauster vehicles at Nyalenda treatment ponds

3.3 Proposed measures for water supply

3.3.1 Scope of works

For the water supply component, the proposed works will include rehabilitation of existing problematic line in lower CBD; extension along the bypass highway to connect Nyamasaria lines better from Kibuye reservoir; and reinforcement of existing lines in Kadero area. A total of five kilometres of water pipeline will be layed during the works. The map below presents the revised scope of works for Works Package 1 water network works:

3.3.2 Pipe material

The pipe materials to be used in this exercise include Ductile Iron or Steel for pipes of diameter greater than 150 mm; and HDPE for pipes of diameter equal or inferior to 150 mm. All materials shall comply with international standards, such as EN, ISO, NF, etc.

3.3.3 Connections

New household connections will be realised by KIWASCO following its standards. No works will be carried out in private areas. Installations of water meters will not be part of this exercise and water meters will be installed, if necessary, by KIWASCO. No works will be carried out in private areas. In case of rehabilitation, decommission or reinforcement of existing lines, Works will include the transfer of the existing connections to the new line, using the appropriate diameters, and DE25 HDPE pipe for house connections. For house connections, connection pits will be used wherever the width of the road exceeds 4m. According to design configuration, connection pits will serve more than one household located on the same side of the road to minimize excavation of the existing pavement and it will be connected to the water main via DE50 HDPE pipe.

3.3.4 Water network lines

3.3.3.1 Rehabilitation in lower CBD

KIWASCO has requested the replacement of two existing parallel lines of DN75 to DN150, with which they currently have issues (frequent burst), by one single larger line. The two existing lines shall be disconnected and all existing connections – distribution network and customer – shall be transferred to the new line. The lines are located along Bank street in the CBD so the works will mostly take place in the existing road's easement. However, the North tip of the line might require easement (already obtained for one of the existing line) since not located along an existing road. If easement cannot be obtained there, an alternative route, as shown as "Alt 2" on the map shall be pursued. In this case any connexion on "Alt 1" section should be transferred to the Southern and Eastern sides of the block. The underground of Bank street is fairly busy since in certain sections, in addition to the existing water lines, it accommodates a wastewater line, the fibre optic network on the North East side and a storm water line under the pavement on the South West side. The works that are planned as part of works package 1 water network works include decommissioning of and construction of 478m of DN75 line; decommissioning of 268m of DN 100 pipeline and rehabilitation of 1,018m of DN150 pipeline. A total of 1.765 kilometers of line will be worked on.

3.3.3.2 Extension along bypass highway

KIWASCO has proposed an extension to connect Nyamasaria more efficiently from Kibuye reservoir, as shown on the map below: This extension was already planned as part of the works for Works Package 2 in order to obtain higher pressures in the South East section of Kibuye reservoir's pressure zone. The area along the by-pass road is relatively swampy, including the "natural" stream running from North to South which will have to be crossed including just North of the interchange. There have also recently been some earthworks along the bypass, presumably within the road reserve. Those will require additional excavations for the installation of the line. Although there is currently no water network along the by-pass, there are two sewer lines, including the main DN600 which has been installed as part of the LTAP project, and storm water channels and culverts to be crossed, including along Nairobi road. Moreover there is relatively low space for the works along Nairobi Road between the storm water drain and the power line, where the installation of a new sewer collector is also planned. The works along this line will involve extension of 1.346km of DN250 pipeline.

3.3.3.3 Reinforcement in Kadero area

KIWASCO has proposed reinforcing an existing DN-40-DN50 line in Kadero area in order to reach more customers. This line is connected to the existing DN150 distribution line from Kajulu reservoir. Extensions and reinforcements were already planned as part of the works for Works Package 2 in order to expand the distribution network in this area. The proposed works are shown on the map below: Apart from the existing water lines there are no major utilities in this area. There are a few storm water culverts to be crossed but they are not deep. The line proposed mostly followed a wide dirt road. The works planned along this line include reinforcement of 2.672m of DN150 pipe.

3.4 Proposed measures for Wastewater Network Works

3.4.1 General description of scope of works

The general scope of works will involve rehabilitation of 11.962km of sewer line and extension of 20.927km of the line within Kisumu city. A total of 32.888km will be rehabilitated, replaced or extended. The final scope of works is shown on Figure 1 below as rehabilitation lines (in yellow) and extension lines (in red). It includes the following wastewater network works:

(i) Rehabilitation of main trunk sewer line in Manyatta;
(ii) Extension in Migosi;
(iii) Rehabilitation and extension in Manyatta North;
(iv) Rehabilitation and extension in Manyatta South;
(v) Extension along Auji river;
(vi) Extension along Nairobi Road in Nyamasaria;
(vii) Rehabilitation of main collector to Nyalenda ponds;
(viii) Rehabilitation and extension along ring road;
(ix) Extension along Nairobi road in city centre;
(x) Extension and rehabilitation around Kibuye market;
(xi) Rehabilitation and extension around Shaurimoyo high school and Nubian village;
(xii) Rehabilitation and extensions in Kaloleni estate;
(xiii) Rehabilitation and extensions in Polyview estate;
(xiv) Extension along Ondiek highway;
(xv) Extension next to railway station;
(xvi) Rehabilitation within CBD
(xvii) Rehabilitation and extension next to Kenya Breweries.

Figure 1: Wastewater network works- General layout

3.4.2 Feasibility of wastewater mains

The feasibility study has been carried out with the intention of facilitating the works execution in such urban conditions as those found in Kisumu city. The pipes alignments endeavours as much as possible to reduce the pipe depth in order to limit the extent of earth works; minimize road crossings; and prevent utilities crossing and potential damages. The detailed layouts and profiles of all lines is annexed in Annex 3.

3.4.3 Description of wastewater Network works

The following describes proposed works on wastewater networks:

3.4.3.1 Rehabilitation of main trunk sewer line in Mamboleo

The line starts next to Mamboleo slaughter house and passes through Mamboleo cemetery and terminates at Car Wash area. The area is dominated by residential, commercial, institutional, agricultural and cemetery land uses. The line will not significantly affect personal properties as only rehabilitation of existing line will be done. Manholes along this line have various issues including missing manhole covers and blocked manhole chambers; and these will be unblocked and lined. Some sections of the line have been exposed due to erosion and these will be properly backfilled. The line also passes through a swampy area and any excavation works shall be carried out during dry weather condition. Various business premises, flower beds, churches and perimeter fences may be affected especially within Car Wash area

Plate 3: Blocked manhole within the line releasing raw sewage

3.4.3.2 Rehabilitation of main trunk sewer line in Manyatta

This main collector stretches on 4,380 ml and collects wastewater from the North-Eastern part of the existing network, around Migosi, to the existing DN600 steel pipe laid during the LTAP along the bypass, around Joyland and the Nubian village. Its catchment covers more than 826 ha. The existing concrete pipe of diameter DN350 is already fairly deep, between 2 and 4.5m deep. The works along this line will involve rehabilitation of 1.478km of uPVC DN300 pipes, 1.168km of DIDN500 pipes and 1.736km of DIDN600. A total of 4.382 km of sewer pipes will be rehabilitated along this line.

3.4.3.3 Extension in Migosi area

Migosi's sewer network is connected to the upstream part of Manyatta's main sewer line. It collects wastewater from a catchment of 200 ha. The network is divided into three main sub-lines, with some tertiary network attached to them. These include line 3 (1.4km), Migosi west line (2.050km) and Lower Migosi line (1.94km). The works along this line will involve laying of 2.968km of uPVC DN200 pipes, laying of 830m of uPVC DN250 pies; laying of 462m of uPVC DN375 pipes and laying of 109m of uPVC DN400 pipes. A total of 3.37km of sewer pipes will be layed along this line at a depth of more that 2 metres

Plate 4: Raw sewage released into storm water drainage

3.4.3.4 Rehabilitation and extension in Manyatta North

Three new lines have been proposed in Manyatta North, with small sections to be rehabilitated. The main line #1 connects on Manyatta's main sewer trunk line, while lines #2 and #3 connect on line #1: The works along this line will involve laying of 640m of uPVC DN200 pipes; laying of 912m of uPVC DN250 pipes; and 1.858km of uPVC DN400 pipes. 1.409km of pipeline will be layed along this line at a depth of less than 2 metres while 2.001km of pipeline will be layed at a depth of more than 2 metres.

3.4.3.5 Rehabilitation and extension in Manyatta South

Manyatta South sewer line is a new line (extension) of 1,770 ml which connects to the main trunk sewer line. The works along this line will involve laying of 912m of uPVC DN200 pipes. A total of 771m of sewer pipes will be layed at a depth of less than 2m while 141m will be layed at a depth of more than 2 metres

3.4.3.6 Extension along Auji River

The new line along Auji River stretches on 3,250 lm and collects wastewater from a large catchment not yet connected to the existing network. It is connected to the existing DN600 steel pipe laid during the LTAP, north of Nairobi interchange. This line runs along the right bank of Auji River in an area dominated by residential land uses. Residential houses and business

premises are likely to be affected by proposed activities. Other structures likely to be affected by the proposed works include trees along the right bank of Auji River and physical infrastructure including access roads and bridges. The works along this line will involve laying of 1.588km of DI DN500 pipes at a depth of less than 2 metres and 1.656km of DIDN500 pipes at a depth of more than 2 metres. A total of 3.244km of sewer pipes will be layed along this line.

Plate 5: Structures along Auji line likely to be affected

3.4.3.7 Extension along Nairobi Road in Nyamasaria

The new line is proposed along Nairobi Road in Nyamasaria area and stretches on about 1 km. It collects wastewater from a large catchment not yet connected to the existing network. It is connected to the existing DN600 steel pipe laid during the LTAP, North of Nairobi interchange. The works along this line will involve laying of 1.033km of uPVC DN400 pipes at a depth of 2 metres

3.4.3.8 Rehabilitation and extension along Ring road

This line stretches along the west side of the Ring Road, before crossing it to Nyalenda's side and passing through Pinocchio Academy before connecting onto the main on Nairobi Road, east of Kachok roundabout. The extension of this line would enable the connection of, among others, LVSWWDA's offices. The works along this line will involve laying of 272m of uPVC DN200 pipes and 972m of uPVC DN300 pipes at a depth of over 2 metres. A total of 1.244km of sewer pipes will be layed along this line. The area is dominated by residential land use coexisting with institutional and commercial land uses. Structures likely to be affected by the proposed works include timber yards and road side kiosks. Perimeter walls including that of Kisumu Gospel Assembly Church are also likely to be affected by the proposed works.

3.4.3.9 Rehabilitation of main collector to Nyalenda ponds

This existing line DN600 steel is the main pipe collecting wastewater from a large catchment from the city centre. It is connected to Nyalenda ponds for wastewater treatment. In order to solve the issues currently faced by KIWASCO on this line, its rehabilitation presupposes laying the new pipe deeper, with a better slope. It will therefore incur important excavation works. The

line is not located within a road reserve and no structures nor will developments be affected by proposed works. The area is extensively covered by vegetative materials and these are likely to be affected during the proposed works. The works along this line will involve laying of 198m of DI DN600 pipes at a depth of less than 2 metres and laying of 510m of DI DN600 pipes at a depth of more than 2 metres. A total of 708m of sewer pipes will be layed along this line.

Plate 6: Manhole missing cover along Nyalenda ponds line

3.4.3.10 Rehabilitation along Nairobi Road in City centre

This existing sewer line of 390 ml is the upstream continuation of the line along Nairobi Road. Its related catchment is fairly small. This line runs along Nairobi Road and terminates next to Sai Petrol Station. The line runs along road reserve and there are no structures along the path of the sewer line that may be affected by the proposed works. There are however some flower beds and perimeter walls that may be affected by the proposed works

3.4.3.11 Extension and rehabilitation around Kibuye Market

Three new lines are proposed in Kibuye market area. Lines #1 & 2 connect an existing pipe of DN200 concrete at the intersection near Kibuye's Church and Winners' Chapel. Line #3 connects line 1 at Kibuye's Supermarket. These lines are upstream the network and collect wastewater from a limited area. Works along the line will include rehabilitation and extension of 517m of uPVC DN200 pipes at a depth of less than 2 metres and laying 309m of uPVC DN200 pipes at a depth of more than 2 metres. The area is dominated by commercial activities. Various businesses including road side kiosks, jua kali artisan shops and itinerant trader sheds are likely to be affected by the proposed works

3.4.3.12 Rehabilitation and extension around Shaurimoyo high school and Nubian village

The works along this line will involve rehabilitation and extension of 1.695km of uPVC DN200 pipes at a depth of less than 2 metres and laying 193m of uPVC DN200 pipes at a depth of more than 2 metres. A total of 1.888km of sewer pipes will be layed along this line. There are no structures along the sewer line path although there may be slight impact on fences and gates

along the road behind the AP line. A few kiosks may also be affected especially on the Shauri Moyo Secondary School side

3.4.3.13 Rehabilitation and extensions in Kaloleni estate

The proposed extensions cover Kaloleni estates encompassing a mix of low to medium income habitat, with sections of asphalted roads and some new dirt roads. Some of the population relies on water kiosks while others have been connected to the water network. The works will involve laying of 2.075km of uPVC DN200 pipes at a depth of less than 2 metres and laying of 445m of uPVC DN200 pipes at a depth of less than 2 metres. A total of 2.520km of sewer pipes will be layed along this line. The line is located within a predominantly residential neighbourhood. Commercial and institutional land uses are also found within the area. The line runs along access roads and the roads within the area have not been significantly encroached. Some buildings are located very close to the road and may be adversely affected by the proposed works.

3.4.3.14 Rehabilitation and extensions in Polyview estate

The proposed rehabilitation and extensions cover Polyview estates encompassing a mix of medium to high income habitat, with some 3-4 storey buildings in closed compounds, with dirt and asphalted roads and connected to the water network. Polyview estates are already connected to KIWASCO via small condominium sewers installed by developers. The works along this line will involve laying of 914m of uPVC DN200 pipes at a depth of less than 2 metres and laying of 160m of uPVC DN200 pipes at a depth of 2 metres. A total of 1.074m of sewer pipes will be layed along this line.

3.4.3.15 Extension along Ondiek highway

This line, designed to bypass Kisumu Day school and thus solves KIWASCO current O&M issues, would stretch along the West side of Ondiek highway in an area dominated by institutional and commercial land uses. It would cross it at its Northern extremity and would cross Nairobi road at its Southern end. There are no structures along the path of the line although car wash areas may be affected during the works. At the Nairobi road interchange is a restaurant and flower beds that may also be affected by proposed works. The works along this line will involve laying of 847m of uPVC DN350 pipes at a depth of less than 2 metres.

3.4.3.16 Extension next to railway station

The two short extensions (< 500m) are located in the quiet low density area between CBD, Milimani and the railway station. The works will involve laying of 481m of uPVC DN200 pipes at a depth of less than 2 metres

3.4.3.17 Rehabilitation of sewer line in CBD

This DN300 sewer line to be rehabilitated passes at the heart of the Central Business District. In addition to be a very busy area many utilities pass there - existing water lines (including sections to be rehabilitated or replaced in Works Package 1 water network works) - fibre optic and storm water lines – and its topography is not advantageous since the existing line follows some short counter slopes on the North East sections. KIWASCO has been facing many issues with this line and most the manholes are currently sealed. This line also receives the flow of Kendu Lane pumping station (when it is operational). The works along this line will involve laying of 677m of uPVC DN300 pipes at a depth of more than 2 metres.

3.4.3.18 Rehabilitation and extension next to Kenya Brewery

The line to be rehabilitated and extended stretches over 2.6km from Kondele roundabout to Kenya brewery along the bypass highway before turning South to reach Obote Road towards Kisat WWTP. The existing line, in some parts higher than road level, has been much encroached upon and passes through numerous “private” areas and even houses. The new route shall follow the road in order to ensure feasibility, however it might therefore require extra excavations. The works along this line will involve laying of 413m of uPVC DN250 pipes at a depth of more than 2 metres, 1.636km of uPVC DN300 pipes at a depth of more than 2 metres and 530m of uPVC DN300 pipes at a depth of less than 2 metres. A total of 2.579km of sewer pipes will be layed along this line. The area is dominated with residential, commercial, institutional and industrial land uses. The sewer way leave has been encroached by various activities including residential houses, commercial premises, timber yards, motor vehicle garages and schools and these may be adversely affected during the works.

Plate 7: Structure located along Kenya Brewery sewer line

3.5 Nyalenda ponds works

The works for Nyalenda ponds include desludging of the middle treatment line and fencing of the site. Main activities associated with the works include geotechnical investigations, demolition of concrete structure, construction of concrete structure / installation of precast concrete culverts, excavations for structures, preparation of landfill site, pumping clear and medium loads water to other treatment lines, construction of track, sludge removal and fencing including installation of two gates

3.5.1 Desludging of the middle treatment line

During the LTAP project, the two outer treatment lines of Nyalenda ponds were desludged. The middle stream, composed of 1 (new) anaerobic pond, 1 facultative pond and 2 maturation ponds, still have to be desludged. Around 87,000 m^3 of excavation / desludging is remaining, according to the *LTAP Completion Report, Seureca, January 2017*. The four ponds shall be desludged successively.

3.5.2 Fencing works

In order to prevent intrusions by fishermen, cattle, etc. on Nyalenda ponds site, it is recommended to fence the site. The fence will be around 2,200 lm long and two gates are proposed at the northern extremities of the site.

3.6 Project components and activities that give rise to environmental and social impacts

Various activities are associated with the proposed project and these have the potential of leading to various adverse impacts to neighbouring populations and land uses. These activities include site clearance; topsoil removal; demolition works; excavation works; disposal of surplus demolition and excavated materials; disposal of excavated material and backfilling works. Other activities associated with the proposed project and which may lead to adverse social and environmental impacts include surface compaction; surface reinstatement; surface restorations; and restoration of borrow areas, spoil tips and quarries as discussed below:

3.6.1 Site Clearance

This will involve preparation of the site by the contractor by carrying out general clearance of the ground and by removing trees and other vegetation to permit the proper execution of the Works. Site clearance will be carried out over the areas to be occupied by the permanent Works before beginning excavation or other works, and shall include the clearance of all trees, stumps, bushes and other vegetation and the grubbing out of all roots and the removal of all boulders between 0.01 and 0.2m^3 volume and disposal of them as directed by the Resident Engineer. Site clearance will also involve removal of various structures located along the proposed water and sewerage pipeline routes including food kiosks and retail business premises.

3.6.2 Topsoil Removal

This is the stripping of top soil by the contractor to a depth as shown in the drawings or as specified in the bill of quantities. This shall be done after establishing surface levels of the ground by the engineering team.

3.6.3 Demolition works

Demolitions will involve dismantling of any buildings or other structures within project alignment area and stacking the recovered materials on the adjoining land of the owner of such building or structure. Demolition exercise may also involve removal of permanent and temporary facilities located along project alignment areas including buildings, business premises, gates, live fences and perimeter walls among other facilities.

3.6.4 Excavation works

Excavation shall involve digging of trenches along the proposed water and sewerage pipeline routes for purposes of laying pipes and casting manholes. Excavations shall also be done for structures, fill foundations, channels for ditches, road cuttings and trenches for pipe laying among other activities. Excavation works may be associated with damage to structures, services or other properties caused by movement of excavation machinery.

3.6.5 Disposal of Excavated Materials

Materials obtained from excavations which are not suitable for forming embankments or other fill areas are normally disposed of. These materials will be disposed of to tips provided by the contractor and approved by the Engineer. Measures shall be put in place to ensure that excess

materials which may be surplus to the total requirements of the Works are used in rehabilitation of excavated areas as directed by the Engineer.

3.6.6 Disposal of Surplus Demolition and Excavated Materials

All surplus demolition or excavated materials will be disposed of by the contractor to tips provided by the contractor and approved by the Engineer. The contractor is expected to comply with existing rules and regulations governing disposal of spoils.

3.6.7 Backfilling works

3.6.7.1 Backfilling of Excavations

All excavated areas will be backfilled with materials from excavation process. All backfilling of excavations will be thoroughly compacted in layers and by means which will not damage the works. Backfilling will also be done of excavations for reinforced concrete structures. Various materials including granular materials imported from approved material extraction sites will be used.

3.6.7.2 Backfilling of Pipe Trenches

This will involve covering the laid pipes in situations where pipes are not surrounded in concrete or imported granular material, with materials obtained from the excavations selected and screened as necessary, free from lumps stones and fragments of rock larger that 20mm and to approval of Engineer.

3.6.8 Compaction

Compaction shall involve pressing of the restored areas using appropriate machinery to restore them to pre-project conditions. Compaction of filling shall proceed as soon as possible after spreading of a soil layer. Compaction of filling of normal materials will be carried out only when the moisture content is within limits specified or directed by the Engineer.

3.6.9 Surface Reinstatement

This shall involve reinstatement by the contractor of all surfaces of roads, fields, paths etc, whether public or private which shall have been affected by the Works. The sites shall be reinstated temporarily by the contractor in the first instance and in due course when the ground has consolidated fully, the surfaces shall be permanently reinstated. The temporary reinstatement and maintenance of all surfaces of roads, tracks, paths and any other surfaces which shall have been affected by the operations of the contractor shall be the contractor's sole responsibility and will be carried out to the satisfaction of the Engineer and of the responsible authority and owner. Temporary reinstatements shall be carried out immediately the trenches are refilled.

3.6.10 Surface Restorations

Temporary restoration will be carried out immediately after excavations have been refilled by returning the excavated material to the position from which it was removed and adding such suitable materials as may be required and consolidating the various materials as works proceed in order to provide a surface that is adequate for the purpose that the original surface fulfilled. Permanent reinstatement will not be carried out until the ground has consolidated completely. In the event of further settlement occurring after the completion of the permanent reinstatement, the contractor will be expected to make good the reinstatement to the approval of the Engineer or responsible authority.

3.6.11 Restoration of Borrow Areas, Spoil Tips and Quarries

This shall involve finishing to safe and fair slopes any spoil tips, quarries or other borrow areas developed by the contractor for the purpose of the Works. Where directed by the Engineer these areas shall be re-soiled and grassed over or otherwise seeded.

3.7 Products by products and wastes

3.7.1 Products

The products associated with this project is a functional water and sewerage system for use by residents of Kisumu city

3.7.2 By- products

There are no by- products associated with the operation of the proposed project

3.7.3 Wastes

There will be solid, liquid and gaseous wastes associated with construction and operation of the proposed project. These will be from project activities during construction, operation and decommissioning phases. There shall be wastewater from civil works, worker activities and the storm water. It is envisaged that at the construction stage, the contractor shall at his own cost, sprinkle water on routes and working areas to reduce dust generation by construction machinery. Other wastes from construction site will mainly be material residues of the construction materials. These include pieces of concrete, heaps of sand and aggregates, bits and pieces of various pipe types, cans of paint, polythene sheets, paper packaging materials, pieces of timber, pieces of iron (metals), among others scattered within the construction area. Wastes during operation will include packaging wastes from the various packaging materials and effluent from toilet flushing. An on-site effluent management system has been proposed for management of effluents arising from project activities. Solid waste shall be managed in strict conformity to the existing legal framework.

3.7.4 Dust and air pollution

Dust emission is anticipated during construction when dust from traffic, construction activities and construction machinery will be emitted. It is recommended that watering be enforced to keep dust at minimal levels. Air pollution is not anticipated to be a major problem during operation phase of the project. The Table below gives a summary of waste to be generated at the site both during construction and operation phases of the project

Table 3. 1: Summary of solid wastes to be generated at the site

Type	Description	Sources
Combustible	Paper, cardboards, cartons, wood, boxes, plastic, rags, cloth, bedding, leather, rubber, grass, leaves, yard trimmings etc	Offices, yards
Non combustible wastes	Metals, tin, cans, glass bottles, crockery, stones etc	Workshops, offices, kitchenette
Bulky wastes	Large auto parts, tyres, stoves, refrigerators and other large appliances, furniture, large crates, trees, branches, stumps etc	Workshops, sidewalks, kitchenette and offices,
Garbage	Waste from the preparation, cooking and serving of food	Kitchenette, eating areas and yards

Street wastes	Street sweeping, dirt, leaves etc.	Sidewalks and open areas within work areas
Abandoned vehicles	Automobile and spare parts	Contractor camps and workshop areas
Construction and demolition wastes	Roofing and sheathing scraps, rubble, broken concrete, plaster, conduit pipes, wire, insulation et	Construction and demolition site
Hazardous wastes	Pathological wastes, explosives, radioactive materials	Store areas, workshop areas, fuel storage areas
Sewage treatment residue	sludge	Water and wastewater treatment plants

3.8 Waste management

The following control measures will be employed by the contractor to reduce the environmental impacts from waste generation, handling, storage and disposal:

(i) Open burning, burying and dumping of waste within construction site, work areas and other areas within construction zone are strictly prohibited;
(ii) Separate labeled waste receptacles will be provided for, plastic, paper, tins, and used bottles among other waste items;
(iii) The mixing of hazardous and non-hazardous waste is prohibited;
(iv) All hazardous waste will be provided with secondary containment and suitably bunded to meet legal requirements, where necessary. The wastes will be handled and transported by licensed hazardous waste handling companies;
(v) A program for regular collection and removal of waste bins will be implemented;
(vi) All litter will be controlled within all work areas by means of good housekeeping;
(vii) Where possible, performance measurement and targets for reduction, reuse and recycling will be developed and implemented;
(viii) Any wastes that cannot be reused and recycled will be transported and disposed of in accordance with requirements of Waste Management Regulations 2006;
(ix) Volumes and types of waste will be monitored to establish whether additional opportunities for improvements in waste management (avoid, reduce, reuse, recycle) can be adopted, where practicable; and
(x) All workers will be trained on the Waste Management Plan, through shift briefs, etc.

3.9 Waste Monitoring Process

Monitoring activities associated with the management of hazardous and non-hazardous waste shall include the following:

(i) Regular visual inspection of all waste collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored.
(ii) Regular audits of waste segregation and collection practices
(iii) Tracking of waste generation trends by type and amount of waste generated, preferably by facility departments
(iv) Characterizing waste at the beginning of generation of a new waste stream, and periodically documenting the characteristics and proper management of the waste, especially hazardous wastes
(v) Keeping manifests or other records that document the amount of waste generated and its destination

(vi) Periodic auditing of third party treatment and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties. Audits shall include site visits to the treatment storage and disposal location

3.10 Waste Handling Matrix

Waste materials shall be properly stored and handled to minimize the potential for a spill or impact to the environment. The Table below shows a waste handling matrix for the proposed project.

Table 3. 2: Waste handling matrix during project construction

Waste Stream	Location	Activity Generating Waste	Hazardous/Non Hazardous	Handling/ Disposal Method
Automotive and Heavy Equipment Parts-Used	Equipment Repair Shop and Fabrication Shop	Replacement	Non-Hazardous	Returned to vendors for recycling
Batteries (Alkaline)	Various Locations	Battery Failures	Universal Waste	"D" cell and below are acceptable in the Non-Burnable Waste Dumpster
Batteries (Lead Acid)	Equipment Repair Shop and Fabrication Shop	Battery Failures	Universal Waste	Lead acid batteries are returned to the vendor upon removal
Cardboard/Office Paper	Parts Department & Offices	Shipping Boxes & Office Activities	Non-Hazardous	Dispose of through contracted solid waste handler.
Computers Discarded	Parts Department & Offices	Replacement	Non-Hazardous	Ship to assigned site for recycling or disposal
Diesel Filters-Used	Equipment Repair Shop and Fabrication Shop	Filter Changes	Non-Hazardous	Dispose of through a contracted solid waste handler
Diesel Rags	Various Locations	Mechanic activities	Hazardous	Dispose of through contracted hazardous waste handlers
Drained Diesel	Equipment Repair and Fabrication Shop	Draining diesel fuel and filters	Non-Hazardous when burned as off-Spec fuel	Burned for energy recovery in clean burn multi-oil heating system.
Empty Paint Cans	Various Locations	Painting activities	Non-Hazardous	Ship to assigned site for recycling or disposal
Fluorescent Light Bulbs	Offices, kitchen, boardrooms etc.	Bulb replacement	Universal Waste	Ship to assigned site for recycling or disposal
Grinding Wheels	Equipment Repair Shop and Fabrication Shop	Grinding activities	Non-Hazardous	Dispose of through a contracted waste handler
Metal Shavings/ Cuttings	Equipment Repair Shop and Fabrication Shop	Fabricating activities	Excluded Hazardous if recycled	Place in recycle metal dumpster
Oil Filters-Used	Equipment Repair Shop and Fabrication Shop	Oil filter changes	Excluded Hazardous	Dispose of through contracted solid waste handler
Oil-Used	Equipment Repair Shop, Fabrication Shop, Service Trucks	Draining oil and filters	Excluded Hazardous if burned for energy recovery	Burned for energy recovery in clean burn multi-oil heating system. Use in the curing of formwork

Oily Waste (rags, absorbents)	Various Locations	Mechanic activities, equipment drips and leaks	Non-Hazardous	Dispose of through contracted waste handler
Scrap Metal	Various Locations	Fabrication activities & house cleaning	Excluded Hazardous if recycled	Place in recycle metal dumpster
Tires	Various Locations	Replacement	Non-Hazardous	Place tires up to 20" rim diameter into dumpster.
Toner Cartridges	Offices	Copiers, printers, fax machines	Non-Hazardous	Ship to assigned site for recycling or disposal
Welding Rods	Various Locations	Welding activities	Excluded Hazardous	Ship to assigned site for recycling or disposal
Wood Waste	Various Locations	Various activities and shipping pallets	Non-Hazardous	Place in recycle wood dumpster

3.11 Cost Estimates

The total cost estimates for Works Package 1 – water network works, wastewater network works and Nyalenda ponds works - are therefore estimated at15, 856,454 EUR, including contingencies. It must be noted that the table above does not include the necessary land acquisition. The Table below gives a summary of cost estimates for the proposed activities

Table 3. 3: Works Package 1- Lot 1 Cost estimates

No	Description	Total Cost (Euros)
1	Water network works	784,710
2	Wastewater network works	11,659,807
3	Nyalenda ponds	1,343,704
4	Total	13,788,221
5	Contingencies- 15%	2,068,233
6	**Total with contingencies**	**15,856,454**

CHAPTER 4

4.0 BASELINE INFORMATION

4.1 Site location and description

The proposed project area is located within Kisumu City of Kisumu County along Latitude 0°5'57.9" and Longitude 034°46'9.9'E. The project traverses various administrative locations including Mamboleo, Kasagam, Manyatta and West Kolwa all within Kisumu city boundaries. The project area is dominated by various land uses including residential, commercial, institutional and industrial all of which are likely to be affected by proposed project activities. Due to the fact that implementation of the project will be carried out within built up area, significant impact on vegetation features is not anticipated. The vegetation structure found within the project area is predominantly ornamental trees, flowers and exotic trees planted as fences around residential and business premises. Tree species within the project area include *Croton megalocarpus, Jacaranda mimosifolia, Gravellea robusta, Cupressus lusitanica* and *Eucalyptus saligna*. The main source of energy within the proposed project area is electricity from the national grid. Other sources of energy include diesel generators within business premises, kerosene, charcoal and firewood. Water within the area is obtained from pipe system of Kisumu Water and Sanitation Company, boreholes and shallow wells while sanitation facilities within the project area include KIWASCO sewerage system and pit latrines. Various waste management methods have been adopted by residents of the project area and these include use of private waste handlers, burning and composting. Most roads within the project area are done to bitumen standards while storm water drainage system is available in a few of the roads traversing the project area.

4.2 Physical and Topographic Features

Kisumu County lies in a down warped part of large lowland surrounding the Winam Gulf, at the tip of which is Kisumu Town. The county can be divided into 3 topographical zones namely: the Kano Plains, the upland area of Nyabondo Plateau and the midland areas of Maseno. The major physical features in the county are the overhanging huge granite rocks at Kisian and the legendary Kit Mikayi in Kisumu West Sub-county, the Lake Victoria, which is the second largest fresh water lake in the world, the geographically famous rice-growing Kano Plains, and lake islands (e.g. Ndere National Park which are major tourist attraction). There are three major rivers flowing into the Winam Gulf namely: the Nyando, Kibos and Sondu. The rivers are heavily silted, resulting in the extensive formation of lakeside swamps. The county has a long shoreline along Lake Victoria. This shoreline is 90 km long and has more than 17 beaches all of which are fish landing bays. Within Kisumu City, the shores have been used to put up beautiful tourist hotels like Kiboko Bay, the Yatch Club and Tilapia Beach Resort.

4.3 Ecological Conditions

The soils are dominated by lake sediments, commonly sand and clay soils. In Kano Plains the soils are dark brown and grey, poorly drained and are generally very deep and firm. In the western part of Kano Plains are dark cotton soils commonly associated with the swamps. These types constitute more than 70 per cent of all soil types found in Kisumu County. These soils are suitable for brick making and sand harvesting especially at Maseno and Nyakach. The main cash crops in the county are sugarcane, rice and cotton. Sugarcane is predominantly grown at lower midlands which are common in Maseno, Muhoroni and Miwani while cotton is grown in Kadibo and Nyando.

4.4 Climatic Conditions

The mean annual rainfall varies with altitude and proximity to the highlands along the Nandi Escarpment and Tinderet. The area has two rainy seasons, with the long rains occurring in March and May while the short rains occur in September to November. During the short rains the average annual rainfall ranges between 450mm and 600mm. Rainfall data indicates that the county largely receives substantial rainfall. Maseno has a mean annual rainfall of 1,630mm, Kisumu 1,280 mm, Ahero 1,260 mm, Kibos 1,290 mm, Muhoroni 1,525 mm, and Koru 1,103 mm. The lowland area which forms a trough of low rainfall receives a mean annual rainfall of between 1,000mm and 1,800mm.Although there is no entirely dry month, the peak generally falls between March and May, with a secondary peak in September to November. The mean annual maximum temperature ranges 25^{o}C to 35^{o}C and the mean annual minimum temperature ranges 9^{o}C to 18^{o}C. The altitude in the county varies from 1,144 metres above the sea level on the plains to 1,525 metres above sea level in the Maseno and Lower Nyakach areas. This greatly influences temperatures and rainfall in the county.

4.5 Demographic features

4.5.1 Population Census

The 1999 census showed that the population of Kisumu was approximately 280,966. Between 1989 and 1999 censuses the population growth rate of Kisumu was 4.6%. However from 1999 onwards, the Central Bureau of Statistics (CBS) projects a rate of 2.6% for Kisumu City, as shown in the table below.

Table 4. 1: Population Census Summary for Kisumu City

Year	Population	Households	Growth Rate	No. of Wards
1969	97,685	-	3.45%	14
1979	138,296	-	3.5%	14
1989	217,788	-	4.6%	14
1999	280,966	71,853	2.6%	14

Source Seureca/ CAS Feasibility Study Report 2006

4.5.2 Population Projection

Based on the above mentioned growth rate, Kisumu's population is projected to reach 1327,746 by 2011, 533,000 by 2025, and 622,618 by 2031. The Feasibility Study (Seureca / CAS Consultants 2005) applied a growth rate of 3.2% between years 1999 to 2025, giving an ultimate population of 637,318. MP/OOP considers that projection based on CBS's growth rate to be accurate. The following table gives the population projections breakdown per each sub location or Ward in the City.

Table 4. 2: Population Projection

Sub Location	Category	Population 1999	Area in Ha	2006	2011	2020	2031
Kibuye (Migosi, Nyawita	Urban	48,165	685	56,184	63,878	80,478	106,733
Milimani (N & S)	Urban	19,741	514	23,048	26,181	32,985	43,746
Kanyakwar	Urban	8,576	1014	10,004	11,374	14,330	19,004
Nyalenda (A & B)	Peri-Urban	49,375	582	57,596	65,483	82,500	109,415
Manyatta (A & B)	Peri-Urban	62,937	624	73,416	83,469	105,161	139,468

Wathorego	Peri-Urban	14,394	1035	16,791	19,090	24,051	31,897
Korando	Peri-Urban	14,950	1754	17,439	19,827	24,980	33,129
Kogony	Peri-Urban	13,960	1480	16,284	18,514	23,326	30,935
Kasule	Rural	10,701	1871	12,483	14,192	17,880	23,713
Chiga	Rural	7,109	2083	8,293	9,428	11,878	15,753
Nyalunya	Rural	8,686	2035	10,132	11,520	14,513	19,248
Kadero	Rural	5,304	569	6,187	7,034	8,862	11,754
Okok Got Nyabondo	Rural	6,760	843	7,886	8,965	11,295	14,980
Konya	Rural	10,308	1158	12,024	13,671	17,224	22,842
Total		**280,966**	**16,247**	**327,746**	**372,627**	**469,463**	**622,618**

The Seureca *I* CAS feasibility study determined that the water supply system could not be feasibly be extended to serve the entirety of Kisumu City and its outlying areas. Therefore the population figures used in design are not those of Kisumu City as a whole, but only for the areas intended to be covered by the LTAP, as shown in the following table.

Table 4. 3: Population projection in areas to be served by LTAP works

Sub Location	Category	Population 1999	Area in Ha	2006	2011	2020	2031
Kibuye (Migosi, Nyawita	Urban	48,165	685	56,184	63,878	80,478	106,733
Milimani (N & S)	Urban	19,741	514	23,048	26,181	32,985	43,746
Kanyakwar	Urban	8,576	1014	10,004	11,374	14,330	19,004
Nyalenda (A & B)	Peri-Urban	49,375	582	57,596	65,483	82,500	109,415
Manyatta (A & B)	Peri-Urban	62,937	624	73,416	83,469	105,161	139,468
Wathorego	Peri-Urban	14,394	1035	16,791	19,090	24,051	31,897
Korando	Peri-Urban	14,950	1754	17,439	19,827	24,980	33,129
Kogony	Peri-Urban	13,960	1480	16,284	18,514	23,326	30,935
Kasule	Rural	10,701	1871	12,483	14,192	17,880	23,713
Chiga	Rural	7,109	2083	8,293	9,428	11,878	15,753
Total		249,908	11,642	291,518	331,436	417,569	553,793

4.5.3 Population Density

The mean population density in Kisumu City is projected to vary from 2,017 per km^2 to 3,735 per km^2 from the year 2006 to the year 2031. The sub locations of Kibuye. Milimani, Nyalenda and Manyatta will have population densities varying from 8,202 to 11,765 persons per km^2 in 2006, to 15,187 to 21,7984 persons per km^2 in 2031. The particulars of population density for Kisumu City and its sub locations are given in the Table below

Table 4. 4: Population Density Projections for Kisumu City

Sub Location	2006	2011	2020	2031
Kibuye (Migosi, Nyawita)	8,202	9,325	11,749	15,187
Milimani (N & S)	4,408	5,094	6,417	8,295
Kanyakwar	987	1,112	1,413	1,827
Nyalenda (A &B)	9,896	11,251	14,175	18,323
Manyatta (A & B)	11,765	13,376	16,853	21,784
Watorego	1,622	1,844	2,324	3,004
Korand	994	1,130	1,424	1,841

Kogony	1,100	1,251	1,576	2,037
Kasule	667	750	956	1,235
Chiga	398	453	570	737
Nyalunya	498	566	713	922
Kadero	1,087	1,236	1,557	2.013
Okok, Got Nyabondo	935	1,063	1,340	1,732
Konya	1,038	1,181	1,487	1,923

4.6 Soils

The soils in Kisumu County are dominated by the former lake sediments, commonly sands and clay soils. In Kano plains, the soils are poorly drained and are generally very deep and firm. They are dark brown and grey in colour. In the western part of the Kano plains are the dark cotton soils commonly associated with swamps. On the slightly elevated grounds and piedmont plains are clay soils, which are usually of moderate fertility. On the uplands are sandy soils, which are derived from intermediate igneous rocks. These soils are also imperfectly drained and reasonably deep. The North western part of Kisumu has ferrasols and acrisols which have developed from the granites of rocky south Kakamega uplands. These soils are of low fertility and have rock bases not more than 80cm from the surface. On the fringes of the Winam Gulf and Lake Victoria beach ridges are soils of varying fertility, most of which are susceptible to water logging. The black cotton soil is found mainly in the plains while the upper zones are marked with residuals of brown volcanic soils. In some areas, the soils are rocky giving rise to sandy soils.

4.7 Biodiversity

The project area is endowed with flora, fauna and microbes. The area's wild animals are classified as grassland community. In recent years, man has caused the destruction of the grassland cover, has killed vast numbers of wild animals, and in so doing has opened up large areas for domestic animals. In this way, the number of wild herds has been reduced and they now tend to be confined to certain protected areas. The district has two national parks, viz, the Impala Park and Ndere Island. Ndere Island is a gazetted game park and is the home of Sitatunga, Impalas and Monkeys. The Impala Park in Kisumu Municipality has an orphanage and a sanctuary for leopards, hyenas, dik diks, baboons, monkeys and tortoises in their caged section, while impalas, crocodiles, monitor lizards, hippos, monkeys and pythons roam freely inside the park. The district also has a national museum, which also houses the snake park, where live cobras, black mambas, green mambas, puff udders, pythons and crocodiles are caged for viewing. The grass land also support myriads of seed eating birds including pests such as grain-eating weaverbirds. Many species of rats, mice and numerous other rodents are also found in this area. Inside the lake, Hippopotamus (Hippopotamus amphihibius) are normally found in herds. Their dung fertilizes the habitat thus providing food for certain water plants such as algae on which the lake fish feeds. Crocodiles (Crocodylus niloticus) are found in and by the shores of the lake, as are a great variety of fish stock, some of which have been introduced from outside the area. The two native Tilapia species are Tilapia escutenta and Tilapia variabilis. The introduced species are Tilapia nilotica, Tilapia zilli and Tilapia leocostica. Another important introduced species is the Nile perch (Lates nilotica) which is predatory. Other examples of predatory fish in L. Victoria include Lung fish (Protopterus annecteus) Catfish (Clarius mozambicus), Bagrus and Haplochromis. The lake swamp is also known to be an excellent habitat for the python.

4.8 Energy resources

The main source of energy for cooking in Kisumu County is firewood which accounts for 60 per cent of all energy sources. Charcoal comes second at 17.1 per cent followed by paraffin at 6.9 per cent, gas (LPG) accounts for 2.5 per cent. For lighting, paraffin is the most commonly used source of energy in the county accounting for 79.3 per cent of all energy sources followed by electricity at 18.3 per cent. Electricity as a source of energy is becoming more important in the county with increase in coverage over the last few years especially through the Rural Electrification Programme. Currently, a number of trading centres and secondary schools in the county have been connected to the national grid. An increased number of households have also been connected to the national grid. With the implementation of the laptop project, it is expected that the remaining centres and primary schools will be electrified.

4.9 Land Use and Tenure

4.9.1 Industrial Land use

The current major land uses in Kisumu are for industrial, commercial and residential purposes. The industrial area is situated close to the lake and runs parallel to the lakeshore. The area is served mainly by the railway and acts as the terminus of the two railway lines that connect Kisumu with the rest of Kenya. The industrial area is separated from other land uses by Makasembo road and extends towards the airport in the northwest. In 1969, the industrial zone covered a mere 6.5% of all land uses in Kisumu (Kenya Government 2004) but it has since expanded in two directions; along the road to Maseno in the northwest and along the road to Chemelil in the north east

4.9.2 Commercial land use

The Central Business District (or CBO) is main area of commercially-used land in town. The northern section of the CBD predominantly consists of the central and local government administrative offices, whereas the central portion consists of modern offices, department stores and branches of Nairobi-based companies.

4.9.3 Residential land use

The residential zone covers the greatest portion of urban land in Kisumu. Distinct subdivisions of residential areas related to the historical growth of the town can also be noticed. Kisumu's residential land use falls into three main categories namely:

(i) The high-class residential areas including Milimani, Robert Ouko, Tom Mboya and Okore in the northern suburbs of the town;
(ii) Low and middle income/ public housing areas including the municipal houses, railway houses, Kenya post, Kenya Power etc. most of which dominate the eastern side of the town; and
(iii) The peri-urban, slum settlements and the rural extended boundary areas.

Surrounding the central part of the town is a belt of unplanned slum and informal settlements that has developed to form a semi-circle around the old town. These include Nyalenda, Manyatta, Bandani, Kibos, Nyamasaria, Pandpieri, Migosi and Obunga. Manyatta Arab and Kaloleni alone are located within the CBD. The average plot sizes in the neighbourhoods and estates are quarter acres, which are normally freeholds with titles issued. But in some estates, the residents have an average plot size of 0.8 acres and on a freehold ownership with no titles issued.

4.10 Land Tenure

Land tenure in Kisumu Municipality now tends to be either on a freehold and leasehold basis. The earlier inhabitants of the area - the Luo tribe - controlled the distribution of land in the peri-urban areas of Kisumu. Traditionally, the Luo considered land to be the property of the community, usually the clan, but each member of the clan would be allocated a parcel of land to farm and thereby feed his family. Grazing land and watering places were common and everyone was obliged to provide access to such common land. Subdivision of the pieces of land continued with inheritance from uncles and brothers. Because of this culture of bequeathing land on the sons, further subdivisions of the small parcels of land took place until the size of the land made it uneconomical for most agricultural purposes, although a number of homes continued to breed livestock. In Kisumu 'slum belt', land has gone through the process of adjudication and a large portion has been registered as individual interests on freehold tenure. The principal reason for this is that neither the municipal council nor the central government has been able to acquire any interest on this land due to the cost of compensation that would need to be paid to the dweller. The peri urban area features a number of quality structures that Kisumu Council cannot afford to acquire with a view to gaining full control over their development.

4.11 Land use and land tenures in various areas of Kisumu Municipal area

4.11.1 Nyalenda

Recently there have been rapid transitions in the type land use and tenure in the informal settlements. For instance, in Nyalenda, Nyamasaria and Pandpieri the original inhabitants are selling land to newcomers who are constructing quality residential houses. The original owners tend to stay in typical rural housing surrounded by new developments. Land in Nyalenda 'A' is on freehold tenure. Families tend to hand land down to successive generations and rural traditions such as the burying of the dead within the compounds are maintained. To this extent the area can *be* characterized a rural settlement caught up in urban expansion. Such cultural practices make it very difficult to bring such parcels into the urban land market, despite its location and proximity to the up market Milimani residential area. Nyalenda 'B' is similar to Nyalenda 'A' but the Nyalenda B has, for a variety of reasons, been able to attract new developers.

4.11.2 Pandpieri

Although Pandpieri began as an extension of Nyalenda, its internal accessibility is slightly better and the density of population and settlement continues to be lower. This can be attributed to its proximity to swamps and the distance from Pandpieri to major areas of economic activity. It also has fewer graves and this makes it more amenable to the land market. On the eastern side of this area lies a large tract of agricultural land that is seasonally flooded. This land is an important component of the community's livelihood and is still owned communally by the native inhabitants of the area.

4.11.3 Obunga and Bandani

In Obunga and Bandani, since the 1970's, ownership of land has begun to move away from the communal system towards individual ownership and the majority of the residents have purchased their land as opposed to inheriting it. Those who have bought land acquire title deeds to their property on a leasehold tenure. These areas have experienced a gradual fragmentation of land as the land use has changed from agricultural to residential and commercial, a trend that has accelerated since 1990. The land is now predominantly commercialised, although a few

families still keep livestock. Commercialisation of land has become so common that in the absence of proper planning controls, there is virtually no land left for public facilities.

4.11.4 Manyatta

In Manyatta, land ownership has changed steadily from individual ownership by indigenous populations to small plots bought by people from outside the region, who have invested in commercial and residential buildings. The land value in the area has increased steadily over the last two decades. Manyatta Arab and Kaloleni are located on government land with leasehold tenure which has made the re-planning of the area easier to undertake. Tenants occupy the land under Temporary Occupation License terms and are not allowed to construct permanent structures. After recent upgrading programmes and allocation of plots within the slums, a few tenants have since managed to get title deeds.

4.11.5 Suburban fringes

The suburban fringe areas border the existing slum settlements and could potentially degenerate into slum areas if sufficient over-crowding and pressure on existing resources occurred. The zone is currently undergoing rapid subdivision, urbanization and rising densities, without adequate infrastructure and social services. The land tenure in this area is mixed, with a large portion of the land under freehold tenure and a smaller portion under leasehold

4.11.6 Kanyakwar

In Kanyakwar area, many people have bought land for residential development leading to rapid subdivisions and sale of land. It is important to note that such areas provide the Municipality with the opportunity to acquire land for development projects to provide for the urgent need for community facilities both in the slum areas and to handle the population overspill that suburban areas are facing from the people displaced by redevelopment.

4.12 Industry

With the implementation of the East African Community protocol, Kisumu aims to become capital of the regional bloc. Lake Victoria contributes a very large part to the economy of the county since it supports the fishing and fish processing industry the county's main economic activity. Opportunities exist in further developing this sector for local and export markets. Agriculture is also a common economic activity with sugar industries like Muhoroni, Chemelil, Kibos and rice irrigation industries employing a good number of residents. There are opportunities for further investment in this sector.

Equator Bottlers recently unveiled a Sh1.5 billion bottling plant; Jumbo Mattress Co has established a factory at Ahero while Foam Mattresses is setting up a plant in the town. Other companies setting up shops within Kisumu Town include Mayfair Holdings and United Millers, which recently completed the United Mall that hosts businesses including Tuskys Supermarket and Fox theatres. The county has a total of 27 manufacturing industries, 16 bakeries, 12 *Jua-kali* association and 10,500 *Jua-kali* artisans.

4.13 Employment and Other Sources of Income

The wage earners/ self employed people in the county account for 87.5% of the labour force, which are 184,650 people. Employment levels are skewed against female. The employment levels for the males are 89.4% while for the female is 85% relative to their labour force. The county has an active labour force of 211,077 of which 54.78 per cent (115,624) are men and

45.22 per cent (95,453) are women. This is due to the fact that the population of females is relatively lower than the males though not a sufficient factor to explain this disparity. The total unemployment level in the County is estimated at 12.5%. The unemployment levels are higher in women than men, i.e. 15% of females are unemployed compared to 10.6% of males who are unemployed. Youth unemployment in the county is mainly due to lack of startup capital and entrepreneur skills.

4.14 Road Network

Kisumu's high-income residential areas and formal public housing areas are well served with road infrastructure. However, poor road networks are a common feature in low-income areas because the council's input in terms of planning and capital outlay is minimal. Municipal rental areas are also characterized by decay in infrastructure. A combination of the council's financial constraints and poor governance among the urban poor has resulted in a tendency to concentrate resources on the wealthier areas of the town. Road reserves, which are primarily intended for the provision of service corridors for sewerage, storm drainage and piped water networks, are almost non-existent in slum areas. This is partially due the fact that the road networks are unplanned and also that the few planned road reserves have now been encroached upon by developers. Obunga and Bandani are an example of this. The roads in these areas are amongst the worst in Kisumu. The roads are generally impassable due to poor drainage, inadequate spacing of houses and widespread sewers. Additionally, the roads are not clearly demarcated and structures have been erected on the road reserves. Handcarts are the main modes of transport to access the main roads. In Bandani, unplanned development is predominant on the fringes parallel to the main tarmac road. The railway line cuts Bandani off from the main road, with only one level crossing that does not link well with the internal paths within the areas.

In accordance with rural planning standards that were current at the time of construction, the access roads in Nyalenda, Nyamasaria and Pandpieri, are only 6m wide. However, in urban areas 6m width is only considered suitable for access roads to single plots. However, the majority of roads in these areas do not adhere to even this standard and are only approximately 4m wide. The ring road is the only access network completed which has led to the increase in land values and a change in use to commercial purposes. The ring road is the only public transport vehicle route in the area, beyond which access to the slum area is on foot or bicycle. All the roads within the slums are narrow tracks which lack drainage. Houses are constructed right up to the road edge on either side, allowing no space for road widening.

Manyatta 'A' and Kaloleni are the only slum settlements with well designed road networks that have been gradually improved to increase accessibility to more that 60% of the area. However, the lower parts of Manyatta lack proper roads similar to other slum areas. The Nairobi road is the only motorized access to Manyatta 'B'. Walking and bicycles are the main modes of transport in Manyatta 'B' where roads are narrow, muddy; water logged and lack drainage systems and street lighting. Manyatta Arab although located in the town centre, does not have an adequate road system because, like other slum areas, its size and density would requires some degree of demolition to take place to provide space for new roads.

The suburban fringe areas of Kisumu such as Kibos, Usoma and Kanyakwar lack infrastructure services and the roads are of a similar condition to those in the slums. The road network is of rural standards, which is unlikely to cope with the increased flow of traffic the new developments will bring. The roads are approximately 6m wide and encroachment on the road reserves is also

common. This will pose challenges in the provision of infrastructure services, such as storm drainage, street lighting, sewage and water.

4.15 Water Supply

The water supply system in Kisumu can be categorized into three systems: that provided by KIWASCO, the peri-urban system and the system provided within the informal settlements. The existing water supply facilities provided by KIWASCO are in very poor condition and a large proportion of the population has no access to the service. The coverage of KIWASCO's current water supply network commands 40% - 50% and is mainly concentrated within the built up urban centre. The combined water supply capacity from the two water treatment systems amounts to 20,000m^3/day, which is less that half of the predicted demand of 50,000m^3/day (Department of the Environment strategic plan of 04-07). Peri-urban water supply systems consist of small-scale systems, outside the KMC service area, operated by MW&I, CB0s, NGOs, etc. Informal Settlements Systems are a combination of the Municipal System and Peri-urban Systems.

The existing water supply in the low-income areas, including the informal settlements, is inadequate and does not meet the demand. There is no reliable distribution network and piped water is mostly available through water kiosks. Most of the water connections in these areas are illegal, resulting in major financial losses for KIWASCO. Water vendors help in the distribution of the water to the areas away from the water sources.

Shallow wells, springs, boreholes, streams/rivers and Lake Victoria are important alternative water sources. However, most of these sources are of dubious quality and likely to be contaminated due to over-flowing pit latrines, poor wastewater management, and inadequate solid waste and drainage systems. In some of the informal settlements, KIWASCO piped water supply distribution networks are in place, but there is no water supply. In the informal settlements particularly, some sections of the network have been vandalized. Water carriers in the area help in the distribution of the water to the neighbourhoods. The majority of residents in the informal settlements still obtain water from kiosks, shallow wells, streams and rainwater harvesting. The wells in the settlements are in poor condition, some are unprotected and the water supplied is of dubious quality. The infrastructure for the delivery of water services in the informal settlements is either inadequate or non-existent.

The peri-urban areas are also affected by inadequate infrastructure facilities with most residents acquiring water from contaminated sources. Few properties have connections to piped water, and roof catchments are a common method of water collection. Shallow wells, streams and springs also serve a large proportion of the population in these areas.

4.16 Sanitation Facilities

The main sanitation facility in Kisumu is the pit latrine. However, in black cotton soil areas, pit latrines are often less than six meters deep and therefore tend to fill up quickly and/or overflow. Ventilated Improved Pit (VIP) latrines are a better alternative than unlined pit latrines because they are less odoriferous, but in 2007, only an estimated 7% of residents used these (LVSWWDA, 2008). There are relatively few public toilets in Kisumu City, most of which are concentrated in informal settlements such as Bandani, Nyamasaria and Obunga. In the city center, there are public toilets in places like the markets, Bus Park and Jomo Kenyatta grounds. The sewerage system in Kisumu can be classified into three wastewater treatment districts (WTD) i.e the Central WTD, which collects wastewater generated in the northwest; the Eastern

WTD, collecting wastewater from the southeast; and the Western WTD, which covers the area below the airport.

There are two types of sewer systems in Kisumu City: a conventional sewer system and a lagoon system. However, the 6,800m^3 sewer system serves less than 10% of the population, and the two sewer systems do not accommodate most of the generated wastewater (UN-HABITAT, 2008). In addition, frequent sewer bursts and blockages are common, resulting in groundwater contamination, environmental pollution and outbreaks of water-related diseases. The low-lying areas of Manyatta and Nyalenda have no sewer system, as they are lower than the conventional sewer.

Areas with access to the public sewer network include Lumumba, Makasembo, Milimani, Ondiek and Robert Ouko. The capacity of the sewerage infrastructure is 17,800m^3/day (if operating at full capacity), far less than what is required (LVSWSB, 2008). The sewers were built more than four decades ago, and there has been no rehabilitation or extension of the sewer system, except for the Kibos Trunk sewers, which were built in 1980 (LVSWSB, 2008).Upgrading and expanding the sewerage infrastructure is therefore urgently required.

4.17 Solid Waste

In 2001 it was estimated that only 20 percent of the 400 tons of solid waste generated each day in Kisumu City was collected. By 2008, the daily generation of household waste was estimated to be 437 tons. Fortunately, about 63% of the waste generated in Kisumu is organic; hence there is enormous potential for composting. The city authority (MCK) only has four trucks (two 2-ton trucks, an old 7-ton compactor truck and an old tractor with a trailer) for collecting waste. These vehicles are in poor condition and often break down. As a result, many households, particularly in the peri-urban areas, have no access to public services and are unable to access private waste collection due to fees levied. They therefore resort to burning or burying their waste. Some common dumping grounds have developed on open lands within densely populated neighborhoods. The poor management of solid waste blocks sewers and drainage systems; provides a breeding ground for disease vectors and contributes to the generation of leachates, which pollute the ground water and further contribute to waste related diseases. The city can significantly reduce the waste taken to the existing dumpsite - located near Moi stadium - by composting and recycling, methods not widely practiced in Kisumu, even though adopting these measures would also alleviate environmental pollution and provide informal employment through the resale of the recyclables.

4.18 Civil Societies Operating In the Informal Settlements

A number of civil societies, non-governmental organisations (NGOs) and microfinance organisations operate programs in the informal settlements. They include World Vision, Sustainable Aid in Africa (SANA), KADET, WEDCO, KWFT and the Undugu Society. In addition, a number of local Community Based Organizations (CBOs) also exist within these areas. The programs undertaken by these organisations target diverse areas including improvement of water and sanitation conditions, poverty alleviation and addressing the social and economic impacts of HIV/AIDS. Several NGOs and CBOs operate in Manyatta with programmes focusing on home-based care for HIV/AIDS victims, orphans and affected families with free Voluntary Counseling and Testing (VCT) schemes. A number of organisations including KADET, WEDCO, KWFT and the Undugu Society, offer low interest credit to the residents in order to enable them to invest in and develop income-generating schemes.

The NGOs currently involved in water and sanitation programs in the informal settlements include SANA, World Vision and Undugu Society. Of these, only SANA has a fully comprehensive hygiene promotion focus. SANA uses the PHAST (Participatory Hygiene and Sanitation Transformation) approach, working with CBO partners, and using the Child-to-Child (CTC) approach in hygiene promotion activities in community schools in Manyatta B. SANA has undertaken water and sanitation projects including hygiene education in Bandani and Manyatta "B". World Vision and the Undugu Society use organised community groups as partners in the implementation of their programs. World Vision, whose main programmes are child-focused, operates particularly in Obunga and Bandani and projects include environmental cleanup days in conjunction with the community of Manyatta "A". The organisation is also supporting plans for improving water supply and sewerage system in Manyatta "A", in collaboration with KIWASCO and Ministry of Water and Irrigation.

CHAPTER 5

5.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

5.1 Introduction

Law is a system of rules that are created and enforced through social or governmental institutions to regulate behaviour while a policy is a deliberate system of principles to guide decisions and achieve rational outcomes. A policy is a statement of intent, and is implemented as a procedure or protocol. Law is a system that regulates and ensures that individuals or a community adhere to the will of the state. The law shapes politics, economics, history and society in various ways and serves as a mediator of relations between people. Policies are generally adopted by a governance body within an organization.

5.2 Laws governing Environmental Management in Kenya

The need to take good care of environment is of essence for the survival of human beings. The law has intervened and ensures that human beings are considerate, cautious and careful in their dealings with the environment. Kenyan constitution begins with acknowledging the need for cautionary dealings with the environment by a provision in its preamble that," We the people of Kenya are RESPECTFUL of the environment, which is our heritage, and determined to sustain it for the benefit of future generations" The wording of the constitution in its preamble clearly suggests respect to sustainable development.

5.3 Policy, legal and administrative framework applicable to the proposed project

The review of policy, legal and administrative provisions has been carried out to establish the frameworks within which the significance of the various impacts expected to emanate from proposed project activities can be evaluated. A lot of emphasis has been placed on those frameworks and protocols that have a direct bearing on water and sanitation sector. Legal and regulatory frameworks applicable to the proposed project have been categorised into various sub headings. These include constitution of Kenya and relevant national policies, Kenyan laws and regulations and international agreements and conventions. The regulatory framework considered includes institutions within the water sector and the National Environment Management Authority (NEMA). World Bank Guidelines relevant to the proposed project have also been reviewed. These rules and regulations have formed the basis for the determination of the significance of the various impacts associated with the proposed project. The Tables below give summary of policy, legal and administrative frameworks reviewed and their relevance to the proposed project

5.4 Constitution of Kenya 2010 and the Relevant National Policies

Table 5. 1: Relevant National Policies

National Policy	Provisions	Relevance to the project
The constitution of Kenya 2010	Section 42 under the bill of rights provides that every person has the right to healthy and clean environment which include the right to have the environment protected for the benefit of present and future generations. Section 69 provides for the state's obligation in respect of the environment which includes among others; ensuring sustainable exploitation, utilisation and conservation of the environment and natural resources and encourage public participation in the management, protection and conservation of the environment. Any person whose right to clean and healthy environment has been or is likely to be infringed to seek redress in a court of law.	In conformity with the Constitution of Kenya, every activity or project undertaken within the republic must be in tandem with the state's vision for the national environment as well as adherence to the right of every individual to a clean and healthy environment. The proposed project is located next to an ecologically sensitive area and must not adversely interfere with neighbouring developments and land uses. Local stakeholders must be adequately involved in the through a well thought out public consultation process
Kenya Vision 2030	The Kenya Vision 2030 provides the national development blueprint for the period 2008 to 2030 emanating from the Economic Recovery Strategy for Wealth and Employment Creation. The Visions objective is to transform the Country into a middle-income economy with a consistent annual growth of 10% by year 2030. The Vision outlines the 2030 goal for urban areas as to achieve a "well housed population living in an environmentally-secure urban development" The vision envisages to achieve this by bringing basic infrastructure and services including roads, street lights, water and sanitation facilities, storm water drains, footpaths and others to the people. In achieving these, the vision emphasizes on the need promoting environmental conservation to better support the economic pillar.	The proposed project intends to improve water supply and service delivery in Kisumu City through construction of water supply and sanitation infrastructure. This initiative is part of the process in achieving the goals of Vision 2030 for Kisumu residents. The proponent should also endeavor to protect the environment in supporting the economic pillar of the vision
The National Environmental Action Plan (NEAP).	The NEAP 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-sectoral approach to develop a comprehensive framework to ensure that environmental	The proposed project will interact with the various elements and components of the physical, social and economic environments in ways that could lead to negative impacts. A multi-sectoral approach is desired in identifying

	management and conservation of natural resources are an integral part of societal decision making. The NEAP also establishes the process of identifying environmental problems and issues, raising environmental awareness, building national consensus, defining policies, legislation and institutional needs and planning environmental projects.	and solving environmental problems. All partners and stakeholders should be continuously engaged in identifying and solving environmental problems
National Environment Policy, 2013	The Policy sets out important provisions relating to the management of ecosystems and the sustainable use of natural resources. The policy further acknowledges that natural resources are under immense pressure from human activities particularly for critical ecosystems including forest, grasslands and arid and semi-arid lands. The policy seeks to develop an integrated approach to environmental management, strengthening the legal and institutional framework for effective coordination and promoting environmental management tools	This EIA study has developed an environmental and social management and monitoring plan to mitigate the impacts that may result during the construction and operation phases of the project. This tool is aimed at promoting coordination of environmental management of the project such that sensitive ecosystems are not destabilized by project activities
National Policy on Water Resources Management and Development (1999)	**3**The Sessional paper No. 1 of 1999 was established with the objective of preserving, conserving and protecting available water resources and to ensure that water is allocated in a sustainable, rational and economic way. The policy further desires to supply water of good quality and in sufficient quantities that meets the various water needs while ensuring safe disposal of waste water and environmental protection. To achieve these goals, water supply through increased household connections and developing other resources and improved sanitation is required	While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors of socio-economic progress, it recognizes the by-products of this process as waste water. The proposed project is geared towards providing sufficient and good quality water supply to Kisumu city residents. As an ongoing process, it is important for the proponent to put in place strategies and plans for waste water management given that some areas are not served with sewerage system
The National Land Policy, 2009	In chapter 4 of the land policy under Environmental Management Principles, the policy provides actions for addressing the environmental problems such as the degradation of natural resources, soil erosion, and pollution. The policy also recommends for appropriate waste management systems and procedures, including waste and waste water treatment, reuse and recycling. The policy further advocates for environmental assessment and audit as a land management tool to ensure environmental impact assessments and audits are	The proposed project will result in the generation of sludge from the water treatment process. Sludge management will be carried out in a way that complies with provisions of this policy. The project proponent engaged the stakeholders during the ESIA process and will continue to engage them throughout the construction and operation phases of the project. Any act of pollution to the environment will be remedied by the polluter in compliance

	carried out on all land developments that may degrade the environment and take appropriate actions to correct the situation. Public participation has been indicated as key in the monitoring and protection of the environment. The policy also advocates for the implementation of the polluter pays principle which ensures that polluters meet the cost of cleaning up the pollution they cause, and encourage industries to use cleaner production technologies.	with the provisions of this policy.

5.5 Kenyan Laws and Regulations

Table 5. 2: Relevant Legal Framework

Legal Framework	Provisions	Relevance to the project
The Water Act of 2016 Cap 372 laws of Kenya	This is an Act of Parliament to provide for the regulation, management and development of water resources; water and sewerage services; and for other connected purposes. Every water resource, according to Section 5 of the Act is vested in and held by the national government in trust for the people of Kenya. With regard to the regulation and management of water resources, the Act establishes Water Resources Authority that serves as the agent of the national government to regulate the management and use of water resources. The Act provides for regulation of water rights and works and provides for water permit in Section 36. A permit is required for any use of water resource, except as provided by section 37. Section 38 of the Act stipulates that anyone who without a permit carries out works for a purpose for which a permit is required commits an offence. The Act further provides for right to clean water and stipulates in Section 63 that every person in Kenya has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution. The Act establishes Water Works Development Agencies and stipulates their power and functions in Section 68 which include among others	The Act has provisions for obstruction or pollution of watercourses or water resources and prohibits pollution of any water body. Water pollution as a result of project activities is possible in this project. Rational use of water so as to make it available for competing uses will be achieved through application of permitting requirements of the Act. All stakeholders critical in project implementation shall therefore ensure that project activities do not in any way interfere with water quality and quantity for competing uses. Water quality monitoring requirements of the Act will be strictly complied with.

	undertaking the development, maintenance and management of the national public water works within its area of jurisdiction; operating the waterworks and provide water services as a water service provider, until such a time as responsibility for the operation and management of the waterworks are handed over to a county government, joint committee, authority of county governments or water services provider within whose area of jurisdiction or supply the waterworks is located and providing technical services and capacity building to such county governments and water services providers within its area as may be requested among others.	
Environmental Management and Coordination Act (EMCA) 1999	Part II on general principles provides for entitlement to a clean and healthy environment and states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. The Act also provides for Environmental Impact Assessment in Section 58 (1 and 2) and Environmental Audit and monitoring in Section 68 and 69. Other provisions of the Act include pollution prohibition, air quality standards, standards for waste, provisions for dangerous handling and disposal of waste, prohibition of discharge of hazardous substances, chemicals and materials or oil into the environment and spiller's liability.	Provisions relating to conservation of biological diversity; conservation of biological resources *in situ* and *ex situ* must be observed throughout the project life. Environmental auditing and monitoring of the project's operation status will also be done in compliance with provisions of this Act. Other provisions of the Act that will be observed by the proponent and other key stakeholders include environmental quality standards; water pollution prohibition; air quality standards and licenses to discharge effluents and emissions.
The Environmental Management and Co-ordination (Waste Management) Regulations, 2006	These Regulations were published in the Kenya Gazette Supplement No. 69, Legislative Supplement No. 37, and Legal Notice No. 121 of 29th September 2006. The regulations provide details on management (handling, storage, transportation, treatment, and disposal) of various waste streams including domestic waste; industrial waste; hazardous and toxic waste; pesticides and toxic substances; biomedical wastes; and radioactive waste. Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle. Regulation 5 (1) provides categories of cleaner production methods that should be adopted by waste generators in order to minimize the amount of waste generated and they include improvement of production process through conserving raw materials and	Construction and operation activities of the proposed project will generate various categories of solid waste. Details of wastes from proposed activities include non-biodegradable wastes, plastics, polythene, glass, metals; e-waste including batteries, computer components and other electronics; and oil and grease waste from vehicles and machinery. Provisions of the Regulations including responsibility of waste generators, segregation of waste by generators and cleaner production methods shall be implemented throughout project construction and operation phases. The contractor will prepare a waste management plan during

	energy, eliminating the use of toxic raw materials and wastes and reducing toxic emissions and wastes; and monitoring the product cycle from beginning to end by identifying and eliminating potential negative impacts of the product, enabling the recovery and re-use of the product where possible, reclamation and recycling and incorporating environmental concerns in the design and disposal of a product. The Regulations also requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment. It is an offence under the Regulations for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA.	construction phase to give an indication of how various waste categories shall be managed
Environmental (Impact Assessment and Audit) Regulations 2003	Regulation 4 requires project proponent to carry out environmental impact assessment for projects which are likely to have negative environmental impacts or for which environmental impact assessment is required under the EMCA. Regulation 6 provides for application for environmental impact licence. Regulation 7 stipulates contents of project report while regulation 11 provides for preparation by and approval of Terms of Reference before proceeding with EIA. The Regulations also provide for environmental impact assessment study and contents. The Regulations also provide for public participation and provides for contents of environmental impact assessment study.	These Regulations give guidelines for carrying out EIA and have provisions for preparation of Study Report. Regulation 11-17 of Part III on Environmental Impact Assessment study has governed this ESIA process. Provisions for public participation contained in the Regulations have also be complied with during EIA process. Environmental quality conservation aspects of the project will be realized through the implementation of the Environmental Management & Social Monitoring Plan aimed at mitigating the potentially negative impacts and enhancing the potentially positive impacts predicted through this environmental impact assessment process.
Noise and Excessive Vibrations Pollution Control Regulations	Under Part II , section 3 on 'General prohibitions', the Regulations provide that no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual; various factors including time of the day; proximity to residential area; whether the noise is	Contractors will operate on the basis of maximum permissible noise levels contained in the First Schedule of the Regulations. The Regulations have provisions for use of machinery at the site, noise from construction at night and noise, excessive vibrations for construction, demolition, mining or quarrying sites. All these shall be adhered

	recurrent, intermittent or constant; and the level and intensity of the noise among others may be considered. Any person who contravenes the provisions of this Regulation commits an offence.	to by the contractor. Provisions relating to licensing procedures for various site activities shall also be complied with.
Water quality Regulations 2006	Regulation 4 provides for prevention of water pollution and requires every person to refrain from any act which directly or indirectly causes or may cause immediate or subsequent water pollution. The Regulations also provide for protection of lakes, rivers, streams, springs, wells and other water sources and prohibits any person from discharging any effluent from sewage treatment works, industry or other point sources into the aquatic environment without a valid effluent discharge licence. The Regulations also prohibit discharge into aquatic environment and public sewers unless the discharged substance complies with the standards set out in the third, fourth and fifth schedules of the regulations. The Regulations calls for discharge monitoring and requires licence owners to carry out effluent discharge quality and quantity monitoring in accordance with methods and procedures of sampling and analysis prescribed by NEMA and shall submit quarterly records of such monitoring to the authority or its designated representative	During the construction and operation phases, LVSWWDA management, in Conjunction with relevant government agencies, will require constant monitoring in order to ensure that the activities do not affect the water quality of both surface and underground water resources as the proponent aims to comply with the standards specified in this regulation.
Occupational Safety and Health Act 2007	This Act provides for the general duties of occupiers of work places. In Part II Section 6(1), it states that every occupier shall ensure the safety, health and welfare at work of all persons working in his workplace. Part VI on health general provisions has provisions for cleanliness, overcrowding, ventilation, lighting and drainage of floors. On machinery safety, the Act provides for safe use of plant, machinery and equipment and examination and testing of plants. The Act also has permits to work provisions, protective clothing and appliances and offences and general penalty	Work at the proposed site may involve hazards such as accidental falls, working at heights, exposure to energized circuits and heavy equipment etc. Other potential sources of occupational injuries include entry into confined spaces, including manholes and dust generation associated with construction activities among others. The contractor will continuously improve the safety and health standards at the construction site making safety concern everyone's responsibility. Emergency response plan, warning signs, machinery safety and construction safety provisions of the Act which are aimed at managing occupational accidents, incidents and injuries at the work place will be put in place. All

		requisite trainings, approval and permits including Workplace Registration Certificate shall be procured by the proponent/ contractor
Air Quality Regulations 2014	Regulation 5 prohibits any person from acting in any way that directly or indirectly causes, or is likely to cause immediate or subsequent air pollution or emit any liquid, solid or gaseous substance or deposit any such substance in levels exceeding those set out in the First Schedule of the Regulations. The regulation prescribes primary pollutants in the Second Schedule and prohibits their emission into the environment. The Regulations also provide for ambient air quality levels in Second Schedule and gives odour guidelines whose limits should comply with the ambient air quality limits set out under First Schedule of the Regulations.	Air quality issues related to this project will emanate from excavation works, delivery of construction materials and emissions from construction machinery. Diesel exhaust emissions from machinery used on site should be controlled through regular checks and servicing of vehicles while speed limits within construction areas should be imposed. Dust and air pollution due to dust when excavated material is stockpiled should be limited by means of wetting (particularly dry season), covering with foil or working in small sections so that the trenches are backfilled with excavated soil within shortest possible period.
The Public Health Act Cap 242 Laws of Kenya	The Act contains comprehensive provisions on discharges of pollutants into watercourses among other prohibitions. The Act makes it the duty of every local authority (in the capacity of "health" authority) to take all lawful, necessary and reasonably practicable measures to safeguard and promote public health. Section 13 Part IX of the Act deals with sanitation and housing, and is of most significance for the control of polluting discharges. The Act also makes provision for protecting from pollution sources of drinking water supply. Section 129 makes it the duty of the Local authorities to prevent such pollution, to purify a pollution source and to prosecute the polluters.	Health issues will be integrated into the project to ensure that occupational and public health is maintained. The proponent and the contractor will work together to ensure compliance with provisions of this Act. Through consultation with other key stakeholders, the proponent will also put in place measures to mitigate all forms of nuisance in compliance with Part IX Sections 115 and 118 of the Act. In this regard, noise level, water quality and air quality will be maintained at stipulated levels during construction and operation phases of the project. Solid waste arising from project related activities will be managed in compliance with provisions of this Act.
The Physical Planning Act, 1996	The Act makes provision for development control. Persons wishing to undertake development must apply for and obtain consent from the local authority. The planning authority when considering a planning application shall have regard, *inter alia*,	Provisions of the Act with regard to development control shall be strictly adhered to. All developers within the project area must strictly adhered to requirement of the

	"to the health, amenities, and convenience of the community generally, and the proper planning and density of development and use of land in the area. Conditions imposed in granting consent to a planning application may require or prohibit specified activity. They may also require the applicant to enter into an undertaking to observe the conditions imposed and to furnish security to this end. The proponent and her agents will observe all the provisions of the Physical Planning Act	Act with regard to plot coverage and reservation of land for public utilities
The Malaria Prevention Act Cap 246	Section 5 on Drainage System states that no occupations at the construction phase that shall obstruct flow of water into or out of any drainage. The contractor shall be required to maintain drainage system within the area of the project for removal of water from any land around the project to prevent larvae breeding. The Proponent (LVSWWDA) and her agents including the contractor shall adhere to the provisions in the Act during the establishment and operation of the project	Site reinstatements and restorations must be undertaken in compliance with provisions of this Act. All storm water drainage systems should be restored to pre construction conditions to allow for unimpeded flow of storm water.
The Employment Act of 2007	The Act covers such critical issues: discrimination in employment, sex harassment at work, contract of service protection of wages, rights and duties in employment such as hours of work and termination of service, protection of children and dispute resolution procedures. The Act therefore declares and defines the fundamental rights of employees, to provide basic conditions of employment of employees and to regulate employment of children. No employer shall discriminate directly or indirectly, against an employee or prospective employee or harass an employee or prospective employee on grounds of race, colour, sex, language, religion, political or other opinion, nationality, ethnic or social origin, disability, pregnancy and mental status or HIV status. Notwithstanding any provision of any written law, no person shall employ a child in any activity which constitutes worst form of child labour. A person may make a complaint to a labour officer or a police officer of the rank of an inspector and above if that person considers any child to be employed in any activity which constitutes worst form of child labour.	Project management and the contractor will need to understand the requirements of the Act during employment. Equal opportunity shall be given to all communities around the project area so as to improve the socio-economic status of the area around the proposed project. The contractor will ensure that at no time will minors be engaged in any way during the construction and operation of the road project. The proponent shall also ensure that the contractor is conversant and adheres to all the provisions of the Employment Act
Work Injury Benefits Act (WIBA)	It is an act of Parliament to provide for compensation to workers for injuries suffered in the course of their employment. It outlines the following employer's liability for compensation for death or incapacity resulting from accident; compensation	The proponent and/or his agents shall comply with obligations of employers as contained in the Act. In this regard, the proponent and/or his agents shall obtain and

	in fatal cases; compensation in case of permanent partial incapacity; compensation in case of temporary incapacity; and persons entitled to compensation and methods of calculating the earning. No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury. Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.	maintain an insurance policy, with an insurer approved by the Minister in respect of any liability that the employer may incur under the Act to any of his employees and shall register with the Director of Occupational Safety and Health Services as provided for in the Act. The proponent and/or his agents shall also keep a register or other records of the earnings and other prescribed particulars of all employees. Any employee who shall be involved in any injury at work will be compensated as provided for in the Act.
The EMCA (Wetlands, River Banks, Lake Shores & Sea Shore Management) Regulations, 2009	These Regulations provides for the conservation and sustainable use of wetlands and their resources in Kenya; promotes the integration of sustainable use of resources in wetlands into the local and national management of natural resources for socio-economic development; ensures the conservation of water catchments and the control of floods; ensure the sustainable use of wetlands for ecological and aesthetic purposes for the common good of all citizens; ensures the protection of wetlands as habitats for species of fauna and flora; provides a framework for public participation in the management of wetlands; enhancement of education research and related activities; and the prevention and control of pollution and siltation. It also provides that an EIA and environmental audits as required under the Act shall be mandatory for all activities likely to have an adverse impact on the wetland. It also provides that the sustainable use of wetlands shall be integrated into the national and local land use plans to ensure sustainable use and management of the resources, among others.	The principle of public participation in the management of wetlands; the polluter-pays principle; the pre-cautionary principle; and the principle of public and private good shall be used in the management of wetland resources. Environmental impact assessment licence will be sought for all activities likely to have an adverse impact on the wetland resources. More importantly, wetland resources shall be utilized in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services.

The National Land Commission Act 2012	AN Act of Parliament to make further provision as to the functions and powers of the National Land Commission, qualifications and procedures for appointments to the Commission; to give effect to the objects and principles of devolved government in land management and administration, and for connected purposes. The objectives and functions of the National Land Commission as elaborated in the Act include management and administration of land in accordance with the principles of land policy set out in Article 60 of the Constitution and the national land policy.	The proposed project will seek the advice of the National Land Commission should there be need for acquisition of any public land for purposes of implementation of project infrastructure. A resettlement Action Plan shall be initiated in this regard.

5.6 International Agreements and Conventions

Table 5. 3: International Agreements and Conventions Relevant to the Project

Agreement/Convention	Description	Relevance
Vienna Convention for the Protection of the Ozone Layer, 1985	Protection of the ozone layer, came into force in 1988,	Control of release of Ozone depleting gases into the atmosphere
Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	Protection of the ozone layer.	Control of release of Ozone depleting gases into the atmosphere
United Nations Framework Convention on Climate Change (UNFCC), 1994	Control of greenhouse gas emissions.	Control of release of Greenhouse gases into the atmosphere
The Geneva Convention, 1979	Establishes protocols for emissions of sulphur dioxide, nitrogen oxides, volatile organic hydrocarbons, ammonia, persistent organic pollutants, and heavy metals	These gases must be managed in such a way that they are not released into the atmosphere
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), 1971	The conservation and sustainable utilization of wetlands, i.e. to stem progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.	Release of raw effluents into the neighbouring Lake Victoria should not be allowed in compliance with the provisions of this convention
United Nations Convention on Biological Diversity, 1992	Promotes development of national strategies for the conservation and sustainable use of biological diversity. Often seen as the key document regarding sustainable development.	All biological resources within the project area should be sustainably managed for sustainability reasons
Constitution of the International Labor Organization	Promotes opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and human dignity.	Dignity of all employees engaged at this site should be maintained both during construction and operation phases of the project

5.7 Regulatory Framework

5.7.1 The Water Sector Regulations

5.7.1.1 General

The National Policy on Water Resources Management and Development and the Water Act 2016, presently guides water resources management. The overall goal of the National Water Development Policy is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance to meet all competing uses in a sustainable, rational and economical way. This policy separates policy formulation, regulation and services provision and defines clear roles for sector actors within a decentralized institutional framework and includes

private sector participation and increased community development. The following institutions are relevant for the successful implementation of the proposed project.

5.7.1.2 Ministry of Water and Sanitation (MWS)

This is the overall ministry in charge of water in Kenya. It is responsible for policy development; sector co-ordination; monitoring and supervision to ensure effective water and sewerage services in the country; sustainability of water resources; and development of water resources for irrigation, commercial, industrial, power generation and other uses. Its mission statement is to contribute to national development by promoting and supporting integrated water resource management to enhance water availability and accessibility.

5.7.1.3 Water Resources Authority (WRA)

The Authority is responsible for sustainable management of the nation's water resources; implementation of policies and strategies relating to management of water resources; development of principles, guidelines and procedures for the allocation of water; development of catchments level management strategies including appointment of catchments area advisory committees; regulation and protection of water resources quality from adverse impacts; and classification, monitoring and allocation of water resources.

5.7.1.4 Water Services Regulatory Board (WASREB)

The Regulatory Board is responsible for the regulation of the water and sewerage services in partnership with the people of Kenya. Its mandate include among others regulating the provision of water and sewerage services including licensing, quality assurance, and issuance of guidelines for tariffs, prices and disputes resolution; overseeing the implementation of policies and strategies relating to provision of water services; licensing of Water Services Boards and approving their appointed Water Services Providers; monitoring the performance of the Water Service Boards and Water Service Providers; inform the public on the sector performance; and gives advice to the Minister in charge of water affairs.

5.7.1.5 Lake Victoria South Water Works Development Agency (LVSWWDA)

Lake Victoria South Water Works Development Agency (LVSWWDA) is a state corporation under the Ministry of Water and Sanitation. It was preceded by Lake Victoria South Water Service Board (LVSWSB) established under the Water Act 2002 through Gazette Notice No. 1714 of 12th March 2004 with the mandate of ensuring efficient and economic provision of Water and Sanitation Services in its area of jurisdiction. The Agency is among the 8 Water Works Development Agencies established all over the country. The Water Act 2016 requires that LVSWWDA contracts agents i.e. Water Service Providers (WSP) to provide water and sanitation services on its behalf.

5.7.1.6 Water Sector Trust Fund (WSTF)

This body assists in the financing of the provision of water services to areas of Kenya that are without adequate water services. This shall include providing financing support to improved water services towards capital investment to community water schemes in underserved areas; capacity building activities and initiative among communities' water services activities outlined in the water services strategic plan as prioritized by the government; awareness creation and information dissemination regarding community management of water services; and active community participation in the management of water services

5.7.1.7 Kisumu Water and Sanitation Company Limited (KIWASCO)

Kisumu Water and Sanitation Company Ltd was established through the reforms that took place in the water sector nationally and based on the decision to privatise essential services. The Company was established in July 2003 as an independent company after the transformation of the water and sewerage department of the then Kisumu Municipal Council. The core objective of KIWASCO is to make the water and sewerage services provision a commercial activity that generates sufficient revenue to sustain its operations throughout Kisumu City.

5.7.1.8 The County Government of Kisumu

The passage of Kenya's 2010 constitution has had a wide set of implications for the water sector. Primarily, the constitution acknowledges access to clean and safe water as a basic human right and assigns the responsibility for water supply and sanitation service provision to 47 newly established counties. The County government of Kisumu is therefore mandated to spearhead water and sanitation provision within Kisumu city in partnership with the local water service board.

5.7.2 National Environment Management Authority (NEMA)

NEMA is the administrative body that is responsible for the coordination of the various environmental management activities in Kenya. NEMA is also the principal government authority for implementing all environmental policies. NEMA is also responsible for granting EIA approvals and for monitoring and assessing activities in order to ensure that the environment is not degraded by such project activities.

5.8 European Investment Bank (EIB) Environmental and Social Standards

5.8.1. Assessment and Management of Environmental and Social Impacts and Risks

This Standard applies to all operations likely to have significant and material environmental and social impacts and risks. These impacts and risks need be taken into account at the earliest possible stage in all the technical planning and decision-making processes. The standard requires project proponents to carry out an environmental and social assessment for any project which is likely to have significant environmental and social impacts and risks.

5.8.2 Pollution Prevention and Abatement

Pollution prevention and control are key pillars of EU environmental policy that, in general, contribute significantly to the EU's broader objectives of smart, sustainable and inclusive growth. The objectives of this Standard includes among others the avoidance of any deterioration in the quality of human health or the environment, and any loss of biodiversity, by avoiding, reducing and, if possible, compensating/remedying significant adverse effects of projects supported by the EIB.

5.8.3 Biodiversity and Ecosystems

Biodiversity and healthy ecosystems are necessary for human survival and a good quality of life, but are being lost and degraded at a greatly accelerated rate because of human activities. Underpinning the Biodiversity and Ecosystem Standard of the EIB is the overall goal of maintaining the integrity of areas important for biodiversity as well as the natural functions, processes, and resilience of ecosystems, with the aim of achieving no net loss or a net gain of biodiversity and ecosystem.

5.8.4 Climate-Related Standards

The EIB Climate Standards, related to the value added by the EIB, require that its financing as a whole is aligned with EU climate policy. Specifically, the EIB is committed to making its lending portfolio more climate-friendly by promoting climate change mitigation projects in various sectors and promoting the adoption of energy efficient solutions in the projects financed; mainstream climate risk considerations generally into the project cycle and to promote adaptation projects or projects with adaptation components and measures, in the interests of long term sustainability among others.

5.8.5 Cultural Heritage

The objective of this Standard is to outline the proponent's responsibilities in terms of cultural heritage management, involving the actions taken to identify, assess, decide and enact decisions regarding the impact on cultural heritage associated with operations supported by the EIB. The standard aims to support the conservation of cultural heritage in the context of EIB operations and to protect cultural heritage from adverse impacts of project activities by promoting the cultural heritage impact assessment and management.

5.8.6 Involuntary Resettlement

The objectives of this Standard are to avoid or, at least minimise, project-induced resettlement whenever feasible by exploring alternative project designs and avoid and/or prevent forced evictions and provide effective remedy to minimise their negative impacts should prevention fail. The standard also aims to ensure that any eviction which may be exceptionally required is carried out lawfully, respects the rights to life, dignity, liberty and security of those affected who must have access to an effective remedy against arbitrary evictions. Respect individuals', groups' and communities' right to adequate housing and to an adequate standard of living, as well as other rights that may be impacted by resettlement are also provided for in the standard.

5.8.7 Rights and Interests of Vulnerable Groups

Some individuals or groups may be less resilient to risks and adverse impacts than others. Within the context of EIB operations, individuals and/or groups who are at a higher risk of being unable to anticipate, cope with, resist and recover from project-related risks and/or adverse impacts are considered vulnerable. Vulnerable individuals or groups may include women, children, the elderly, the poor, ethnic, religious, cultural or linguistic minorities, or indigenous groups. This standard sets out to avoid or minimise, or otherwise mitigate and remedy, potential harmful effects of EIB operations to vulnerable individuals and groups whilst seeking that these populations duly benefit from such operations.

5.8.8 Labour Standards

The workforce is a valuable asset for any company. Sound management of human resources and of worker relations is key for sustainable business practices. The development of fair, safe and healthy working conditions based on respect for workers' rights fosters efficiency and productivity. In contrast, the failure to create and maintain sound worker-management relationships can undermine workforce commitment and effective project implementation. In these standards, the responsibilities of the project proponent are defined to ensure that the project embraces the principles of International Labour Standards.

5.8.9 Occupational and Public Health, Safety and Security

Projects often bring employment, economic growth and social improvement opportunities to both workers and communities. Project activities, however, can also increase exposure to hazards, risks and negative impacts in terms of public health and safety. These may arise through or be amplified by project-related occurrences such as increased environmental pollution; elevated noise levels the spread of communicable diseases or disproportionate use of violence by private or public security forces. These standards lay procedures to protect and secure public and occupational health, safety and security and promote dignity of workers and citizens affected by EIB operations.

5.8.10 Stakeholder Engagement

A meaningful engagement process allows for the efficient implementation of a financed operation and, in particular, the early and effective identification, assessment, and management of any environmental and social risks, impacts, and opportunities. The views, interests, and concerns of project affected communities and other interested stakeholders are heard, understood, and taken into account throughout the project lifecycle. The standard outlines a systematic approach to stakeholder engagement that the project proponent is expected to build and maintain by way of a constructive relationship with relevant stakeholders.

5.9 World Bank Environmental and Social Standards (ESS)

5.9.1 ESS1: Assessment and Management of Environmental and Social Risks and Impacts

These standards sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing (IPF), in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).

5.9.2 ESS2: Labor and Working Conditions

This standard recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.

5.9.3 ESS3: Resource Efficiency and Pollution Prevention and Management

This standard recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. This ESS sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life-cycle.

5.9.4 ESS4: Community Health and Safety

This standard addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

5.9.5 ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

Involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

5.9.6 ESS10: Stakeholder Engagement and Information Disclosure

This standard recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

CHAPTER 6

6.0 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 Introduction

This chapter presents the assessment of the issues likely to emanate from implementation of the proposed project and associated infrastructure. For each issue, the analysis is based on its nature, the predicted impact, extent, duration, intensity, probability, and the stakeholders and/or values affected. In accordance with best practice, the analysis includes issues relating to the project's environmental and social sustainability. For potential negative impacts judged to be significant and require mitigation, the analysis is followed by notes on mitigation options. Impacts and their possible mitigation are combined in this chapter for easy reference. As in most impact studies, the analyses focus on potential problems and their solutions. Appropriate actions are included in the EMP (Chapter 9), and recommended immediate next steps are highlighted in Chapter 12.

6.2 Impact identification

6.2.1 Sources of impacts

The impacts associated with the proposed project will emanate from project inputs, activities and outputs. The project inputs that shall be potential sources of impacts include materials taken from local and external sources including sand and cement; skilled and unskilled workforce exerting indirect demand for energy, water supply, sanitation, health services etc; and machinery used at the project site for various activities. The project activities that shall be potential sources of impacts include obtaining raw materials e.g. water abstraction, sand harvesting etc; transportation of raw materials, machinery and labour to the site; site preparation and clearance; topsoil removal; demolition works (for structures located along project alignment areas); excavation works; disposal of excavated materials; backfilling works and compaction. Project outputs likely to lead to adverse impacts include solid wastes from construction and operation activities; emissions from the site (hydrocarbons, Carbon dioxide, and particulate matter); noise pollution from construction activities and hazardous waste (oil) spillage

Table 6. 1: Sources of impacts

Project Inputs	Project Activities	Project Outputs
• Materials taken from local and external sources • Skilled and unskilled workforce • Machinery used at the project site	• Raw material extraction • Transportation of raw materials • Transportation of machinery • Transportation of labour • Site clearance • Excavation works • Spoil and waste disposal • Backfilling and compaction	• Waste generated • Gaseous emissions from the site • Noise from site activities • Oil spills

6.2.2 Receptors of impacts

The anticipated negative impacts will be experienced on both the physical and human environments. Human environment likely to be affected by project activities include structures within project vicinity and alignment areas; residential premises within project vicinity; businesses within project vicinity and workers at the site. Natural environment likely to be affected by project activities include surface and ground water resources within the vicinity of the project and air quality within the project area.

Table 6. 2: Receptors of impacts

Human Environment	Physical Environment
• Residential houses within project vicinity • Business premises within project vicinity • Academic institutions including schools • Workers at the site	• Surface water resources • Ground water resources • Plants and animals within project alignment area • Ecologically sensitive areas • Soil

6.3 Impact Assessment Criteria

The criteria applied in this study are based on industry standards for impact assessment, adopted for use in the assessment of the proposed project impacts. The purpose of impact assessment is to assign relative significance to predicted impacts associated with the project, and to determine the manner in which impacts are to be avoided, mitigated or managed. The rating of impacts assumes that standard construction and operating procedures present in the project description will be implemented. The impact assessment criteria include the spatial context of project impacts; temporal context; and reversibility, magnitude and significance of potential impacts of project construction and operation. The potentially significant environmental and social impacts have been identified based on the nature of the receiving environment, analysis of the proposed activities and analysis of the issues raised by stakeholders during public participation process.

6.4 Impact Assessment Methodology

6.4.1General

In the impact assessment stage of the ESIA, identified issues are analysed and expected impacts are defined. This analysis identifies the types of impact; predicts the magnitude, probability of occurrence and extent of the impact; and determines the overall significance of the impact

6.4.2 Identification of environmental aspects and impacts

The outstanding environmental and social issues identified as having significance have been assessed using the following methodology.

(i) First, the issues identified were described giving consideration to the associated activity and the aspect of that activity that is likely to result into an impact;
(ii) The nature of the impact was then described;
(iii) Once this was undertaken, the significance of the impact was determined.

The following definitions have been used in identification of environmental and social impacts in this study:

(i) An activity

This is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation.

(ii) An environmental aspect

This is an “element of an organisation’s activities, products and services which can interact with the environment”. The interaction of an aspect with the environment may result in an impact.

(iii) Environmental impacts

These are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. Impacts on the environment can lead to changes in existing conditions; the impacts can be direct, indirect or cumulative. Direct impacts refer to changes in environmental components that result from direct cause-effect consequences of interactions between the environment and project activities. Indirect impacts result from cause-effect consequences of interactions between the environment and direct impacts. Cumulative impacts refer to the accumulation of changes to the environment caused by human activities.

Aspects and impacts associated with the proposed development have been differentiated into construction and operation phases of the project.

6.5 Description of aspects and impacts

The accumulated knowledge and the findings of the environmental investigations form the basis for the prediction of impacts. Once a potential impact has been determined during screening and scoping process, it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies and has been used in this study. The aspects and impacts identified have been described based on the following criteria.

6.5.1 Spatial scope

The spatial scope for each aspect, receptor and impact has been defined. The geographical coverage (spatial scope) description has taken account of the following factors:

- The physical extent/distribution of the aspect, receptor and the anticipated impact; and
- The nature of the baseline environment within the area of impact.

The spatial scope of the impact has been rated on the following scale:

Activity specific	1	Area specific	2	Whole site	3	Regional/ neighbouring areas	4	National	5

6.5.2 Duration

Duration refers to the length of time that the aspect may cause a change either positively or negatively on the environment. The environmental assessment has distinguished between different time periods by assigning a rating to duration based on the following scale:

One day to one month	1	One month to one year	2	One year to ten years	3	Life of operation	4	Post closure	5

6.5.3 Severity

The severity of environmental aspect has been determined by the degree of change to the baseline environment, and has included consideration of the following factors:

(i) The reversibility of the impact;
(ii) The sensitivity of the receptor to the stressor;
(iii) The impact duration, its permanency and whether it increases or decreases with time;
(iv) Whether the aspect is controversial or would set a precedent; and
(v) The threat to environmental and health standards and objectives.

The following ratings have been used

Insignificant/ non-harmful	1	Small/ potentially harmful	2	Significant/ slightly harmful	3	Great/ harmful	4	Disastrous/ extremely harmful	5

6.5.4 Frequency of Activity

Frequency of activity has considered the repetitiveness of various project activities and how this may impact on the various receptors of the impacts. The following ratings have been used

Annually or less	1	6 monthly	2	Monthly	3	Weekly	4	Daily	5

6.5.5 Frequency of the impact

The frequency of the impact occurring refers to how often the aspect impacts or may impact either positively or negatively on the environment. After describing the frequency the findings have been indicated on the following scale:

Almost never/ almost impossible	1	Very seldom/ highly unlikely	2	Infrequent/ unlikely/ seldom	3	Often/ regularly/ likely/ possible	4	Daily/highly likely/ definitely	5

6.6 Assessment of significance of impacts

6.6.1 General

The purpose of impact evaluation is to assign relative significance to predicted impacts associated with the project, and to determine the manner in which impacts are to be avoided, mitigated or managed. The information presented above in terms of identifying and describing the aspects and impacts have been summarised in a tabular form and significance has been assigned with supporting rationale. Significance has been determined before and after mitigation, taking into consideration all the factors described above. A definition of a “significant impact‟ for the purposes of this study is: “An impact which, either in isolation or in combination with others, could, in the opinion of the specialist, have a material influence on the decision-making process, including the specification of mitigating measures.”

6.6.2 Significance determination

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which has already been assessed by the relevant

specialist. The description and assessment of the aspects and impacts undertaken is presented in a consolidated table (Table 6.2) with the significance of the impact assigned using the process and matrix detailed below. The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the CONSEQUENCE of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the LIKELIHOOD of the impact occurring. The product of CONSEQUENCE and LIKELIHOOD leads to the assessment of the SIGNIFICANCE of the impact, shown in the significance matrix below.

Table 6. 3: Significance Assessment Matrix

CONSEQUENCE (Severity + Spatial Scope + Duration)															
LIKELIHOOD (Frequency of activity + Frequency of impact	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 6. 4: Positive and Negative Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very high	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-high	76-100	Improve current management	Maintain current management
	Medium-low	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very-low	1-25	Maintain current management	Improve current management

The model outcome is then assessed in terms of impact certainty and consideration of available information. Where a particular variable rationally requires weighting or an additional variable requires consideration, the model outcome is adjusted accordingly. Arguments for such adjustments are presented in the text and associated table.

Table 6. 5: Framework for Assessing Environmental Impacts

SPATIAL SCOPE	RATING	DURATION	RATING	SEVERITY	RATING
Activity specific	1	One day to one month	1	Insignificant/ non-harmful	1
Area specific	2	One month to one year	2	Small/ potentially harmful	2
Whole site / plant	3	One year to ten years	3	Significant/ slightly harmful	3

Regional (neighbouring areas)	4	Life of operation	4	Great/harmful	4
National	5	Permanent	5	Disastrous/ extremely harmful	5

FREQUENCY OF ACTIVITY	RATING	FREQUENCY OF IMPACT	RATING
Annually or less	1	Almost never / almost impossible	1
6 monthly	2	Very seldom / highly unlikely	2
Monthly	3	Infrequent / unlikely / seldom	3
Weekly	4	Often / regularly / likely / possible	4
Daily	5	Daily / highly likely / definitely	5

SIGNIFICANCE OF IMPACT	TIMING
Very Low (1-25) Low (26-50) Medium -Low (51-75) Medium-High (76-100) High (101-125) Very High (126-150)	Pre-construction Construction Operation

6.7 Description of Feasible Alternatives

Although alternatives were investigated in detail during screening and scoping process, a review of the options based on the impact assessment have been undertaken in comparison with the preferred option.

6.8 Mitigation

Measures to avoid, reduce or manage impacts consistent with best practice have been proposed and the effectiveness of such measures assessed in terms of their ability to avoid, remove an impact entirely, render it insignificant or reduce its magnitude. In assessing the significance of the impact, natural and existing mitigation have been taken into account. Natural and existing mitigation measures are defined as natural conditions, conditions inherent in the project design and existing management measures that alleviate (control, moderate or curb) impacts. In addition, the significance of impacts has been assessed taking into account any mitigation measures that are proposed.

6.9 Existing environmental and social impacts

Provision of water and sanitation services within Kisumu city is not at the same level in all residential areas within the city. While some areas are adequately covered by water and sanitation services, others lack these services. Lower Migosi for example has no functional sewerage system. Residents of the area release their raw sewer into the storm water drainage channels and the untreated water ultimately ends in Lake Victoria. Most access roads within the estate have not been done to bitumen standards and get muddy during rainy season. These roads are narrow and have been encroached by private developers and business enterprises including food kiosks and retail shops. While Upper Migosi has functional sewerage system, the system is in dire state of disrepair characterised with pipe bursts and blockages leading to discharge of raw sewer into the environment. This wastewater ends up in local storm water drainage systems within the area and ultimately to Lake Victoria. Manholes chambers within the project area are dilapidated and some lack covers. It was noted during the study that some

sewer lines in this area passed under private buildings while manholes were located in private properties. Private individuals have also blocked access between plots making it difficult to carry out any maintenance works on the existing lines. In many areas, buildings have been constructed such that they cover entire plot areas leaving no space for implementation of public infrastructure. With regard to water supply, the city gets its water from the pipe system of Kisumu Water and Sanitation Company, boreholes and shallow wells. The above situation is repeated in most residential areas of Kisumu City. Issues noted within the project area that may adversely impact the proposed project implementation include the following.

6.9.1 Encroachment of road reserve by development facilities

Road reserves within the project area have been encroached by private developers. A number of business enterprises have been erected within road reserves. These businesses include second hand cloth stores, food kiosks, retail shops and workshops. Some of the businesses are constructed of permanent materials while others are constructed of temporary materials. This has led to a situation where the roads have become narrower and this may pose challenges during implementing public works.

6.9.2 Encroachment of sewer line way leaves by private developments

It was noted that some buildings have been constructed on the path of sewer lines while in some situations, manholes chambers are located within private residential houses. This makes it difficult to respond to emergencies like sewer blockages and back flows. Carrying out line maintenance activities also becomes a challenge under these circumstances.

Plate 8: Building constructed on top of sewer line in Migosi area

6.9.3 Buildings covering the entire plot areas

It was noted that most buildings have been constructed to cover entire plot areas and no space has been left for implementation of public infrastructure. This state of affairs may present

challenges during construction process as private properties may be demolished to give way for the proposed works.

6.9.4 Release of raw sewer into storm water drainage systems

Majority residents in areas that are yet to be connected to sewerage systems discharge raw sewer into the storm water drainage channels within the affected areas. This practice contributes to significant levels of pollution of both ground and surface water resources.

Plate 9: Raw sewer released into storm water drainage system

6.9.5 Location of sewerage infrastructure within private compounds

It was noted during the study that some sewerage infrastructure including manholes chambers were located within private properties making it difficult to respond to emergencies like blockages, backflows and also routine maintenance activities

6.9.6 Blocked access between buildings

Accesses between buildings in some areas have been blocked by private developments. It was noted during this study that in some areas, perimeter walls have been erected between buildings completely blocking access. Lines within fenced off areas cannot be accessed for maintenance unless the property owners are available and this may pose challenges during implementation of public works.

6.9.7 Manhole chambers covered underground

It was noted also during the study that manholes chambers in some areas have been covered underground and this makes it difficult to carry out maintenance works. This also exposes buried manhole chambers to blockages, a state of affair that may affect the entire system

6.9.8 Manholes chambers lacking manhole covers

The open manhole chambers pose challenges that are both environmental and public health in nature. Open manholes can aggravate accidents when people fall into them. The manholes may also be used by local residents as solid waste receptacles causing blockages of the system. Once the chambers are blocked, raw sewage may end up in the local environment ultimately contributing to pollution of both surface and ground water resources.

6.9.9 Blocked manhole chambers

A number of manhole chambers were noted to be blocked and this impedes flow of wastewater within the system. Raw sewage was noted freely flowing within the storm water drainage channels and along the access roads within the project area. This significantly contributes to environmental pollution within the project area.

Plate 10: Blocked manhole chambers within project area

6.9.10 Encroachment of Nyalenda Treatment Pond site

It was noted during the study that sections of Nyalenda treatment pond area has been encroached by some neighbouring community members. These include herders, fishermen and farmers. Local residents may in future lay claim to the land if this situation is allowed to continue

6.10 Potential impacts and mitigation measures during construction phase

6.10.1 Disruption of socio-economic activities within the project area

Impacts on socio-economic front associated with the proposed project have been looked at from the point of view of individual properties that will be affected by project infrastructure. Most of the properties in question include business premises among them kiosks and shop verandas. Most of these are located along project alignment areas and will be affected during construction process. The disruptions of the socio-economic activities have the potential of leading to losses of revenue.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	4	9	9	81
	Whole site	One month to one year	Harmful	Daily	Likely			Medium-high
Mitigation Measures	• Kiosk owners who have constructed their kiosks within road reserves will be advised in advance to remove the kiosks before excavation activities begin. They will be allowed to reconstruct their kiosks after the pipes have been layed and trenches backfilled. The impacts will therefore be short term. • In situations where the facilities are outside the road reserve but have to be affected by the works, the affected individuals shall be compensated as per provisions of World Bank OP 4.12 and applicable Kenyan legislations. • Other option available is to reconstruct the affected structure on behalf of the Project Affected Person (PAP) • Loss of revenue from disrupted services e.g. water shall be mitigated through expeditious restoration							
With mitigation Measures	1	1	1	4	1	3	6	15
	Activity specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

6.10.2 Disruption of services within the project alignment area

Construction of the project and associated infrastructure may lead to disruption of water services due to breakage of underground water pipes by construction machinery. Underground power and optic fibre cables may also be disrupted during excavation and trenching works. Construction of the project and associated infrastructure may also lead to disruption of power services due to breakage of underground power cables by construction machinery

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	3	9	8	72
	Whole site	One month to one year	Harmful	Daily	Infrequent			Medium-Low
Mitigation Measures	• The contractor shall liaise with Kisumu Water and Sanitation Company (KIWASCO) and private water service providers to restore all disrupted water services as soon as pipe laying and backfilling of trenched areas are finalised • The contractor shall liaise with Kenya Power Company to restore power cables cut during excavation activities as soon as pipe laying and backfilling of trenched areas are finalised.							
With mitigation Measures	1	1	1	4	1	3	5	15
	Activity specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

6.10.3 Impact on fences and perimeter walls

These impacts shall emanate from destruction of individual properties including live fences, barbed wire fences and perimeter walls to provide way leave for project infrastructure. The fences could either be accidentally demolished or live fences uprooted during trenching works.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	2	9	7	63
	Whole site	One month to one year	Harmful	Daily	Very seldom			Medium-Low
Mitigation Measures	• The destroyed fences will either be restored by the contractor • Where destruction is significant, owners compensated after resettlement Action Plan are carried out and the properties valued.							
With	1	1	1	4	2	3	6	18

mitigation Measures	Activity specific	One day to one month	Non harmful	Weekly	Very seldom			Very Low

6.10.4 Impact on public infrastructure

There are instances where the proposed project infrastructure will cross public roads and rail line thus disrupting traffic flow. Access roads within the project area are likely to be temporarily blocked by excavated materials. Road surfaces may also be interfered with as a result of trenching works

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	2	9	7	63
	Whole site	One month to one year	Harmful	Daily	Very seldom			Medium-Low
Mitigation Measures	(i) All excavated soil shall be used for backfilling of trenched areas and site restoration. (ii) Damaged road surfaces shall be adequately restored to pre-excavation conditions. (iii) Excess spoil materials shall be disposed of in approved tips in compliance with existing laws, rules and regulations							
With mitigation Measures	1	2	1	4	2	3	6	18
	Activity specific	One day to one month	Non harmful	Weekly	Very seldom			Very Low

6.10.5 Blockage of drainage channels

Drainage blockages due to temporary disruption of surface runoff as a result of the construction process will be experienced.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	2	9	7	72
	Whole site	One month to one year	Harmful	Daily	Very seldom			Medium-Low
Mitigation Measures	(i) Working under dry weather conditions and unclogging all blocked storm water drainage channels shall be implemented.							
With mitigation Measures	1	1	1	4	2	3	6	18
	Activity specific	One day to one month	Non harmful	Weekly	Very seldom			Very Low

6.10.6 Impacts of obtaining construction materials

The project will require some amount of materials for construction of project related infrastructure. Specific sources for these materials have not been identified. The project will require both borrow pits (for soil) and quarries (for rock). These need to be sited, accessed, operated and closed so as to avoid archaeologically sensitive sites, minimise impacts on land users and avoid the creation of safety or health hazards (e.g. steep slopes, malarial ponds). The project will also require sand. Sand mining from rivers is associated with habitat destruction due to changes in channel morphology.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	5	2	3	4	4	10	8	80
	National	One month to one year	Significant	Weekly	Likely			Medium-High

Mitigation Measures	• Maximise the re-use of excavated materials in the works, as fill. • Site quarries and borrow pits carefully so as to minimise impacts on existing land uses. • Strip all available topsoil from borrow pits and quarries and store it safely for use in site restoration. • Close all borrow pits and quarries in accordance with an approved plan to maximise their long-term biological productivity (capacity for plant growth) and minimise health and safety hazards. • Carry out EIA for quarry site if new quarries are to be opened for purposes of this project • Include a provision in the tender documents that where goods and services are of equal quality, those sourced from an organisation implementing a certified EMS and/or CSR approach will be preferred.							
With mitigation Measures	2 Area specific	1 One day to one month	1 Non harmful	2 Six monthly	1 Almost impossible	4	3	12 Very Low

6.10.7 Accidents and Injuries to workers and residents

Activities associated with construction such as excavating of trenches, movement of construction vehicles, the use of equipment and the congregation of workers and staff on site increase the risk of injury. Construction activities will also result in access of the area by vehicles delivering materials to the site that may result in accidents/incidents. Work at the proposed site may involve hazards such as accidental falls into open trenches, slippery walkways, working at heights, exposure to energized circuits, and heavy equipment. Work at the project site may also involve entry into confined spaces, including manholes and storage tanks among others.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3 Whole site	2 One month to one year	4 Harmful	5 Daily	4 Likely	9	9	81 Medium-High
Mitigation Measures	• The Contractor shall conform to all the stipulations of the Occupational Health and Safety Act, 2007. The Act requires the designation of a Health and Safety representative when more than 20 employees are deployed; • The contractor shall provide ample warning signs, guard rails, warning tape, etc., around open excavations, stacks of material, debris, etc. and shall be held liable for all claims as a result of neglect of such precautions and provisions; • Proper access control should be enforced to ensure that no unauthorised persons enter the site; • Material delivery vehicles should be under the control of competent personnel. Ensure that persons handling equipment and materials are suitably trained, supervised and adequately instructed; • Install railing around all process tanks and pits. Require use of a life line and personal flotation device (PFD) when workers are inside the railing, and ensure rescue buoys and throw bags are readily available; • Implement a confined spaces entry program that is consistent with applicable national requirements and internationally accepted standards. • Valves to storage tanks should be locked to prevent accidental flooding during maintenance; • Use of requisite Personal Protective Equipment (PPE) at all times during construction works • Use fall protection equipment when working at heights; • Maintain work areas to minimize slipping and tripping hazards; • Use proper techniques for trenching and shoring; • When installing or repairing mains adjacent to roadways, implement procedures and traffic controls, such as establishment of work zones so as to separate workers from traffic and from equipment as much as possible; reduction of allowed vehicle speeds in work zones to 10km/hr; and use of high-visibility safety apparel for workers in the vicinity of traffic							
With mitigation Measures	1 Activity specific	2 One month to one year	1 Non harmful	5 Daily	1 Almost impossible	4	6	24 Very Low

6.10.8 Risks to local residents

The public as well as workers are at risk from major civil engineering projects such as this project, particularly from construction traffic, and local women through sexually transmitted diseases. The project will generate substantial amount of traffic compared to the non-project situation. This traffic will be travelling on the public roads within the project area. Accidents could occur due to excessive speeds, unsafe loading, poor road surfaces, poor vehicle maintenance, and unwary pedestrians, especially drunken men, and children. Local women may take advantage of the cash available to male project workers. They may therefore be involved in unsafe sex and be at high risk of becoming infected with (and subsequently passing on) sexually transmitted infections including HIV/AIDS. This is a significant gender issue.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	4	9	9	81
	Whole site	One month to one year	Harmful	Daily	Likely			Medium-high
Mitigation Measures	• Establish and enforce a strict code of conduct for all project drivers including outside suppliers delivering materials. The code should focus on safety, especially speed, and loading, especially banning all carriage of staff, workers and passengers except in seats. • Establish and implement an HIV/AIDS prevention programme specifically related to the project's construction phase. The programme should include, at a minimum, the identification of specific risk groups (e.g. bar workers, truck drivers), specific AIDS awareness campaigns for these risk groups and HIV/AIDS tests for identified sex workers and the provision of Anti retro-virals.							
With mitigation Measures	1	2	1	5	1	4	6	24
	Activity specific	One month to one year	Non harmful	Daily	Almost impossible			Very Low

6.10.9 Solid waste generation

Construction will result in the generation of various solid wastes, principally surplus aggregates, metal scraps, plastics (wrappings and containers) and wood. During operation phase, the project will generate a variety of waste types which must be disposed of in accordance with national laws and regulations.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	2	2	2	5	3	6	8	48
	Regional	One month to one year	Potentially harmful	Six monthly	Likely			Medium to low
Mitigation Measures	• Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable to the supervising architect and environmental consultant; • Construction site management plans will be required for all works. This plan will include a waste management plan for all activities during the construction period. • Dispose of lime sludges by land application at a solid waste disposal site approved by the local authority and in compliance with Solid Waste Regulations 2006. • Bins/ receptacles shall be placed at appropriate locations within the site as collection centres to facilitate separation and sorting of the various types of wastes; • The contractor shall work hand in hand with private waste handlers and local council to facilitate sound waste management; and • The wastes shall be properly segregated and separated to encourage recycling of some useful waste materials.							
With mitigation Measures	1	1	1	5	1	3	6	18
	Activity specific	One month to	Non harmful	Daily	Almost impossible			Very Low

		one year						

6.10.10 Minimal soil erosion

Soil erosion may occur due to uncontrolled excavation of trenches during rainy seasons, from inadequacies in backfilling construction works and improper drainage of storm water. Excavation works will expose soil to agents of erosion leading to soil erosion problems. Occurrence of the impact will be short term and will be restricted to construction phase of the project. Implementation of mitigation measures can reduce the impact to significance of low to negligible.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	3	2	5	4	8	9	72
	Whole site	One year to ten years	Potentially harmful	Six monthly	Likely			Medium-Low
Mitigation Measures	• Avoid hampering drainage of surface water and plan for restoration measures after construction. • At the end of construction works, level off the soils and facilitate vegetation regeneration.							
With mitigation Measures	1	1	1	5	1	3	6	18
	Activity specific	One day to one month	Non harmful	Daily	Almost impossible			Very Low

6.10.11 Atmospheric Pollution

The expected air pollutants from the proposed project will include dust, particulate matter and gaseous emissions from construction materials. Dust will be generated from the excavations, batching activities, earth moving and materials delivery. Particulate matter will be generated by dry construction materials including sand, cement, gravel, murram, etc. Smoke, hydrocarbons and nitrogenous gases will be emitted from machinery exhausts. These will be expected to increase slightly and will be localized hence expected to be experienced within 30m radius of the project. Air pollution is expected to be a low key impact during the construction period.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	3	5	3	9	8	72
	Regional	One month to one year	Harmful	Daily	Infrequent			Medium-Low
Mitigation Measures	• Impose speed limits (10 km/h in all areas within the site boundaries). • Damping down of access roads, stockpiles and cleared areas must take place to minimize dust pollution. • Ensure that no refuse wastes are burnt on the premises or surroundings. Refuse wastes should be removed by an official contractor and dumped at an approved site in compliance with local laws and regulations. More significantly, an Integrated Solid Waste Management system is encouraged. • Proper rehabilitation and restoration of disturbed areas is required in order to minimize bare patches. • Vehicles to be used during the construction phase are to be kept in good working condition and should not be the source of excessive fumes. • Transported materials must be done in such a manner that they do not fly or fall off the vehicle by covering or wetting friable materials. • Sprinkle water before undertaking very dusty operations to reduce dust pollution. • Dust and air pollution due to dust when excavated material is stock piled, should be limited by means of wetting (particularly dry season), covering with foil or working in small sections so that the trenches are backfilled with excavated soil within shortest possible period (maximum 2 days).							
With	1	1	1	3	1	3	4	12

mitigation Measures	Activity specific	One day to one month	Non harmful	Monthly	Almost impossible			Very Low

6.10.12 Noise Impact

Construction activities associated with the proposed project are likely to increase noise level to more than what is experienced under non project scenario. Use of heavy construction machinery including excavators, water pumps and generators will lead to relative noise levels. Fabrication of site equipment and concrete mixing both at the contractor's workshop and at the construction site will generate significant noise levels. Material delivery is also expected to lead to significant noise levels during construction phase. Operation phase of the project is however not associated with significant noise pollution.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	1	2	2	2	4	5	6	24
	Activity specific	One month to one year	Potentially harmful	Six monthly	Likely			Very low
Mitigation Measures	• Schedule road traffic movements to normal working hours (08H00 –17H00). • Silencers on equipment such as generators will be properly designed. • Where need be, all exposed workers will be provided with functional ear muffs, whose use is mandatory, and closely enforced, monitored and supervised.							
With mitigation Measures	1	2	1	2	1	4	3	12
	Activity specific	One month to one year	Non harmful	Six monthly	Almost impossible			Very Low

6.10.13 Water supply disruption

Possible temporary disruption to water supply services may occur during excavation and backfilling works. Excavation activities may lead to disruption of underground water pipes leading to service disruptions. Disruption of water supply due to shutting off valves during construction works may also lead to service disruption in some service areas during construction period. Flushing of the system may also lead to temporary water supply disruption during operation phase although this will be of negligible impact significance.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	2	5	4	8	9	72
	Regional	One month to one year	Potentially harmful	Daily	Likely			Medium-Low
Mitigation Measures	• Give warning to consumers so that they can store water that can last them within the period of disruption • Notify KIWASCO in writing to enable then disconnect water services ahead of excavation works • Ensure that water services are restored within 24 hours and keep records of restoration as evidence.							
With mitigation Measures	2	1	1	4	1	4	5	20
	Area specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

6.11 Potential impacts and mitigation measures during operation phase

6.11.1 Hazardous Chemicals

Water treatment will involve the use of chemicals for coagulation, disinfection and water conditioning. Chlorine is one of the most used chemical in water treatment. Exposure to hazardous chemicals used in the water treatment process have the potential of leading to long term impacts that may be felt both at the local and regional level. The severity of the impact will be medium but will be low with implementation of mitigation measures.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	1	2	4	3	7	7	49
	Regional	One day to one month	Potentially harmful	Weekly	Infrequent			Low
Mitigation Measures	• Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply; • Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; • Develop and implement a plan for responding to accidental releases.							
With mitigation Measures	2	1	1	3	1	4	4	16
	Area specific	One day to one month	Non harmful	Monthly	Almost impossible			Very Low

6.11.2 Water system leaks and loss of pressure

Water system leaks can reduce the pressure of the water system compromising its integrity and ability to protect water quality (by allowing contaminated water to leak into the system) and increasing the demands on the source water supply and the quantity of chemicals. Leaks in the distribution system can result from improper installation or maintenance, inadequate corrosion protection, stress from traffic and vibrations and overloading among other factors.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	4	5	3	10	8	80
	Regional	One month to one year	Harmful	Daily	Infrequent			Medium-High
Mitigation Measures	• Ensure construction meets applicable standards and industry practices; • Conduct regular inspection and maintenance; • Implement a leak detection and repair program (including records of past leaks and unaccounted- for water to identify potential problem areas); • Consider replacing mains with a history of leaks or with a greater potential for leaks because of their location, pressure stresses, and other risk factors.							
With mitigation Measures	2	1	1	5	1	4	6	24
	Area specific	One day to one month	Non harmful	Daily	Almost impossible			Very Low

6.11.3 Water Discharges

Water lines may be periodically flushed to remove accumulated sediments or other impurities that have accumulated in the pipe. Flushing is performed by isolating sections of the distribution system and opening flushing valves or, more commonly, fire hydrants to cause a large volume of flow to pass through the isolated pipeline and suspend the settled sediment. The major environmental aspect of water pipe flushing is the discharge of flushed water, which may be

high in suspended solids, residual chlorine, and other contaminants that can harm surface water bodies.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	1	2	2	2	6	4	24
	Regional	One day to one month	Potentially harmful	Six monthly	Highly unlikely			Very low
Mitigation Measures	• Where possible, flushed water should be carried in bowsers for discharge into a municipal sewerage system; • Discharge the flush water into a separate storm sewer system with storm water management measures such as a detention pond, where solids can settle and residual chlorine consumed before the water is discharged; • Where water is flushed into the environment, erosion should be minimised during flushing by avoiding discharge into areas that are susceptible to erosion and spreading the flow to reduce flow velocities.							
With mitigation Measures	2	1	1	2	1	4	3	12
	Area specific	One day to one month	Non harmful	Six monthly	Almost impossible			Very Low

6.11.4 Chemical exposure and hazardous atmospheres

Water treatment involves use of potentially hazardous chemicals. Water may contain radioactive substances and heavy metals, which typically accumulate in the water treatment sludge. Potential sources of exposure to radionuclides include: pumps and piping where mineral scales accumulate; lagoons, and flocculation and sedimentation tanks where residual sludges accumulate; filters, pumping stations, and storage tanks where scales and sludges accumulate; facilities where filter backwash, brines, or other contaminated water accumulates; facilities that are enclosed (radon); residuals processing or handling areas; and land disposal or application areas where residuals are shoveled, transported, or disposed. Exposure to radioactive substances and heavy metals from treatment sludge may cause health impacts which may be experienced regionally.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	2	5	3	8	8	64
	Regional	One month to one year	Potentially harmful	Daily	Infrequent			Medium-Low
Mitigation Measures	• Implement a training program for operators who work with chlorine and ammonia regarding safe handling practices and emergency response procedures; • Provide appropriate personal protective equipment (including, for example, self-contained breathing apparatus) and training on its proper use and maintenance. • Install safety showers and eye wash stations near the chlorine and ammonia equipment and other areas where hazardous chemicals are stored or used; • Ventilate enclosed processing areas and ventilate equipment, such as pump stations, prior to maintenance. • Prohibit eating, smoking, and drinking except in designated areas; • Rotate personnel among the various treatment plant operations to reduce inhalation of air-stripped chemicals, aerosols, and other potentially hazardous materials.							
With mitigation Measures	2	1	1	4	1	4	5	20
	Area specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

6.11.5 Contamination of drinking water from treatment operations

An adequate supply of clean drinking water is critical to community health and hygiene. Hazardous chemical associated with this project is chlorine. If residual levels of chlorine are beyond the recommended limits, there would be long term impacts on health of the consumers.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	2	5	3	8	8	64
	Regional	One month to one year	Potentially harmful	Daily	Infrequent			Medium-Low
Mitigation Measures	• Install alarm and safety systems, including automatic shutoff valves that are automatically activated when a chlorine release is detected; • Use corrosion-resistant piping, valves, metering equipment, and any other equipment coming in contact with chlorine, and keep this equipment free from contaminants, including oil and grease; • Ensure that treatment capacity is adequate to meet anticipated demand; • Construct, operate and maintain the water treatment facility in accordance with national requirements and internationally accepted standards to meet national water quality standards and WHO Guidelines for Drinking Water Quality ; • Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; and • Evaluate the vulnerability of the treatment system and implement appropriate security measures, such as background checks of employees, perimeter fencing and video surveillance and improve the electrical power feeds to the facilities.							
With mitigation Measures	2	1	1	5	1	4	6	24
	Area specific	One day to one month	Non harmful	Daily	Almost impossible			Very Low

6.11.6 Deficiencies in water distribution system

The water distribution system is a critical component in delivery of safe potable water. Even if water is effectively treated to remove contaminants and destroy pathogens, waterborne diseases outbreaks can occur because of deficiencies in the water distribution system. Exposure of water to pathogens from storage facilities and from external sources may lead to long term impacts whose effects will be experienced regionally. The severity of the impacts will be high without mitigation measures.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	4	5	4	10	9	90
	Regional	One month to one year	Harmful	Daily	Likely			Medium - High
Mitigation Measures	(i) Construct, operate, and manage the water distribution system in accordance with applicable national requirements and internationally accepted standards; (ii) Construct and maintain the distribution system so that it acts as a barrier and prevents external contamination from entering the water system by: • Inspecting storage facilities regularly, and rehabilitating or replacing storage facilities when needed. This may include draining and removing sediments, applying rust proofing, and repairing structures • Ensuring that all installation, repair, replacement, and rehabilitation work conforms to requirements for sanitary protection and materials quality • Testing material, soil, and water quality and implementing best practices to prevent corrosion, such as cathodic protection • Preventing cross- connections with sewerage systems. • Separating water lines and sewer pressure mains (e.g., at least 10 ft apart or in separate trenches, with the sewer line at least 18 inches below the water line) (iii) Maintain adequate water pressure and flow throughout the system by: • Implementing a leak detection and repair program • Reducing residence time in pipes • Maintaining positive residual pressure of at least 20 pounds per square inch (psi) • Monitoring hydraulic parameters, such as inflows, outflows, and water levels in all storage tanks, discharge flows and pressures for pumps, flows and/or pressure for regulating valves, and pressure at critical points, and using system modeling to assess the hydraulic integrity of the system (iv) Prevent introduction of contamination from the distribution system itself by: • Minimizing microbial growth and biofilm development (e.g. by ensuring adequate residual disinfection							

	levels). Collect samples from several locations throughout the distribution system, including the farthest point, and test for both free and combined chlorine residual to ensure that adequate chlorine residual is maintained • Using construction materials that do not contribute to release undesirable metals and other substance or interact with residual disinfectants							
With mitigation Measures	2 Area specific	1 One day to one month	1 Non harmful	5 Daily	1 Almost impossible	4	6	24 Very Low

CHAPTER 7

7.0 PROJECT OPTION/ ALTERNATIVES

7.1 No Project Option

This alternative presupposes that the status quo with regard to water supply and sanitation remains. It was noted during this study that water supply within greater sections of Kisumu city is inadequate and local inhabitants are forced to look for water from sources majority of which are unreliable. Some of the sources relied upon by the local people are unprotected and thus aggravates incidents of waterborne diseases. Although sections of Kisumu city are currently covered by water supply system, significant parts of the city still remain without reliable water supply. Some residents get their drinking water from polluted sources like shallow wells, unprotected springs and boreholes and more often than not take it raw without any further treatment. Water supply within the town is also unreliable due to periodic power outages that are commonplace in Kisumu city and its environs.

With regard to sanitation, pit latrines are significantly used as the main sanitation facility especially within Kisumu city slum belt. In black cotton soil areas, pit latrines are often less than six meters deep and therefore tend to fill up quickly and/or overflow. Ventilated Improved Pit (VIP) latrines are a better alternative than unlined pit latrines because they are less odoriferous, but in 2007, only an estimated 7% of residents used these (LVSWSB, 2008). There are relatively few public toilets in Kisumu city, most of which are concentrated in informal settlements such as Bandani, Nyamasaria and Obunga. In the city centre, there are public toilets in places like the markets, Bus Park and Jomo Kenyatta grounds.

There are two types of sewer systems in Kisumu city: a conventional sewer system and a lagoon system. However, the 6,800m^3 sewer system serves less than 10% of the population, and the two sewer systems do not accommodate most of the generated wastewater. In addition, frequent sewer bursts and blockages are common, resulting in groundwater contamination, environmental pollution and outbreaks of water-related diseases. The “No Project” option does not therefore offer significant health and safety advantages to the residents of Kisumu city

7.2 Water Supply and Sanitation System Improvement Option

7.2.1 Water Supply System Improvement

The proposed project has two components namely water supply component and sanitation component. For the water supply component, the proposed works will include rehabilitation of existing problematic lines in lower CBD; extension along the bypass highway to connect Nyamasaria lines better from Kibuye reservoir; and reinforcement of existing lines in Kadero area. A total of five kilometres of water pipeline will be layed during the works. Despite the significant works recently implemented by KIWASCO regarding water supply in Kisumu town, supply in CBD has not expanded much following LTAP works. The works were more focused on production / transmission / storage and experienced significant reductions in scope, within informal settlements in particular. Strengthening the distribution delivery pipelines and water storage supports to and service lines within low income areas will significantly benefit local residents. Extension of service lines will ensure that residents are supplied with quality drinking water

7.2.2 Sanitation system improvement

With regard to sanitation facilities, the general scope of works will involve rehabilitation of 11.962km of sewer line and extension of 20.927km of the line within Kisumu city. A total of 32.888km will be rehabilitated, replaced or extended. The works for Nyalenda ponds include desludging of the middle treatment line and fencing of the site. Main activities at Nyalenda Ponds will include geotechnical investigations, demolition of concrete structures, construction of concrete structure / installation of precast concrete culverts, excavations for structures, preparation of landfill site, pumping clear and medium loads water to other treatment lines, construction of track, sludge removal and fencing including installation of two gates

7.3 Options for Sewage Collection

The different type of sewage collection and transfer systems include gravity, gravity + pressure pumping station, gravity + lift pumping station; and separate or combined. Since the 1990s, separate sewerage systems are preferred to combined sewerage system. The reason for this is twofold. To begin with, separate sewerage systems have smaller diameter thus lower costs. They also have lower risk of pollution. Combined sewers transport rain water, and overflows happen during heavy rain events, causing health and pollution threats. Separate sewers however transport only wastewater, and there should be no overflows from the sewers. In the scope of the project, only separate sewers are proposed for implementation.

7.4 Options for Sewer Pipeline Routes

The determination of the sewerage pipeline routes is the result of a compromise between maximization of gravity flow to the WWTP and avoiding systematic pumping; collecting maximum amount of sewage with the minimum length of pipe; and technical feasibility of sewerage pipeline works and easy access for future operation and maintenance. To this end, the routes have been designed to run along existing roads and railway lines where the need to acquire land is totally minimised. This has the advantage of lowering the project implementation cost

7.5 Options for Pipe Material

Several types of pipeline materials are used for sewerage applications. These materials include reinforced concrete; steel fibre concrete; HDPE (high density polyethylene); unplasticised polyvinyl chloride (uPVC); GRP (glass reinforced plastic); steel with epoxy coating; vitrified clay; and ductile iron.

7.5.1 Comparison of the sewerage pipeline materials

The following factors were considered in choosing pipe materials to be used in the proposed works

(i) Reinforced concrete has many advantages like durability, resistance. Installation costs can be competitive with uPVC and ductile iron. However, reinforced concrete is heavy, difficult to manoeuvre and water tightness of joints and service connections are often problematic. Corrosion due to sulphates can also lead to rapid deterioration. Reinforced concrete pipes are usually not adapted for small and medium cities (min DN 300mm);
(ii) HDPE is a light material with low installation costs. HDPE only requires an internal lining (no external coating required). HDPE pipes can be butt welded thus ensuring water tightness of

joints. However, HDPE's mechanical properties decrease with time and the pipe has a reduced life cycle when compared to ductile iron and steel. The flexible pipe can also be subject to ovalisation under heavy loading which can cause water tightness problems at joints for large diameters;

(iii) GRP pipes are flexible pipes with low friction coefficients (reduced installation depths). The pipe is highly resistant to corrosion and coatings/linings are not required. However, mechanical properties of pipe decrease with time and pipe has a reduced life cycle when compared to ductile iron and steel. Also, difficulties can occur with pipe assembling (no locked joints) thus necessitating anchor blocks. Pipe can ovalise under heavy loads and its installation costs are usually high;

(iv) Ductile iron is attractive for large diameters in cities where the procurement costs are lower than the installation costs. The mechanical properties of ductile iron make this pipe durable and capable of withstanding heavy loads (semi rigid material). Push-in joints usually ensure adequate water tightness. However, being a metallic pipe subject to corrosion, internal linings (polyurethane) and external coatings (metallic zinc, epoxy) are required and increase the purchase costs;

(v) Steel is lighter than ductile iron and is flexible (adapted to seismic regions). However, being a metallic pipe, it is susceptible to corrosion (to a larger degree than ductile iron) and both passive (linings, coatings) and active protections (cathodic protection) are required to ensure minimum durability. Pipe durability is generally less than that of ductile iron and operating and installation costs are higher than that of ductile iron. Also, procurement delays are generally long;

(vi) PVC is the lightest material with low procurement and installation costs. It also withstands corrosive environments. However, the material is flexible, fragile and has a low life cycle. Water tightness of joints can be an issue if the pipe is subject to heavy loads (leads to ovalisation). Its cost and ease of installation makes it the best material for small diameters, if adequate material and installation standards are followed;

(vii) Vitrified clay has an exceptional durability and is very economical as regards installation and operational costs. Due to low friction coefficients, installation depths can be reduced. However, the pipe is heavy and fragile with associated high purchase costs and difficult manoeuvring. Overall pipe performance is closely linked to installation conditions; and

(viii) Steel fibre concrete is more effective than reinforced concrete but it is the heaviest material. Installation costs are very expensive.

7.5.2 Recommendations as regards sewerage pipeline materials

The following recommendations apply for the proposed works

(i) For gravity sewerage mains with DN ≤ 400mm, either HDPE with corrugated walls or uPVC pipe following EN 13476 are recommended;
(ii) For gravity sewerage mains with DN >400mm, ductile iron pipe is recommended;
(iii) For pressure sewerage mains, HDPE pipe is recommended.

In addition, sewer mains shall be installed whenever possible along the road verge. If installation under the carriageway is unavoidable, special care shall be exercised to ensure resistance to dead and live loads. At times, special protection of the flexible pipes shall be required (concrete encasing, sleeves etc.);

7.6 Options for Connections

New household connections shall be realised by KIWASCO following its standards. No works will be carried out in private areas. In case of rehabilitation or reinforcement of existing lines, the works will include the transfer of the existing connections to the new line. The houses will be connected to the main sewer line through connection to main manhole or connection pit/manhole by using 160 mm uPVC pipes. Connection pits will be used wherever the width of the road exceeds 4m and houses to be directly connected to the main manholes for narrow roads of 4m width and less. According to design configuration, connection pit/manhole will serve more than one household located on the same side of the road to minimize excavation of the existing pavement and it will be connected to the main manhole via 160 mm uPVC pipes.

CHAPTER 8

8.0 PUBLIC CONSULTATION

8.1 Background to Public participation

Informing and consulting the public are integral tasks within any environmental assessment process in Kenya and forms part of best practice. Accordingly, the ToR required the ESIA consultant to organise and implement a public consultation exercise while undertaking the ESIA process. Consultations of interested and affected parties (IAPs) in this project were carried out to inform the local people and key stakeholders about the proposed project and its objectives; to seek views, concerns and opinions of the project stakeholders concerning the proposed project; and to establish if the local people foresee any positive or negative environmental and social impact which may arise as a result of implementation of the proposed project and how they would like the identified adverse impacts to be addressed.

8.2 Approaches to public participation

Informing the local people, leaders and key stakeholders about the proposed project was carried out through direct interviews, key informant interviews, questionnaire administration, email communication and telephone calls. Stakeholders consulted were supplied with information regarding the proposed project including its objectives, technologies of implementation and possible impacts associated with its implementation and mitigation measures proposed to deal with adverse environmental and social impacts associated with project implementation.

8.3 Determination of who should be involved in the ESIA

The ESIA study benefited from targeted stakeholder consultations with a critical people who have roles in implementation of the proposed project and also those who may be affected in one way or the other due to project implementation. This was achieved through stakeholder analysis which was conducted to identify stakeholders who should be involved in the ESIA process. The basis of inclusion of these stakeholders was informed by their relevance, significance and importance in implementation of the proposed project. Stakeholder relevance was determined through consideration of stakeholder activities within the project area and how various elements and components of the proposed project are likely to impact on specific stakeholder groups. Stakeholder importance and significance were looked at from the point of view of roles of various stakeholders in the provision and management of water and sanitation services within the project area. Stakeholders were categorised into two groups for purposes of this study. The first group consisted of institutional stakeholders and the second group consisted of community stakeholders. The institutional stakeholders were drawn from Lake Victoria South Water Works Development Agency, officials of the national and county governments, members of various groups operating within the project area and Kisumu Water and Sanitation Company (KIWASCO). Community stakeholders on the other hand mainly consisted of members of the public residing within the project area.

8.4 Methods used to consult various stakeholders

The following is a summary of the methods used to consult various stakeholders during the ESIA process.

8.4.1 Key informant interviews

One-on-one interviews with key stakeholders within the project area were undertaken in order to gather baseline information of the project area and also to assist in analysis of existing and anticipated impacts of project activities to the environment, local community and institutions within the project area. These interviews were conducted to augment and confirm data and information obtained using other tools and methodologies. The interviews were focused on getting information from key stakeholders within the project area and focused on stakeholders in water and sanitation sector within the project area. Among those consulted through this method include departmental heads within Kisumu Water and Sanitation Company, representatives of youth groups, representative of welfare groups, representatives of women groups, area Chiefs and Assistant Chiefs, Village Elders and individuals within Lake Victoria South Water Works Development Agency.

8.4.2 Direct interviews

Interviews were conducted within the project area and this targeted those living within the proposed project area and who were unable to fill in the questionnaires for one reason or the other. The interviews were conducted to augment and confirm data and information obtained using other tools and methodologies and focused on water and sanitation issues and problems experienced by area residents. Respondents were also asked how they would like the identified negative impacts to be addressed both during project construction and operation phases.

3.4.3 Questionnaire administration

Questionnaires were prepared and administered to the various stakeholders identified at the initial stages of the study. The questionnaires were administered along the proposed water and wastewater lines and contained questions on water quality and access; wastewater and solid waste management; physical and biotic factors; and anticipated impacts on the environment, neigbouring populations, facilities and structures. Those to whom questionnaires were administered were mainly individuals living within the vicinity of the project site and who could be affected by project activities in one way or the other. The assessors visited them in their homes and business premises where they were guided to fill in the questionnaires. Sample questionnaires have been annexed to Appendix 1 of this Study Report.

8.5 Comments from those consulted

The stakeholders contacted at this stage are happy with implementation of the proposed project. Their position is based on the condition of water and sanitation facilities within Kisumu city. They feel that construction of the proposed project will lead to improved service delivery and will make water and sanitation services to be available to a majority of Kisumu residents.

8.5.1 Positive impacts

Those consulted associated implementation of the proposed project with the following benefits

(i) Implementation of the project will help in dealing with cases of burst manholes will reduce. These will significantly reduce
(ii) The locals will have an opportunity to channel their wastewater in a properly functioning system
(iii) Implementation of the project will deal with the nuisance of foul smell that is normally associated with malfunctioned sewer system and blocked manholes
(iv) Project implementation will help in reducing exposure to water related diseases

(v) The project will enhance the environment through proper management of wastewater. Pollution of local water bodies will be significantly managed
(vi) The project will lead to management of contamination of wells and other underground water resources within the project area
(vii) The project will help in curbing soil pollution that normally emanate from uncontrolled wastewater disposal

8.5.2 Negative impacts

Those consulted associated construction and operation of the proposed project with the following adverse impacts:

(i) Implementation of the project is likely to expose locals to increased levels of danger from moving vehicles and construction machinery
(ii) There may still be cases of pollution from wastewater if proper management of manholes are not effected
(iii) The proposed project will lead to disruption of businesses during construction phase
(iv) Open trenches during construction will pose safety challenges to local residents and especially school going children
(v) Implementation of the proposed project will disrupt transport services especially at the road crossings
(vi) Business people may be forced to relocate their businesses to provide space for project infrastructure
(vii) The noise and dust from the construction will be uncomfortable to those living near or along affected areas.

CHAPTER 9

9.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

9.1 Introduction

The key outcome of the Environmental and Social Impact Assessment (ESIA) process for the proposed construction of Water supply and sanitation infrastructure for Kisumu city is the Environmental and Social Management Plan (ESMP). In real meaning, the ESMP is a mechanism to address the recommended environmental and social mitigation measures. This ESMP is an instrument that will allow LVSWWDA, Kisumu Water and Sanitation Company and other key stakeholders to integrate environmental management measures during implementation, operation and decommissioning phases of the project.

9.1.1 Scope and Objectives of the ESMP

This ESMP focuses on mitigating the impacts identified during the environmental assessment. It is an instrument that will allow the project component and the contractor to integrate environmental management measures during the various phases of the proposed project. This plan is meant to establish measures and procedures to control the identified impacts and monitor progress of implementation of the recommended mitigation measures. It will achieve the following in the long run:

(i) Provide the National Environment Management Authority (NEMA) with a tool to make easy the evaluation of the implementation status of commitments made by the proponent during ESIA study phase;
(ii) Provide clear and mandatory instructions to the contractor with regard to their environmental and social responsibilities during project implementation phase;
(iii) Ensure continuous compliance of the contractor with Kenyan legislation and policies regarding environment conservation and management;
(iv) Assure the regulators and interested and affected parties the satisfaction of their demands in relation to environmental and social performance of the project;
(v) Ensure that adequate financial and human resources are allocated to the project in order to give effect to such requirements or commitments, and to ensure that the scale of ESMP-related interventions is consistent with the significance of identified impacts;
(vi) Provide a coherent and pragmatic framework for the implementation of the requirements, ranging from the formation of structures to administer the implementation, through the roles and responsibilities of the key project role-players, to the auditing and reporting of compliance; and
(vii) Ensure suitably qualified personnel with adequate power of authority are integrated with the various project implementation organisations to timeously identify and render appropriate and proactive corrective actions to unforeseen events or changes in project implementation not considered in the ESIA process.

9.1.2 Applicable Legislation

The pieces of legislation applicable to this Environmental and Social Management Plan are described in Chapter five of this Study Report. International normative instruments concerning the environment, as well as international best practice have also been considered.

9.2 Environmental Awareness

The project proponent and associates will be sensitive to the needs of the environment so as not to degrade the existing environmental conditions. It is the proponent's primary responsibility to ensure that all parties directly involved in the construction and operation phases of the project, including

contractors and workers are aware of the need to prevent or minimize environmental degradation. The awareness activities should be guided by the following issues:

(i) Prevention of pollution of surface and groundwater resources;
(ii) Prevention of air quality degradation;
(iii) Prevention of increased noise levels;
(iv) Prevention/reduction of social and economic disruptions; and
(v) Prevention of risks to health and safety of workers and the general public.

9.3 Organisational structure, roles and responsibilities

The organisational structure identifies and defines the responsibilities and authority of the various role-players (individuals and organisations) involved in the project. The key role-players for the project are LVSWWDA, the Engineer, the Contractor and the Contractor's Environmental and Social Management Team. The organisational structure has been developed to ensure that there are clear channels of communication; there is an explicit organisational hierarchy for the project; and potential conflicting or contradictory instructions are avoided. All instructions and official communications regarding environmental matters shall follow the organisational structure as determined by this ESMP. In terms of the recommended organisational structure, all instructions that relate to environmental matters shall be communicated to the Contractor via the Engineer's Representative. The only exception to this rule would be in an emergency (defined as a situation requiring immediate action and where failure to intervene timeously would, in the reasonable opinion of the Contractor's Environmental Specialist (or equivalent), result in unacceptable environmental degradation), where instructions may be given directly to the Contractor. The detailed roles and responsibilities of the various role-players identified in the organisational structure are described in the section below. Whatever the structure adopted, it is essential that the responsibilities outlined are assigned to specific parties with the capacity and experience required to implement the ESMP.

9.3.1 The Client

The Client (LVSWWDA) is the holder of authorisations issued by the relevant environmental regulating authorities responsible for authorising and enforcing environmental compliance. The Client, either directly or through Supervising Consultant will ensure that all project operations are conducted in accordance with the applicable environmental regulations and in accordance with this ESMP. The Client will ensure that the ESMP and other requirements related to health, safety and environment are implemented in full. To achieve this objective, the Client and/or through the Supervising Consultant will:

(i) Request the contractor to operate on the basis of valid authorizations/approvals/ licenses for all activities to be implemented by the contractor;
(ii) Ensure that the various project activities comply with the mitigation measures proposed in this Environmental and Social Management Plan (ESMP);
(iii) Ensure that there are contingency plans and resources for employees health and contingency plans to respond to accidents at work (emergency response plan);
(iv) Make regular inspections to the different activities with regard to social aspects, health, safety and environment and check for any non-conformity with the ESMP attributable to the Contractor and identify the steps taken for its correction;
(v) Approve work procedures established for each phase of the project and ensure that proposed activities are implemented in accordance with the approved plans;
(vi) Establish and implement a complaints management procedure that allows treatment/appropriate response to them;
(vii) Ensure that any corrective activities recommended by audits or inspections (performed internally or externally) are implemented within the recommended timelines.

9.3.2 The Engineer

The Engineer will be appointed by, and act for, the Client as the Client's on-site implementing agent and shall carry the responsibility to ensure that the contractor undertakes its construction activities in such a way that the Client's environmental responsibilities are not compromised. The Engineer will be responsible for issuing instructions to the Contractor's Environmental Specialist where environmental considerations call for action to be taken. If in the opinion of the Engineer, the Contractor's Environmental Specialist is not fulfilling his/her duties in terms of this ESMP, the Engineer may, after discussion and agreement with the Contractor and Client exercise his powers under general conditions of contract and instruct replacement of the Environmental Specialist in writing and with stated reasons.

9.3.3 The Contractor

The contractor will be responsible for project delivery in accordance with the prescribed specifications, among which this ESMP shall be included. The contractor shall receive and implement any instruction issued by the Engineer relating to compliance with the ESMP. Compliance with the provisions contained herein or any condition imposed by environmental approvals shall become the responsibility of the contractor through an approved Designated/Dedicated Environmental Officer (DEO). The contractor shall nominate a person from among his site personnel to fulfill this function and submit to the engineer the *curriculum vitae* of the proposed DEO. Among many tasks, the contractors shall:

(i) Prepare Construction Environmental and Social Management Plan within thirty days of signing the contract and submit the same to the Client for approval;
(ii) Submit to the proponent work procedures/methods or equivalent documents for approval;
(iii) Operate on the basis of valid licenses/approvals/authorizations for site activities;
(iv) Employ techniques, practices and construction methods to ensure compliance with this ESMP;
(v) Prevent or minimize the occurrence of accidents/incidents which might cause damage to the environment and be able to respond positively to an accident/incident if it occurs;
(vi) Meet the working procedures and environmental and health and safety requirements established by contract with the Client; ensure compliance with them by sub-contractors who might be hired by him;
(vii) Minimize environmental damage, avoid pollution, prevent loss or damage on any private property or natural resources and minimize project negative effects on the users and occupants of surrounding lands and the public;
(viii) Provide Personal Protective Equipment (PPE) to workers which is appropriate to the tasks to be performed and ensure that they are used at all times;
(ix) Implement all corrective activities agreed in audit (internal or performed by other agencies) or inspections, within the pre- established deadline;
(x) Manage the complaints process on the elements that fall within their jurisdiction, or refer complaints to the Client, so that they can receive treatment/appropriate response;
(xi) Prepare a rehabilitation plan which shall include preliminary designs on the temporary and permanent restoration plan during both the construction and post-construction/operation periods).

9.3.4 The Designated / Dedicated Environmental Officer (DEO)

Once a nominated representative of the contractor has been approved, he/she shall become the DEO and shall be the person responsible for ensuring that the provisions of this ESMP are complied with during construction phase of the project. The DEO shall submit regular written reports to the Engineer, but not less frequently than once a month. As a minimum, the DEO shall have Bachelors Degree in environmental or natural sciences or equivalent and have a minimum of 2 years' experience in the environmental regulatory field in construction. The DEO shall monitor

implementation of construction ESMP and ensure the Contractor's compliance with the Project's environmental performance requirements during construction phase of the project. The duties shall include:

(i) Sampling, analysis and statistical evaluation of monitoring parameters with reference to the ESIA study report recommendations and requirements and the construction ESMP;
(ii) Environmental site inspections;
(iii) Audit of compliance with the environmental protection and pollution prevention and control regulations;
(iv) Monitor the implementation of environmental mitigation measures;
(v) Monitor the compliance with the environmental protection clauses / specifications in the Contract;
(vi) Investigate and evaluate complaints and identify corrective measures;
(vii) Liaise with the Environmental Control Officer (ECO) on all environmental performance matters and timely submission of all relevant environmental monitoring reports;
(viii) Advice the Contractor on environmental improvement, awareness, enhancement matters, etc. on site; and
(ix) Modify construction ESMP and monitoring programme in consultation with the Engineer and ECO if necessary throughout the period of works.

9.3.5 Environmental Control Officer (ECO)

The main duty of the ECO will be to carry out environmental, health and safety (EHS) monitoring of the construction process which shall include, inter alia, the following:

(i) Objectively and regularly monitoring the contractor's implementation of Construction Environmental and Social Management Plans (C-ESMPs) and NEMA Licence conditions;
(ii) Audit the overall EHS management and monitoring programme including the implementation of all environmental mitigation measures, submissions relating to EHS management and monitoring and any other submission required under NEMA and DOSHS licences;
(iii) Validate and confirm the accuracy of the monitoring results, monitoring procedures and locations of sensitive receivers;
(iv) Conduct random site inspections during construction period;
(v) Arrange and conduct monthly general site inspections of work sites during the construction period;
(vi) Carry out random sample check and audit on monitoring data and sampling procedures;
(vii) Ensure the impact monitoring is conducted according to the prescribed schedule at the correct locations as identified in the monitoring document;
(viii) Audit the Environmental and Social Impact (ESIA) recommendations and requirements against the status of implementation of environmental protection measures on site;
(ix) Review the effectiveness of EHS mitigation measures and project EHS performance;
(x) Verify the investigation results of complaint cases and the effectiveness of corrective measures;
(xi) Review and audit in an independent, objective and professional manner all aspects of the EHS management and monitoring programme;
(xii) Feedback audit results to the Engineer according to construction environmental management plan and environmental monitoring document;
(xiii) Verify and certify reports prepared by the contractor before submission to regulatory authorities; and
(xiv) Report the findings of the site inspections and other EHS performance reviews to the Client through preparation of Monthly Progress Reports.

9.3.6 County Public Health office

The County Public Health office through Public Health Officers will monitor implementation of environmental management and monitoring plan by carrying out routine inspections on public health issues associated with project construction and operation. The department will carry out routine inspection of contractor's camp to ensure that cleanliness is maintained at all times and requisite waste management infrastructures have been put in place. The department shall also ensure that food handlers associated with the project have undergone requisite tests and issued with requisite certification to handle food.

9.3.7 Directorate of Occupational Safety and Health Services (DOSHS)

The directorate will monitor implementation of safety and health systems as stipulated in OSHA 2007 by commissioning routine health and safety audits and fire safety audits. The audits will form significant components of monitoring process. The directorate shall also issue workplace registration certificate to the contractor's camp.

9.3.8 Water Resources Authority (WRA)

The Water Resources Authority under their pollution control mandate shall carry out routine water sampling for analysis during operation phase of the project to ascertain pollution levels. Physical/chemical and bacteriological parameters of the water shall be tested. Effluent sampling for analysis shall also be carried out by the authority. Physical/Chemical analysis shall involve tests of physical parameters such as conductivity, pH and tests to establish chemical content for water that is used for domestic purposes. Bacteriological analysis shall involve tests to establish the bacterial content in water. Such tests shall include Feacal Coliforms, E-coli, Residual Chlorine, Chlorine Demand, and Salmonella. The tests shall be carried out to determine suitability of water for drinking and shall target water at the treatment plant and customer drawing points.

9.3.9 External Auditor

An external auditor shall be retained to carry out routine environmental, health and safety and fire safety audit and environmental measurements and tests during construction phase of the project. The auditor will work in partnership with the contractor and supervising consultant and shall carry out requisite audits at the contractor's camp and also carry out noise level and air quality tests. The Tables below provide summaries of the environmental and social management plans for the project

Table 9. 1: Environmental and Social Management Plan

Activity / Issue	Action required	Responsibility	Parameters to monitor	Monitoring Means	Frequency of monitoring	Estimated Annual cost (Kshs)
Poor environmental, health, safety and social management	Hire an Environmental Specialist	Contractor	• Environmental Specialist available on site	Observation during weekly site inspections	One off	840,000.00
	Hire a Health and Safety Specialist	Contractor	• Health and Safety Specialist available on site	Observation during weekly site inspections	One off	840,000.00
	Hire Sociologist	Contractor	• Sociologist available on site	Observation during weekly site inspections	One off	840,000.00
Encroachment of neighbouring facilities during civil works	All civil works shall be restricted to within project alignment areas.	Contractor	• Approved program of works	Observation during weekly site inspections	Weekly during construction phase	Nil- Standard Best Practice
Solid waste generation at contractor's camp	Place solid waste collection bins in offices at the contractor's camp	Contractor	• Presence of solid waste collection bins at the contractor's camp	Observation during monthly site inspections	Monthly during construction phase	5,000.00
	Segregate waste generated into various waste streams for easy disposal	Contractor	• Evidence of waste segregation at the contractor' site	Observation during monthly site inspections	Monthly during construction phase	Use internal capacity
	Solid waste generated from offices at the camp should be temporarily stored at a weather proof solid waste holding area pending collection for disposal by a contracted solid waste handler	Contractor	• Evidence of weather proof solid waste holding area.	Observation during monthly site inspections	Monthly during construction phase	50,000.00
Spoil generation as a result of excavation works	All spoil generated as a result of excavation and trenching works shall be used to backfill the trenched pits and for restoration of disturbed areas within the work places.	Contractor	• Evidence of restoration of the work areas • Number of complaints from local residents filed with either the contractor or consultant	Observation during weekly site inspections	Weekly during construction phase	To be determined
Storm water Management and	The contractor shall restore all storm water drainage	Contractor	• Presence of unclogged storm	Observation during weekly site	Weekly during construction	To be determined

Activity / Issue	Action required	Responsibility	Parameters to monitor	Monitoring Means	Frequency of monitoring	Estimated Annual cost (Kshs)
control	channels blocked as a result of his activities at the site.		water drainage channels within construction area	inspections Periodic checks of storm water drainage channels for blockages	phase	
Fire incidents at the contractor's camp	Reasonable and precautionary steps to be put in place to manage fire incidents including having a method statement on management of fire incidents at the contractor's camp and providing firefighting equipment at the camp.	Contractor	• Presence of write ups on fire precautions • Presence of method statement on management of fire incidents • Service schedules of firefighting equipment	Document reviews during weekly site inspections	Weekly during construction phase	Use internal capacity
	All fire incidents at the site shall be recorded and reported to relevant authorities as soon as they occur.	Contractor	• Presence of fire incident records • Availability of evidence of fire incident report to the authorities	Document review during weekly site inspections	Weekly during construction phase	Use internal capacity
Dust pollution during material transportation	All vehicles transporting construction materials shall be covered with tarpaulins to minimise material being blown away by wind during transportation	Contractor/ material suppliers	• Presence of tarpaulins on material delivery vehicles	Observation during material deliveries	*Ad hoc* basis	Nil- Standard Best Practice
Occupational accidents from machinery failures	All vehicles, trucks, plants and general construction machinery shall be maintained in good condition to mitigate premature failure which may result to occupational injuries	Contractor	• Machinery servicing schedules • Maintenance records of site equipment and machinery	Document review during monthly site inspections	Monthly during construction phase	Construction costs
	Only suitably qualified personnel to operate construction vehicles and	Contractor	• Academic and professional certificates as	Document review during weekly site inspections	Weekly during construction phase	Nil- Standard Best Practice

Activity / Issue	Action required	Responsibility	Parameters to monitor	Monitoring Means	Frequency of monitoring	Estimated Annual cost (Kshs)
	machinery.		evidence of personnel qualifications			
	Handling of equipment and materials to be supervised and adequately instructed.	Contractor	• Inspection notes as evidence of supervision of material handling	Document review during weekly site inspections	Weekly during construction phase	Construction costs
Occurrence of workplace accidents during work executions	The contractor shall prepare method statements covering procedures and response plan for the main activities which could generate emergency situations at the work areas including among others: • Accidental fires • Accidental leaks and spillages • Vehicle and plant accidents • Blasting at the quarry site	Contractor	• Availability of method statements on accidental fires; management of accidental leaks and spillages; management of vehicle accidents at the site and blasting at the quarry site • Availability of equipped First Aid kit • Evidence of staff training on emergency procedures • Number of emergencies recorded	Document review during weekly site inspections	Weekly during construction phase	Use internal capacity
Lack of records of accidents, incidents and dangerous occurrences	The contractor to prepare an accident incident form for daily recording of accidents, incidents and dangerous occurrences at workplaces	Contractor	• Presence of an accident/ incident form	Document review during monthly site inspections	Monthly during construction phase	Use internal capacity
	The contractor to provide all supervisors with the forms for daily recording of accidents, incidents and dangerous occurrences at their places of	Contractor	• Presence of the forms at the work areas	Document review during weekly site inspections	Weekly during site inspections	Use internal capacity

Activity / Issue	Action required	Responsibility	Parameters to monitor	Monitoring Means	Frequency of monitoring	Estimated Annual cost (Kshs)
	work.					
	Supervisors to submit the forms on a daily basis to the office manager for filing in an accident/incident register	Contractor	• Presence of the forms in a file at the contractor's office	Document review during monthly site inspections	Monthly during construction phase	Use internal capacity
Lack of requisite Personal Protective Equipment by workers	All staff shall be provided with requisite PPEs including safety shoes, hand gloves eye shields, nose masks, ear muffs and reflector jackets	Contractor	• Evidence of provision of PPEs to staff	Observation during weekly site inspections	Weekly during construction phase	250,000.00
Lack of First Aid kit at the contractor's site office and work areas	The contractor to provide a standard first aid kit at the main office at the contractor's camp and at all work areas	Contractor	• Presence of First Aid kit in offices and other work areas	Observation during weekly site inspections	Weekly during construction phase	20,000.00
Inadequate sanitation facilities	The contractor to provide adequate sanitation facilities for the construction workers at the contractor's camp and in all work areas	Contractor	• Evidence of sanitation facilities at the contractor camp and work areas	Observation during weekly site inspections	Weekly during construction phase	To be determined
Noise and vibration pollution during work executions	Construction and the use of construction machinery to be limited to working hours between 0600hr and 1800hr. No construction works should be carried out at night	Contractor	• Presence of work schedule for construction works	Observation during weekly site inspections	Weekly during construction phase	Nil- Standard Best Practice
	Construction equipment shall be routinely serviced to mitigate excessive noise	Contractor	• Presence of service logs for site machinery	Observation during weekly site inspections	Weekly during construction phase	To be determined
Tree/Vegetation removal	Effectively monitor the working strip required for the construction of the water supply and sanitation infrastructure to prevent excessive vegetation removal	Contractor	• Presence of monitoring records	Document review during weekly site inspections	Weekly during construction phase	Nil- Standard Best Practice
	Adequately compensate individuals whose crops and trees may be destroyed during construction process	Contractor	• Availability of payment vouchers to Project Affected Persons (PAPs)	Document review during monthly site inspections	Monthly during construction phase	To be determined
Water service	Notify Kisumu Water and	Contractor	• Evidence of	Document review	Weekly during	To be

Activity / Issue	Action required	Responsibility	Parameters to monitor	Monitoring Means	Frequency of monitoring	Estimated Annual cost (Kshs)
disruptions during construction activities	Sanitation Company (KIWASCO) in writing to enable then disconnect water services ahead of excavation works Ensure that water services are restored within 24 hours and keep records of restoration as evidence.		notification of KIWASCO • Evidence of service restorations	during weekly site inspections	construction phase	determined
Blocked drainages due to excavation works	All storm water drainage systems should be inspected prior to commencement of works	Contractor	• Photographic evidence of pre construction condition of drainage systems	Observation during weekly site inspections	Weekly during construction phase	Nil- Standard Best Practice
	All drainages should be unblocked to pre-construction conditions	Contractor	• Evidence of unblocking of drainage systems	Observation during weekly site inspections	Weekly during construction phase	To be determined
De-mobilisation	The site is to be cleared of all construction materials, including litter prior to hand over	Contractor, LVSWWDA KIWASCO	• Evidence of clearance of site	Observation at the end of construction phase	One off at the end of construction phase	To be determined
	Fences, barriers and demarcations associated with the construction phase must be removed from the site	Contractor	• Evidence of removal fences, barriers and demarcations associated with construction phase	Observation at the end of construction phase	One off at the end of construction phase	Ditto
	A meeting must be held on site between the Engineer, Environmentalist and the Contractor to approve all remediation activities and ensure that the site has been restored to a condition approved by the Engineer	Contractor and supervising consultant	• Minutes of the meeting	Document review	One off at the end of construction phase	Administrative costs
	Rehabilitation Activities of Environmental Cases	Contractor and supervising	• Availability of rehabilitation	Document review at the end of	One off at the end of	To be determined

Activity / Issue	Action required	Responsibility	Parameters to monitor	Monitoring Means	Frequency of monitoring	Estimated Annual cost (Kshs)
	indentified must continue throughout the defect liability period	consultant	progress report	construction phase	construction phase	
Total						**2,845,000.00**

Table 9. 2: Operation Phase Environmental Management Plan

Impact	Mitigation/ incremental impact measures	Responsible for implementation	Monitoring	Periodicity	Estimated Amount (Kshs)
Installation of meters leading to high water bills	• Sensitize people on the long term benefits of rational utilization of water resources.	Lake Victoria South Water Works Development Agency / KIWASCO	Carry out surveys to ascertain the level of consumer satisfaction.	One off	Use internal capacity
Exposure to hazardous chemicals used in the water treatment process	• Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply; • Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; • Develop and implement a plan for responding to accidental releases.	Lake Victoria South Water Works Development Agency/ KIWASCO	Carry out analysis of Physico-chemical and bacteriological parameters for water quality. Verify the degree of compliance in implementing the proposed mitigation measures	Quarterly	Operation costs
Water system leaks and loss of pressure	• Ensure construction meets applicable standards and industry best practice; • Conduct regular inspection and maintenance; • Implement a leak detection and repair program (including records of past leaks and unaccounted- for water to identify potential problem areas); • Consider replacing mains with a history of leaks or with a greater potential for leaks because of their location, pressure stresses, and other risk factors.	Lake Victoria South Water Works Development Agency / KIWASCO	Verify the degree of compliance in implementing the proposed mitigation measures	Weekly	Use internal capacity

Discharge of flushed water that may contain suspended solids and residual chlorine into the environment	• Where possible, flushed water should be carried in bowsers for discharge into a municipal sewerage system ; • Discharge the flush water into a separate storm sewer system with storm water management measures such as a detention pond, where solids can settle and residual chlorine consumed before the water is discharged; • Where water is flushed into the environment, erosion should be minimised during flushing by avoiding discharge into areas that are susceptible to erosion and spreading the flow to reduce flow velocities.	Lake Victoria South Water Works Development Agency / KIWASCO	Verify the degree of compliance in implementing the proposed mitigation measures	Quarterly	Use internal capacity
Exposure of water to pathogens from storage facilities and from external sources	• Construct, operate, and manage the water distribution system in accordance with applicable national requirements and internationally accepted standards; • Construct and maintain the distribution system so that it acts as a barrier and prevents external contamination from entering the water system by: ➢ Inspecting storage facilities regularly, and rehabilitate or replace storage facilities when needed. This may include draining and removing sediments, applying rust proofing, and repairing structures ➢ Testing material, soil, and water quality and implementing best practices to prevent corrosion, such as cathodic protection ➢ Preventing cross- connections with sewerage systems. ➢ Separating water lines and sewer pressure mains (e.g., at least 10 ft apart or in separate trenches, with the sewer line at least 18 inches below the water line)	Lake Victoria South Water Works Development Agency / KIWASCO	Carry out analysis of physico-chemical and bacteriological parameters for water quality. Verify the degree of compliance in implementing the proposed mitigation measures	Quarterly	Operation costs

	• Maintain adequate water pressure and flow throughout the system by: ➢ Implementing a leak detection and repair program ➢ Reducing residence time in pipes ➢ Maintaining positive residual pressure of at least 20 pounds per square inch (psi) ➢ Monitoring hydraulic parameters, such as inflows, outflows, and water levels in all storage tanks, discharge flows and pressures for pumps, flows and/or pressure for regulating valves, and pressure at critical points, and using system modeling to assess the hydraulic integrity of the system • Prevent introduction of contamination from the distribution system itself by: ➢ Minimizing microbial growth and biofilm development (e.g. by ensuring adequate residual disinfection levels). Collect samples from several locations throughout the distribution system, including the farthest point, and test for both free and combined chlorine residual to ensure that adequate chlorine residual is maintained ➢ Using construction materials that do not contribute to release undesirable metals and other substance or interact with residual disinfectants				

9.4 Environmental Monitoring and Audit (EM&A)

9.4.1 Purpose of the Environmental Monitoring and Audit

Environmental Monitoring and Audit (EM&A) will be carried out during construction and operation phases of the project to ensure effective implementation of mitigation measures recommended in the Environmental and Social Impact Assessment (ESIA) report, and relevant environmental protection and pollution prevention and control legislations. The EM&A programme will be used to assess the effectiveness of, *inter alia*, the implementation of the recommended mitigation measures, and to identify any further need for additional mitigation measures or remedial actions. Monitoring and audit during construction stage aims to provide systematic procedures for monitoring, auditing and minimizing the environmental impacts associated with construction works. Findings, recommendations and requirements of the ESIA; all relevant requirements under the Environmental Management and Coordination Act (EMCA) 1999 and other environmental legislations; and the Kenyan planning standards and laws have been adopted in these monitoring and audit procedures.

9.4.2 Reporting Procedures during construction stage

During construction, the contractor will supply regular progress reports (weekly and monthly as appropriate) to the Engineer (the Supervision Consultant) covering all aspects of the Works. The progress reports will include data and information on health and safety (accidents and incidents), environmental protection (spill and non-compliance), labour (numbers, grades, problems), community relations (complaints, issues), and relevant training. The supervision consultant will check the contractor's reports and forward them to the Employer (LVSWWDA), including any additional records concerning implementation of the project's Environmental and Social Management Plan (ESMP). It is recommended that the Contractor's staff on site shall establish and maintain effective communication links with relevant agencies including local administration, National Environment Management Authority (NEMA) and Directorate of Occupational Safety and Health Services (DOSHS) to ensure easy two-way flow of information.

9.4.3 Auditing

Auditing of ESMP implementation and/or effectiveness also requires external specialist skills. These could be provided by highly experienced and independent specialists. It is hereby recommended that an external auditor shall be retained by the contractor to carry out routine environmental, health & safety and fire safety audits for various project components during construction phase of the project. Measurement of environmental parameters including noise and vibration levels, dust levels and water quality among others shall form part of this audit.

9.4.4 Parameters to monitor

Parameters associated with the project and which will be monitored during construction phase are summarised in the Table 9.2 below. They include among others: Compliance with regulatory requirements; awareness and training; safety and health management; air quality -construction, batching and quarry dust; noise Impact- construction and blasting noise (as applicable); water quality; waste generation including storage and disposal; conditions of biological environment; and employment HIV/AIDS and gender issues.

9.5 Monitoring Methodology

9.5.1 Air Quality

During project construction phase, dust monitoring program will focus on Total Suspended Particulates (TSP) and dust deposition. The sampling locations and frequency will be established before the onset of construction. Baseline monitoring shall be completed before the construction

work commences. Impact monitoring shall be conducted whenever there is dust generating activity going on at the site. Regular site audits shall also be carried out by the contractor's Designated Environmental Officer (DEO) and independent audits carried out annually by an external auditor to check for compliance with air quality standards by the project.

9.5.2 Noise Monitoring

Potential noise impacts shall emanate from construction activities during project implementation. Noise monitoring shall be carried out to ensure that mitigation measures contained in Construction Environmental and Social Management Plan (C- ESMP) are timeously implemented and that the noise sensitive receivers are effectively protected. Baseline monitoring shall be completed before noise producing activities commences. Impact monitoring shall be conducted whenever there is implementation of any noise generating activity at the site. Permitted Noise Level (Leq) in dB (A) shall be recorded

9.5.3 Water quality monitoring

Water quality is one of the main indicators of the quality of service provided to the consumer. Water quality has an impact on both the public health and aesthetic value of water as a consumable product. For effective monitoring of water quality, both internal self monitoring by the contractor and an independent monitoring by an external laboratory will be put in place. External monitoring shall be carried out by NEMA-accredited laboratory.

9.5.4 Waste Management

Waste monitoring will be carried out during construction process. Monitoring of each waste stream shall be carried out periodically to determine if wastes are being managed in accordance with approved procedures and the Construction Waste Management Plan (CWMP). The audits shall cover all aspects of waste management including waste generation, storage, recycling, treatment, transport, and disposal. The general site inspections will be undertaken weekly by Supervision Consultants Environmental Team to check all construction activities for compliance with all appropriate environmental protection and pollution control measures, including those set up in the CWMP.

9.5.5 Conditions of biological environment

Monitoring of biological environment within the project area will be carried out to ensure that project activities like site clearance and stripping of top soil do not adversely affect biological environment. The monitoring will be carried out by the Supervision Consultant's personnel

9.5.6 Labour, employment, HIV/AIDS issues

The key issues to be monitored during construction phase include labour relations, employment of local labour, HIV/AIDS awareness, gender relations and underage employment among others.

Table 9. 3: Monitoring Framework for Environment, Health, Safety and Social Issues

Main Issues/ Impacts	Parameters to monitor	Monitoring Indicators	Monitoring Methods	Frequency of monitoring	Responsibility for monitoring
Compliance with Regulatory requirements	Operation licences and permits	NEMA licence for project construction, contractor camps, quarry sites, borrow sites and crushing plant in place	Review of records	Monthly	Supervision Consultant
		Blasting permit from Mines and Geology Department in place	Review of records	Monthly	Supervision Consultant
		Health certificates for food handlers in place	Review of records	Monthly	Supervision Consultant
	Audit reports	Health and Safety, Fire Safety, Environmental Audit and Risk Assessment reports available	Document Review	Monthly	Supervision Consultant
Training and awareness on environmental, health and safety issues	Induction training on Environment, health and safety issues	List of staff trained	Review of records	Monthly	Supervision Consultant
		Signed attendance list	Review of records	Monthly	Supervision Consultant
	Staff training on health and safety	List of staff trained	Review of records	Monthly	Supervision Consultant
		Signed attendance list	Review of records	Monthly	Supervision Consultant
	Staff training on environmental issues	List of staff trained	Review of records	Monthly	Supervision Consultant
		Signed attendance list	Review of records	Monthly	Supervision Consultant
	Staff training on fire safety	List of staff trained	Review of records	Monthly	Supervision Consultant
		Signed attendance list	Review of records	Monthly	Supervision Consultant
Human Resource Management	Environment, Health Safety and Social personnel	Health and Safety Officer available	Review of records	Monthly	Supervision Consultant
		Designated Environment Officer (DEO) available	Review of records	Monthly	Supervision Consultant
		Community Liaison Officer (Sociologist) available	Review of records	Monthly	Supervision Consultant
Relationship with local community	Complaints and grievances	Number of grievances lodged	Review of records	Monthly	Supervision Consultant
		Number of grievances redressed	Review of records	Monthly	Supervision Consultant
	Grievance Redress Mechanism	Grievance Redress Plan in place	Review of records	Monthly	Supervision Consultant
		Grievance Redress Forms in place	Review of records	Monthly	Supervision Consultant
		Grievance register in place	Review of record	Monthly	Supervision Consultant
Occupational Health and Safety issues	Health and Safety Management	Work Health and Safety Plan in place	Review of records	Monthly	Supervision Consultant
		First Aid kits available on site	Periodic checks	Monthly	Supervision Consultant
		Number of condom dispensers loaded with male condoms	Periodic checks	Monthly	Supervision Consultant

Main Issues/ Impacts	Parameters to monitor	Monitoring Indicators	Monitoring Methods	Frequency of monitoring	Responsibility for monitoring
		Number of toilets available on site	Periodic checks	Monthly	Supervision Consultant
	Health and safety committee in place	Minutes of committee meetings	Review of records	Monthly	Supervision Consultant
		Attendance list of committee meetings	Review of records	Monthly	Supervision Consultant
	Provision of Personal Protective Equipment (PPE)	Number of workers provided with safety shoes	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with helmets	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with reflective jackets	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with eye shield	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with nose masks	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with hand gloves	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with overalls	Periodic checks	Daily	Supervision Consultant
		Number of workers provided with nose masks	Periodic checks	Daily	Supervision Consultant
	Occurrence of Accidents and incidents	Accident/ Incident forms available	Review of records	Monthly	Supervision Consultant
		Number of injuries reported	Review of records	Monthly	Supervision Consultant
		Number of off days due to injuries	Review of records	Monthly	Supervision Consultant
		Number of injury related treatments	Review of record	Monthly	Supervision Consultant
		Number of compensations launched	Review of records	Monthly	Supervision Consultant
Consultations and meetings	Number of community meetings, Health and Safety Committee meetings and Grievance Redress Committee (GRC) meetings held	Meeting schedules	Review of records	Monthly	Supervision Consultant
		Attendance list of participants	Review of records	Monthly	Supervision Consultant
		Minutes of meetings	Review of records	Monthly	Supervision Consultant
Traffic related issues	Construction traffic management	Traffic Management Plan in place	Review of records	Monthly	Supervision Consultant

Main Issues/ Impacts	Parameters to monitor	Monitoring Indicators	Monitoring Methods	Frequency of monitoring	Responsibility for monitoring
		Traffic signs in place	Random checks	Weekly	Supervision Consultant
		Speed limits in place	Random checks	Weekly	Supervision Consultant
		Traffic diversion signs in place	Random checks	Weekly	Supervision Consultant
Labour, employment, gender and HIV/AIDS	Labour and employment management	Labour and working conditions plan in place	Review of records	One off	Supervision Consultant
		Number of employees who have signed code of conduct	Review of records	Monthly	Supervision Consultant
	Compliance with labour laws	Number of underage workers employed	Random checks	Daily	Supervision Consultant
		Number of workers with employment contracts	Review of records	Monthly	Supervision Consultant
	HIV/AIDS awareness	HIV/AIDS awareness Plan in place	One off	Monthly	Supervision Consultant
		List of staff	Review of records	Monthly	Supervision Consultant
		Attendance list	Review of records	Monthly	Supervision Consultant
Record keeping	Presence of records of site activities	Filled in Designated Environment Officer (DEO) diary	Review of records	Monthly	Supervision Consultant
Water quality	Chemical components	Temperature, pH, Conductivity, dissolved Oxygen, Nitrates, Alkalinity, Total suspended solids, Total dissolved solids	Sampling for analysis in NEMA accredited laboratories	Quarterly	Contractor
			Sampling for analysis in NEMA accredited laboratories	Annually	External NEMA licensed Expert
	Bacteriological components	Total coliforms per 100ml, Feacal coliforms per 100ml	Sampling for analysis in NEMA accredited laboratories	Quarterly	Contractor
			Sampling for analysis in NEMA accredited laboratories	Quarterly	External NEMA licensed Expert
Noise impacts	Noise pollution	Noise levels in Db (A)	Onsite measurement and analysis using noise meter	Weekly	Contractor
			Onsite measurement and analysis using noise meters	Annually	External NEMA licensed Expert
Emission impacts	Air quality	Sulphur Oxides (SO_X), Oxides of Nitrogen, (NO_X), Carbon Dioxide (CO_2), Suspended Particulate	Onsite analysis of environmental parameters	Monthly	Contractor

Main Issues/ Impacts	Parameters to monitor	Monitoring Indicators	Monitoring Methods	Frequency of monitoring	Responsibility for monitoring
		Matter (SPM), Respirable Particulate Matter (RPM) (<10µm), $PM_{2.5}$, Nitrogen Dioxide	Onsite analysis of environmental parameters	Annually	External NEMA licensed Expert
Waste management	Solid and hazardous waste management infrastructure	Waste Management Plan in place	Review of records	Monthly	Supervision Consultant
		Waste collection bins in place	Inspections	Monthly	Supervision Consultant
		Weather proof waste storage area in place	Inspections	Monthly	Supervision Consultant
		Contract with NEMA-licensed solid waste handler in place	Review of records	Monthly	Supervision Consultant
		NEMA licence for solid waste handler available	Review of records	Monthly	Supervision Consultant
Soil erosion	Quantity of soil eroded	Gulleys within the construction site, silt deposits within the area and turbidity of water in local water bodies	Observation during field inspections	Weekly	Supervision Consultant
Bush clearance	Trees and vegetation removal	Number of trees destroyed	Tree census	Monthly	Supervision Consultant
		Area cleared	Observation during site inspection	Monthly	Supervision Consultant

CHAPTER 10

10.0 DECOMMISSIONING

10.1 Introduction

Decommissioning normally takes place both at the end of construction period and during the final phase of a project life-cycle. Environmental planning is therefore necessary before any decommissioning activities should be allowed to commence. The reason for this is because a project earmarked for decommissioning has in all likelihood been operational for some time, and as such, the environment within which it lies has stabilised in response to the presence of the associated infrastructure, activities and facilities. At the end of construction phase, decommissioning mainly targets temporary facilities associated with construction camps and site restorations. The decommissioning of one or all components of the proposed project will therefore have some effect on the environmental status quo of the project site, either in a positive or in a negative way. This section contains various environmental guidelines which will assist decision makers to take environmentally responsible and sustainable decisions in terms of which infrastructure to retain, which to develop further (and how to do this), and which to remove completely in so far as construction and operations of this project are concerned. In this way, the positive aspects of decommissioning may be maximized and the negative aspects minimized or even avoided.

10.2 Purpose and objectives of decommissioning

The generally accepted purpose of decommissioning is the release of valuable assets such as machinery and sites for alternative use, recycling and reuse of materials and the restoration of environmental amenity. In all cases, the basic objective is to achieve an end-point that is sensible in technical, social and financial terms, that properly protects workers, the public and the environment and, in summary, complies with the basic principles of sustainable development. Stringent regulatory controls protect the public, the environment and workers from the hazards associated with decommissioning activities.

10.3 Decommissioning at the end of construction phase

The construction process for the proposed project site will involve a number of activities which may contribute to some changes in the local environmental conditions. The decommissioning exercise will involve dismantling of site facilities; backfilling all disturbed areas and transportation of materials out of site for disposal or re- use in similar future projects. Materials from the site will be basically remains from construction activities and include scrap metals and plastic pipes among others. These materials can be reused, recycled and donated to other organizations. Scrap materials, can often be reused or refurbished. Some items could be used by the proponent for their next job, and many items can be sold to used - materials stores, scrap recyclers, waste exchanges or other outlets. Various items shall be accumulated separately to facilitate recycling. The table below gives a summary of mitigation measures proposed for decommissioning during construction stage

Table 10. 1: Decommissioning at the end of Construction Phase

Issue	Action Required	Responsibility
Impacts related to procurement of construction materials	Close all borrow pits in accordance with an approved plan to maximise future use and minimise health and safety hazards.	Contractor
Solid waste arising from construction activities	The site is to be cleared of all construction materials, including litter prior to hand over	Contractor, LVSWWDA, KIWASCO
Fences, barriers and demarcations	Fences, barriers and demarcations associated with the construction phase must be removed from the site	Contractor

Disturbed areas	The site must be fully rehabilitated and stabilised (for example, through revegetation)	Contractor
Contractor camp	Decommission all contractor camp services including electricity, water and sanitation facilities	Contractor
Site remediation	A meeting must be held on site between the Engineer, Environmentalist and the Contractor to approve all remediation activities and ensure that the site has been restored to a condition approved by the Engineer	Contractor and supervising consultant
Hazard to workers	(i) Implement full H&S programme (Health and Safety Plan) and labour welfare provisions. (ii) Establish and operate an emergency evacuation procedure for casualties.	Contractor
Environmental cases identified	Rehabilitation Activities of Environmental Cases identified must continue throughout the defect liability period	Contractor and supervising consultant

10.4 Decommissioning during final phase of the project

Decommissioning of the project infrastructure is anticipated to be after the end of design life of the water supply and sanitation infrastructure. During decommissioning, the following steps should be considered in order to undertake the procedure in a structured manner.

Table 10. 2: Decommissioning during the final phase of the project

Step	Activity	Actions required	Responsible party
Step 1	Initiation	• Development of an objective worksheet and checklist incorporating references, legal and policies	Proponent
Step 2	Prepare road map for decommissioning design	• Conduct design review to validate elements of the design and ensure design features are incorporated in the decommissioning design. • Carry out public consultations	Proponent
Step 3	Prepare and award contract	• Prepare a contract that incorporates validated project information and award to a contractor as per the procurement rules.	Proponent
Step 4	Implement the project.	• Implement design elements and criteria on the project in accordance with specifications and drawings. • Inspect during decommissioning and at project completion to ensure that all design elements are implemented according to design specifications.	Contractor and proponent
Step 5	Non-conformance, corrective/preventive action	• Determine root cause • Propose corrective measures • Propose future preventive measures.	All responsible

CHAPTER 11

11.0 ENVIRONMENT, HEALTH AND SAFETY (EHS)

11.1 EHS Management and Administration

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools / equipments and the biotic environment. It is an essential tool in determining the ESIA study. The objective of EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational health and safety issues during construction, operation and decommissioning phases of the proposed project through avoidance of injuries; provision of safe and healthy working environment for workers comfort so as to enhance maximum output; control of losses and damages to plants, machines, equipment and other products; and enhancing environmental sustainability through developing sound conservation measures.

11.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the project neighbourhood by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a checklist by project stakeholders in planning and modification of the construction of the proposed project infrastructure. The plan will also provide for the establishment of an appropriate legal and institutional framework for the implementation of EHS in conformity to relevant statutes like; the Public Health Act Cap. 242; Occupational Safety and Health Act (OSHA), 2007; Environmental Management and Co-ordination Act (EMCA) 1999; Workmen Compensation Act Cap. 236 and other accompanying laws and by-laws already mentioned elsewhere in this report

11.3 Organization and implementation of the EHS Management Plan

The contractor(s) shall use the EHS plan at the proposed project site during construction and operation phase of the project with the assistance of EHS personnel who shall enforce its provision throughout the project duration.

11.4 Occupational Health and Safety Management

The proponent shall ensure, so far as is reasonably practicable, the health, safety and welfare at work of his employees including those of his sub-contractors and of all other persons on site. The Contractor shall comply with OSHA 2007, the Public Health Act; the Work injury benefits Act, the Employment Act and other Statutory Regulations, rules and bylaws regarding occupational health, safety and gender. The Proponent's responsibilities shall*, inter alia*, include requirements contained in the sections below.

11.4.1 Safe constructional plant, equipment and methods of work

The proponent and/ or his agents shall provide and maintain project equipment and systems of work that are safe and without risks to health and safety of workers and visitors to the site. This shall include maintaining equipment, engines, and related electrical installations in good working order; maintaining a clean and tidy work space; providing signals; providing work site rules, safe working procedures and allocating appropriate places to carry out the work.

11.4.2 Safe handling, storage, transport and disposal

The proponent and/ or his agents shall execute suitable arrangements for ensuring safety and absence of risk to health in connection with the use, handling, storage, transport and disposal of articles and substances. Transportation of any material by the Proponent and/ or his agents shall be in suitable vehicles which when loaded does not cause spillage and all loads shall be suitably secured.

Any vehicle that does not comply with this requirement or any of the local traffic regulations and laws shall be removed from the site. The Proponent and/or his agents must ensure that all stores are located such as to reduce risks to the workers on site. Arrangements for the safe use, handling, storage, transport and disposal of articles and substance are to be made before work commences to the satisfaction of the supervising Engineer.

11.4.3 Protective Clothing, Equipment etc

Provision of protective clothing and equipment, first aid stations with such personnel and equipment as are necessary and such information, instruction, training and supervision as are necessary to ensure the health and safety at work of all persons employed on the works all in accordance with the Laws of Kenya. The Proponent and /or his agents shall provide, at his own expense, protective clothing and safety equipment to all staff and labour engaged on the works to the satisfaction of the supervising Engineer. Such clothing and equipment shall include, at a minimum high visibility vest for workers directing traffic; protective boots and gloves for the workforce operating excavation machines and equipment; protective footwear, gloves, goggles, and dust mask for the workforce at the construction site; and ear protectors and dust mask for the workforce engaged in rock drilling or in using vibrating equipment.

11.4.4 Safety Officer

The Proponent shall designate a qualified Safety Officer (Accident Prevention Officer) from one of his senior staff who has specific knowledge of safety regulations, experience of safety precautions on similar works and who shall advise on all matters affecting the safety of the workforce and on measures to be taken to promote such safety. The Safety Officer shall work full time directly on the project at the project site. He/she might have other obligations in relation to similar topics, e.g. environment, social and/or medical aspects including HIV/AIDS prevention, as long as at least 50% of his/ her time is devoted to Occupational Health and Safety. The Safety Officer shall have specific training in the Proponent's safety and health management system and procedures, practice, etc. and before commencement of the Works, the Safety Officer shall receive training in (or receive a refresher course in) industrial first aid (or the equivalent). The Safety Officer shall routinely provide workers with training in safe work practices and general awareness of potential danger situations to avoid injuries. Trained first aid personnel, transport for sick or injured workers, and a stocked first aid kit shall be available at the site at all times. The Proponent shall establish emergency evacuation procedures to enable a rapid response to accidents.

11.4.5 Safety courses

All employees shall be given training on how to ensure their own personal safety and on ways to reduce the accident risk on those sites where large, mobile heavy vehicles and equipment or equipment with moving parts are in use. The Safety Officer shall provide training in safe work practices and general awareness of potential danger situations to avoid injuries. In addition, all employees handling dangerous/toxic materials shall be trained in how to handle dangerous/toxic materials.

All the Proponent's and contractor’s personnel shall, before starting to work, have an induction course on safety and health at the site. The information and training shall be on the site and have duration of at least two hours. It shall be conducted in English and, if necessary, also in a relevant local language to ensure that all personnel can understand the information and instructions. The Site Manager shall take part in at least the first part of the training. He shall present the Proponent's safety policy and goal, the responsibilities and roles in relation to safety and health of all individuals, and the more specific responsibilities and roles of key staff (Site Manager, Safety Officer, foremen, and others). The topics of the course shall be, but are not limited to:

(i) Proponent's/ Contractor's safety policy and goal;
(ii) Organization of safety and health at work and the responsibilities and roles of the Site Manager, the superintendents/supervisors/foremen, the Safety Officer and of each individual worker;
(iii) Mandatory use of personal protective equipment on the site;
(iv) Specification of the type of equipment, where and when to use it and how it shall be used, stored, cleaned and maintained correct;
(v) Placement and content of first aid equipment and fire extinguishers;
(vi) Use of fire extinguishers;
(vii) How to use the equipment and information on who are specially trained in first aid and how to contact them;
(viii) How to transport an injured person to a medical doctor or to the hospital;
(ix) Safety rules for the site, e.g. in relation to the use of different equipment, tools, vehicles, fuel, oil, chemicals, explosives and abrasives;
(x) Cleaning, housekeeping and maintenance of the site, including vehicles, equipment, tools, workshops, houses etc;
(xi) If work permits are required for specific tasks;
(xii) Manual handling, transport, storage and disposal of equipment, goods, etc. in a safe way preventing accidents and too heavy burdens;
(xiii) How to ensure that equipment, goods, etc. will not be an obstacle imposing a risk to other persons due to inadequate placement and protection of it;
(xiv) Welfare facilities and access to drinking water and water in case of skin burns on the site;
(xv) The use of safety signs and protective barriers;
(xvi) Safe use of fuel, oil, chemicals, explosives;
(xvii) Prevention of dust generation and exposure;
(xviii) Road safety aspects, sign posting and principles and measures for minimising the risk of traffic accidents;
(xix) HIV/AIDS prevention (only an introduction, more information shall be provided within one month of the employment on the site); and
(xx) Consequences of breach of discipline and not complying with rules

Different induction courses can be held for different types of workers ensuring the correct weight on relevant topics, e.g. vehicle operators, work shop workers etc. A Safety booklet written in English (a Swahili version is also recommended) shall spell out the most important aspects of occupational safety and health. The Safety booklet may take its starting point in the Proponent's general description of safety and health, but it shall be very specific for contract works. The safety booklet shall be handed to all staff at the introduction course and used as training material. More training material might be relevant to use at the induction course.

11.4.6 Safe access

The Proponent and his agents shall provide and maintain access to all places on the site in a condition that is safe and without risk of injury.

11.4.7 Latrines and other sanitary arrangements

The Proponent and/ or his agents shall provide an adequate number of suitable latrines and other sanitary arrangements at sites where work is in progress to the satisfaction of the supervising Engineer.

11.4.8 Reporting of accidents

The Proponent and/ or his agents shall report details of any accident to the relevant authorities, if appropriate, as soon as possible after its occurrence.

11.4.9 Occupational health hazards

The Proponent and /or his agents shall reduce occupational health hazards, such as:

(i) Physical hazards (continuous noise and vibrations, prolonged stay in high temperatures);
(ii) Chemical hazards (exposure to fumes, chemicals and dust including solvents, paints, and exhaust gases);
(iii) Mechanical hazards (unguarded or exposed moving objects and other dangers from the use and operation of machines);
(iv) Risk of accidents with hand tools (slips, falls, eye injuries) heavy items (the accidental dropping of heavy items) and vehicles;
(v) Thermal hazards (heat stroke from long hours working in direct sunlight and burns due to contact with hot items);
(vi) Electrical, fire or explosion hazards;
(vii) Ergonometric risk factors (personal injuries associated with poor working postures, heavy lifting, repetitive work, repetitive hand arm vibrations, manual transport); and
(viii) Sanitation hazards (including contaminated drinking water, poor food practices, improper waste disposal, unhygienic toilet and washing facilities, contact with solid and/or biological waste).

11.4.10 Means of reducing Occupational health hazards

The means of reducing occupational health hazards shall include:

(i) Using vibration-reduced and sound-reduced equipment;
(ii) Providing shade at stationary work places and at welfare facilities;
(iii) Having only trained and experienced persons use dangerous chemicals and operate the machines;
(iv) Providing safety awareness training for all workers;
(v) Providing easily movable equipment to reduce risk of injury associated with heavy lifting or & work;
(vi) Varying job functions (to avoid excessive repetitive motions);
(vii) Providing on the site, throughout working hours, adequate and easily accessible supplies of safe drinking water, access to washing facilities (because of chemical and biological hazards), proper eating places and waste disposal facilities;
(viii) Provide adequate signing, fencing and guards to ensure that unauthorised persons shall be kept off the site. This is especially relevant for the dangerous parts of the site, e.g. the storage areas for oil, fuel, chemicals, machines, the car park, and the work shop, near deep holes, and power lines;
(ix) The Proponent and/ or his agents shall keep the site free from all unnecessary obstructions, and shall store or dispose of any equipment or surplus of materials. The Proponent and/ or his agents shall clear away and remove from the site any wreckage, rubbish and temporary works which are no longer required;
(x) The Proponent and/ or his agents are responsible for providing safe passage around and through the work site for all kinds of traffic, including non-motorised traffic and pedestrians. Traffic signs, traffic control signals and barriers shall be used for direction and control of traffic and to inform drivers of the importance to slow down and drive carefully;
(xi) Vehicles shall at all times be maintained in accordance with original manufacturer's specifications and service manual. This will ensure low noise generation, low emission of diesel particulate emission and that the vehicle will not result in accidents due to inadequate maintenance. Special inspection and maintenance is required for brakes, steering wheel, light, horn, tyres, oil and water. Seat belts shall be installed and used. All heavy vehicles shall have reverse warning signal. The operators shall be instructed in avoiding spillage, not overturning or

overloading and not to drive at too fast speed. Operators shall be protected against the sun and a cabin shall protect against injuries if the vehicle is tipping around; and

(xii) All accidents shall be recorded and analyzed by the proponent and/ or his agents in order to prevent similar accidents in the future. Fatal accidents shall also be reported to the Police. Accident records shall be submitted to the authorities in accordance with applicable regulations.

11.4.11 Monitoring process

The proponent and/or his agents shall by daily inspections monitor:

(i) The use of specified personal protective equipment;
(ii) The cleanliness of the working area which is to be kept tidy with no unnecessary obstacles;
(iii) Dust generation and exposure and appropriate watering if required;
(iv) The presence of any new workers on the site, or plans to hire in the near future, and therefore need for induction courses;
(v) The position and adequacy of signing, barriers and fencing; and
(vi) The Safety Officer shall, at least on a monthly basis, monitor all site activities and prepare a report on his findings. The report shall include:
   a. Number and type of accidents, and preventive measures implemented to minimise future similar accidents;
   b. Number of workers who have attended (and not attended) an induction course;
   c. Number of workers who have received special training because they started on a new work function, and the total number of workers who should have received such training;
   d. Stock of personal protective equipment and quantities issued;
   e. Maintenance of the vehicles: tyres, brakes, light, steering wheel, oil, water;
   f. Condition of first aid equipment in place with quantities and requirements for replenishment; and
   g. The change in number of workers and their work functions.

11.5 HIV/AIDS and STI prevention

The Proponent's Management Plan for HIV/AIDS and STI shall include details of the measures he proposes to adopt to combat the spread of HIV/AIDS and sexually transmitted Infections (STI) between his staff, labour and the local community. The plan shall also outline workplace policies and programmes for employees living with HIV/AIDS, information and awareness campaigns and effective screening and counselling policies for STI and HIV/AIDS cases of his project staff. In any case, the Proponent shall comply with the HIV and AIDS Prevention and Control Act (2006) which prohibits discrimination of persons living with HIV and AIDS.

The proponent and/ or his agents will work closely with Kenya National Aids Control Council and MoH to put in place non-discriminatory workplace measures to protect the employees living with HIV/AIDS and to ensure that they are treated and counselled. Prevention measures will also be established to protect others against any risk of illness and injury, which can result in HIV/AIDS infection and transmission.

The Proponent and/ or his agents shall advise all site staff and labour of the danger and impacts of STI's in general and HIV/AIDS in particular. To this end, the Proponent shall conduct information, education and consultation (IEC) campaigns at least every other month, targeting the aforementioned site staff, labour, and the immediate local communities. The Safety Officer or another of the Proponent's staff may carry out the awareness training if qualified; otherwise a person from outside (e.g. from Hospital) may be hired to carry out the awareness training.

11.6 Gender

The Proponent's Management Plan for Gender shall include description of recruitment policy and procedures, awareness raising meetings, gender sensitive working conditions and facilities to be provided at the workplace, and participatory gender sensitive monitoring of site conditions. The Proponent and/ or his agents shall ensure that recruitment procedures and working conditions and facilities are gender sensitive and in particular that:

(i) Announcement notices of equal employment opportunities are posted in visible and popular places in the local communities and that such notices also reach women and youth leaders;
(ii) Both men and women are represented in any information and consultative meetings held at the site and that gender and social issues are raised and analyzed;
(iii) Equal payment is made to men and women for similar work and that payment of wages is made to the workers and not to representatives;
(iv) Flexible working hours are introduced to the fullest extent possible to take account of multiple roles of women and cultural norms.; and
(v) Separate toilets are provided for women, including sanitary facilities and shades for children of working mothers.

CHAPTER 12

12.0 CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

The following conclusions apply to the proposed Kisumu Water Supply and Sanitation project

12.1.1 General

From the EIA study, it was noted that Kisumu city has a number of development challenges that need to be addressed to ensure sustainable implementation of the proposed water and sanitation project. To begin with, water supply within greater sections of Kisumu city is inadequate and local inhabitants are forced to look for water from very unreliable sources. Some of the sources relied upon by the local people are unprotected and thus aggravates incidents of waterborne diseases. Although significant sections of Kisumu city are currently covered by water supply network, some parts still struggle with the problem of inadequate water supply. It was noted that some residents get their drinking water from polluted sources like shallow wells, unprotected springs and boreholes and more often than not take it raw without any further treatment. Water supply within the town is also unreliable due to periodic power outages that are commonplace in Kisumu city and its environs. Sanitation situation in the town is poor and a majority depends on unconventional means to dispose of effluents from their premises. The unconventional effluent disposal methods have led to pollution of Lake Victoria and this affects a large number of people who depend on the lake as drinking water source. It is therefore important that a lasting solution to the problem of water and sanitation in Kisumu city is realised. The proposed project is timely and the local people will significantly benefit from it. The project will achieve twin results of environmental conservation and promotion of public health. It is however important broad based consultation process be maintained throughout construction period in order to galvanise local support.

12.1.2 Environmental and Social Impacts

It was noted during this study that the proposed project will lead to a number of environmental and social impacts both during construction and operation phases of the project. The adverse impacts will be on private properties, natural environment and neighbouring land uses. Analysis of the anticipated adverse impacts revealed that most of the impacts are low in significance and can be adequately mitigated through implementation of the recommended mitigation measures contained elsewhere in this Study Report. Monitoring of progress with regard to implementation of these mitigation measures shall be implemented by the Project Proponent to ensure sustainable coexistence of the project and neighbouring populations and land uses.

12.1.3 Project benefits

The project will result in better access to safe drinking water and sanitation facilities leading to improved standard of living and changes in exposure to both communicable and non-communicable diseases. Project implementation will promote a more sustainable use of water resources with improvements in the infrastructure to reduce losses and introduction of better metering and billing procedures to encourage more efficient use of water. Cases of burst manholes which is a major nuisance to residents of the project area will be managed courtesy of this project. Local people will have an opportunity to channel their wastewater in a properly functioning sewer system while foul smell associated with malfunctioned sewer system and blocked manholes will be adequately dealt with courtesy of the project. Other benefits associated with the proposed project include reduced exposure to water related diseases;

environmental enhancement through proper management of wastewater hence managing the pollution of local water bodies; management of contamination of wells and other underground water resources within the project area; and help in curbing soil pollution that normally emanate from uncontrolled wastewater disposal

12.2 Recommendations

A number of measures for sustainable implementation of the proposed project and associated infrastructure are contained in Chapter 9 that deals with Environmental and Social Management Plan (ESMP). The Project proponent is advised to implement these additional recommendations to ensure sustainable coexistence of the project and neighbouring populations and land uses.

12.2.1 Resettlement Action Plan (RAP)

Sanitation component of the project may involve interference with existing developments some of which have been built on road reserves. These developments may either be demolished or temporarily relocated to give way for construction works. Project Affected Persons (PAPs) should be properly identified and assets affected valued under the auspices of resettlement Action Plan (RAP). Restorations and compensations should be made in compliance with applicable rules and regulations.

12.2.2 Community sensitisation

Local community members should be sensitised about the project ahead of construction activities. This sensitisation will enable those who have erected developments on water and sewer line paths to remove them in advance of development activities to avoid losses. Where businesses may be temporarily affected during construction process, affected individuals should be allowed to reconstruct their businesses after construction works

12.2.3 Regularization of development projects within the project area

The physical planning department should work closely with local developers to ensure that local planning requirements with regard to development control are strictly adhered to. Those who have encroached road reserves should be given notices to comply with local planning requirements in regard to plot coverage. All access roads between plots should be opened up to enable unmitigated access within the project area. The narrow roads should be opened up to their design sizes.

12.2.4 Opening up of the way leaves for water and sewerage

Private developers who have erected developments along way leaves for public works should be notified to remove such developments in compliance with applicable laws and regulations. Cooperation between local community leadership, local administration and planning authority should be harnessed towards this objective. Arrangements should be made to enable local developers comply with laws that require them not to put up any development within way leaves of public works

12.2.5 Enforcement of city by laws, rules and regulations

The local administrators and planning authority should strictly enforce city by laws, rules and regulations relating to development permission. No development should be implemented without requisite development approval. The approvals for development activities should be in compliance with applicable planning principles. This will in the long run mitigate encroachment of way leaves by private developers

12.2.6 Rehabilitation of water supply and sewerage infrastructure

Rehabilitation works should be initiated for water supply and sewerage infrastructure within Kisumu city. This work should target blocked manhole chambers, manhole chamber without covers, buried manhole chambers and burst sewer pipes. All old and burst pipes should be rehabilitated and all worn out parts replaced. All manhole chambers should be properly covered and inspection chambers installed for routine maintenance operations

12.2.7 Acquisition of land around Nyalenda Treatment Ponds

Kisumu Water and Sanitation Company should work towards acquiring land around the treatment pond to form a buffer between the facility and residential areas. A buffer of about five hundred metres around the treatment ponds should be acquired to mitigate environmental nuisance like odour.

12.2.8 Construct a laboratory for wastewater quality monitoring

Laboratory for wastewater quality monitoring should be constructed on-site. This will enable water quality monitoring to be carried out more often and will ultimately ensure that wastewater undergoes proper treatment before release into the environment.

12.2.9 Diversion of wastewater into the wetland area

River Uhuru channel should be re-engineered such that waste water is diverted into the existing natural wetland to enable for complete treatment of nitrates and phosphates. This will ensure that wastewater released into Lake Victoria does not contribute to high Biological Oxygen Demand (BOD)

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ANNEXES

Annex 1: Sample Survey Questionnaire Administered

Annex 2: List of persons consulted during ESIA study

Annex 3: List of stakeholder groups consulted during the study

Annex 4: List of Chiefs and Assistant Chiefs consulted during the study

Annex 5: Identified water works

Annex 6: Identified wastewater works

Annex 7: NEMA Licence of ESIA Expert

Annex 8: Curriculum Vitae of Key Personnel

Annex 9: Consolidated List of stakeholders consulted

Annex 10: Approval Letter for Terms of Reference