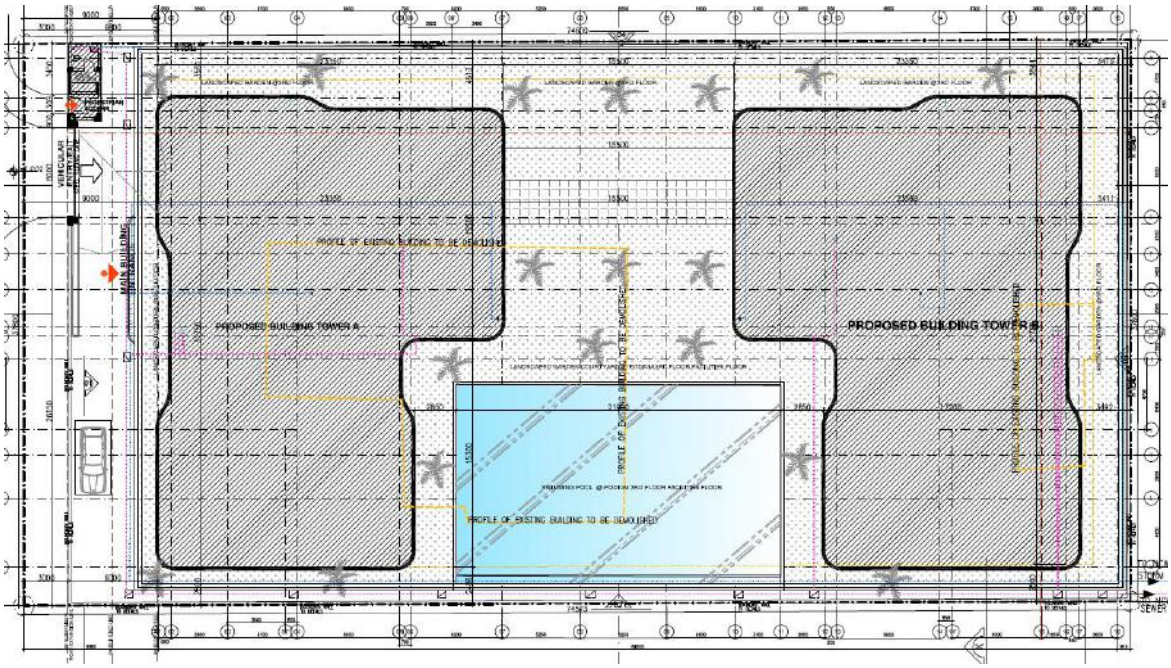
ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT
FOR
THE PROPOSED APARTMENTS ON PARCEL NO. NAIROBI/BLOCK 34/420, SITUATED ALONG WESTLANDS ROAD, WESTLANDS, NAIROBI CITY COUNTY



This Environmental Impact Assessment (EIA) Project Report is submitted to National Environmental Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003

JANUARY 2024

DECLARATION AND DOCUMENT AUTHENTICATION

GEE PLAN MANAGEMENT LIMITED (Reg. No 6859) on behalf of the Proponent, submit the following Environmental Impact Assessment Study Report, for the **Proposed Apartments on Parcel No. Nairobi/Block 34/420, situated along Westlands Road, Westlands within Nairobi City County.** The Environmental Impact Assessment has been carried out according to the Environmental Management and Coordination Act, 1999 and Environmental (Impact Assessment and Audit) Regulations, 2003.

Signed on this ……..day of January 2024

Mr. Robert Koech *Signature*……

Lead Expert, Gee Plan Management Limited

NEMA Reg. No. 2728

PROPONENT

I……. Signature ……on behalf of **Hai Jiang International Company Limited (Proponent)** submit the following Environmental Impact Assessment Report, for **Proposed Apartments on Parcel No. Nairobi/Block 34/420, situated along Westlands Road, Westlands within Nairobi City County.**

Signed on this …….. day of January 2024.

ACRONYMS

DGs	Diesel Generators
EA	Environmental Audit
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
EMS	Environmental Management System
Ha	Hectare
HFCs	Hydro fluorocarbons
ICT	Information Communication Technology
IEA	Initial Environmental Audit
KPLC	Kenya Power and Lighting Company
KRA	Kenya Revenue Authority
MDGs	Millennium Development Goals
NEAP	National Environment Action Plan
NEC	National Environment Council
NEMA	National Environment Management Authority
NPEP	National Poverty Eradication Plan
PFCs	Perfluorocarbons
PVC	Polyvinyl Chloride
SHE	Safety, Health and Environment
TOR	Terms of Reference
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
WRMA	Water Resources Management Authority
WSB	Water Services Board

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The Proponent (Hai Jiang International Company Limited) has proposed to put up Apartments on Parcel No. Nairobi/Block 34/420, situated along Westlands Road, in Westlands, Nairobi City County. The parcel of land lies on coordinates 1°15'58.2"S and 36°48'21.6"E and measures 0.2819 ha. The proposed project site is currently developed with a residential bungalow, that hosts offices, and servant quarters.

Environmental Impact Assessment is a tool for environmental Planning and has been identified as a key component in new project implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) No.8 of 1999 second schedule 9 (1), and Environmental (Impact Assessment and Audit) Regulation, 2003, new projects must undergo Environmental Impact Assessment. The report of the same must be submitted to National Environment Authority (NEMA) for approval and issuance of relevant certificates. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

This assessment covered construction works of the proposed development which includes ground preparation, masonry, and installation of service lines as well as the utilities required.

The main objective of the assignment was to assist the proponent prepare a Environmental Impact Assessment Study Report after carrying out an Environmental screening of the proposed Residential Development to ensure that appropriate measures to mitigate any adverse impacts to the environment are taken into consideration.

Methodology outline

The general steps followed during the assessment were as follows:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, 1999.
- Environmental scoping that provided the key environmental issues
- Review of architectural plans and relevant literature.
- Distribution, completion, collection and analysis of questionnaires
- Physical inspection of the site and surrounding areas
- Reporting

Project description

The proposed project pertains the construction of Residential Apartment. The proposed development shall comprise of twenty eight (28) floors as described in the table below;

The estimated cost of the proposed Project is approximately One billion, five hundred and eighty one thousand, eight hundred and eighteen thousand seven hundred and two shillings) (Kshs. 1,581,818,702).

Table 1: Project description

Category	No of levels	Description
Basements and parking	5	330 bays
Facilities	1	Children play area, Land scaped garden, indoor games, GYM and swimming pool
APartments	24	300 No. 1 Bedroom units and 150No. 2 bedroom units

Impacts and Mitigation Measures

Adequate environmental management systems will be incorporated during the entire planning, construction and operating stages of the project to minimize any adverse environmental impacts and assure sustainable development of the area. A Summary of major impacts and mitigation measures is presented in the Table below.

Table 2: Summary of Impacts and proposed mitigation measures

Positive impacts	**Impact Description**
Employment opportunities	The construction, operation and decommissioning of the proposed Project are expected to offer numerous employment opportunities both directly and indirectly.
Impacts on local and national economy	Gains in the local economy will result from the utilization of locally available construction materials and paying of taxes to the government.
Increased security	The fencing with associated guards and security lights once complete will increase security within the general area.
Provision of residential units	The project will lead to the provision of residential units
Optimal use of land	Change in land use from idle land to land on which a modern development will be constructed will optimize land use in the area
Negative Impacts	**Proposed Mitigation Measures**
Soil erosion, water logging and siltation	• Terrace, level and rip off compacted areas of the project site to reduce run-off velocity and increase infiltration of storm water into the soil • Proper planning of site excavation works such that a section is completed and rehabilitated before another section begins • Landscaping and construction of retention walls to control soil erosion • Surface runoff and roof water shall be harvested and stored in suitable underground reservoir for reuse
Noise and vibrations	• Comply with maximum permissible noise and vibration levels for constructions sites as per Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 • Apply for a License from NEMA whereby maximum permissible noise levels are to be exceeded • Prescribe noise reduction measures if appropriate e.g. restricted working hours and transport hours and noise buffering. • Install portable barriers to shield compressors and other small stationary equipment where necessary and locate stationary noise sources as far from existing sensitive receptors as possible. • Co-ordinate with relevant agencies regarding all construction activities in the project site.

	• Limit pickup trucks and other small equipment to minimize idling time and observe a common-sense approach to vehicle use such as shutting up idle engines whenever possible. • Ensure use of well serviced and maintained vehicles and equipment. • All construction works and delivery of materials shall be carried out during the day between 8:00 AM and 5:00 PM • Implement good working practices (equipment selection and siting) to minimize noise and also reduce impacts on human health.
Air pollution (exhaust emissions and dust)	• Use water sprinklers to keep the place wet to control dust. • Vehicles and machinery should be switched off when not in use. • Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard; • Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction site; • Use of electrically operated construction machinery to avoid externalities produced by diesel engines. This procedural change may reduce problems related to emission, idling and maintenance
Health and safety	• Unattended public access to the construction site should be restricted. • Rosta and general register of all construction workers should be kept within the project site. • Appropriate health and safety measures shall be implemented. • Warning signs should be placed in appropriate places. • Safety education and training of the construction workers should be emphasized. • Install proper fire management equipment and strategies. • Security personnel should be posted on site at all times • Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste; • Use of construction materials containing recycled content when possible and in accordance with accepted standards; and • Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.
Minimizing traffic along access road	• All transportation of construction raw materials and excavated materials are to be conducted at traffic off peak hours only

	• Sensitize truck drivers to avoid unnecessary road obstruction • Cover all trucks hauling soil, sand and other loose materials to avoid spillage and dust emissions that may interfere with smooth motoring • Work hours shall be restricted to the period between 8:30 a.m. and 3:30 p.m., Monday through Friday, unless approved otherwise. When night work is required, work hours shall be 9 p.m. to 5 a.m. • Access to driveways will be maintained at all times unless other arrangements are made

Conclusion

The Environmental Assessment established that the proposed project has both positive and negative impacts. The study team has developed mitigation measures which if implemented will ensure a sustainable and friendly environment as the project is implemented.

Recommendation

Given the proposed project's potential contribution in the provision of quality facility and creating employment opportunities, its implementation is considered important and beneficial, thus, the proponent shall implement it. The key effort should be geared towards safeguarding the environment. This can effectively be achieved through close following and implementation of the recommended environmental management plan.

CHAPTER ONE: INTRODUCTION

1.1 Background and rationale for an Environmental Impact Assessment (EIA)

The Proponent (Hai Jiang International Company Limited) has proposed to put up Apartments on Parcel No. Nairobi/Block 34/420, situated along Westlands Road, in Westlands, Nairobi City County. The parcel of land lies on coordinates 1°15'58.2"S and 36°48'21.6"E and measures 0.2819 ha. The proposed project site is currently developed with a residential bungalow, that hosts offices, and servant quarters.

According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) of 1999 and Part II and III of the Environmental (Impact Assessment and Audit) Regulations 2003 (Legal No. 101), construction of the proposed development requires an Environmental Impact Assessment

Report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual Licensing before the development commences.

1.2 Terms of reference (TOR)

The TOR for this assessment is based on the Environmental (Impact Assessment and Audit) Regulations dated 2019 and relevant circulars. According to the circulars, the Environmental Impact Assessment Study Report should where possible, contain description of the following: -

- Project Description
- Potential environmental and social impacts of all the project cycle phases: Planning, Construction, operation and decommissioning.
- Mitigation measures for all potential environmental and social impacts.
- Environmental Management Plan for the entire project life cycle.
- Evidence of comprehensive public consultation including duly signed minutes of consultation meetings with project affected persons and key stakeholders, attendance lists and filled questionnaires.

1.3 Methodology of the environmental impact assessment

1.3.1 Data collection procedures

Data collection was carried out through administration of questionnaires, use of checklists, observations and photography, site visits and desktop environmental studies, where necessary,

in the manner specified in the Environmental (Impact Assessment and Audit) Regulations, 2003.

1.3.2 Desktop study

This included documentary review on the nature of the proposed activities, Project documents, and relevant legislative and regulatory frameworks among others. It also included discussions with the developer and the architects among other relevant stakeholders.

1.3.3 Site assessment

Field visits were carried out specifically for physical inspection of the proposed project site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts. It also included taking photographs of the proposed site, access roads that will be used to access the site and other important features within the site and the surrounding areas.

1.3.4 EIA public consultation

To ensure adequate public consultation in the process, the Expert prepared questionnaires which were administered to the sites' neighbours and the information gathered was subsequently synthesized and incorporated into the Report. The appendices contain random sample copies of the completed questionnaires that were administered

1.3.5 Reporting and documentation

The information collected from the Assessment was analyzed, interpreted and presented, in this Report in accordance with NEMA guidelines. The consultant ensured that the proponent was constantly briefed during the exercise.

1.3.6 Obligations of the consultant

The Consultant undertook all the works necessary to produce the Environmental Report and the supporting details for submission to NEMA. In order to do this, the Proponent provided a contact person to provide information required by the Consultant and background information of the proposed Project. The Proponent also provided copies of land ownership, design drawings and estimated project cost. Copies of the land title deeds of the proposed site and design drawings are appended within the Appendix of this Report.

CHAPTER TWO: DESCRIPTION OF THE PROJECT

2.1 Project brief

The proposed project is a residential Apartments. Table 3 shows the details of the proposed building; The property developed with a residential bungalow and servant quarters. The bungalow currently hosts offices (Figure 1 and Figure 2).

Table 3: Project Briefs

Category	Level/Floor	Description	Areas (SM)
Basements & parking floors	Basement 01	68 bays	2,245
	Basement 02	66 bays	2,245
	Ground floor	64 bays	2,245
	1st Floor	64 bays	2,245
	2nd Floor	68 bays	2,245
Sub total		**330 bays**	**11,225**
	3rd Floor	Facilities - Children play area, Land scaped garden, indoor games, GYM and swimming pool	1,246
Apartments	4th - 28th	1 Bedroom apartments - 12No. Per floor	31,150
		2 Bedroom apartments - 6 No per floor	
Floor Slab			150
Sub-total			**32,546**
Gross built area			**43,771**

2.1.1 Project location

The proposed project site is located within Westlands along Westlands Road, Nairobi County.

2.1.2 Character of surrounding environment

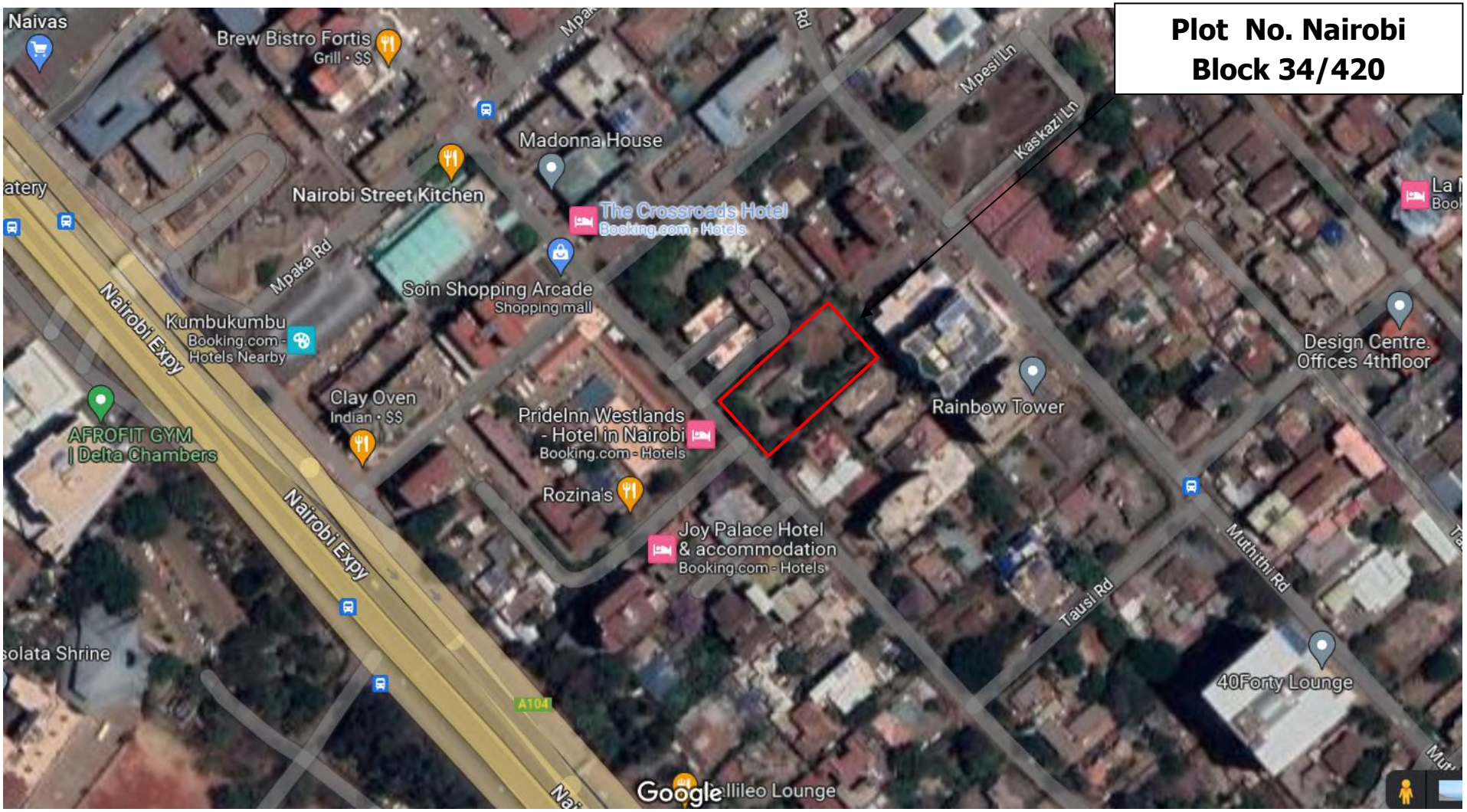
The neighborhood, where the proposed project site is located, is characterized by Apartments and commercial buildings including Prideinn westlands, GTC, Villa Rosa Kempinski. The proposed development does not contravene the County's Zoning Policy and has obtained planning approvals from the Nairobi City Council.

Figure 1: Existing Bungalow being used as offices

Figure 2: Existing servants quarter

Figure 3: Similar developments within the Neighbourhood

LOCATION OF THE PROPERTY



2.1.3 Project budget

The estimated cost of the proposed Project is approximately One billion, five hundred and eighty one thousand, eight hundred and eighteen thousand seven hundred and two shillings) (Kshs. 1,581,818,702).

2.1.4 Design of the proposed project

The design of the proposed project has been executed with due consideration of the existing topography of the proposed project site. In addition, measures have been taken to ensure that the existing landmass, strata and vegetation are least disturbed during construction of the proposed project.

In general, the design of the proposed project optimizes the use of best available technology to prevent or minimize potentially significant environmental impacts associated with the project and proposes to incorporate efficient operational controls together with trained staff, to ensure high level business and environmental performances.

2.1.5 Solid waste

Solid waste management will consist of dustbins stored in cubicles protected from rain and scavenging animals in all housing units. The waste will then be collected by a private waste management company to be composted, palletized or re-cycled depending on the waste management strategy to be adopted.

2.1.6 Waste water

Waste water from the individual units will be channeled into the existing sewer line.

2.1.7. Solid waste management

Waste in the project area will be collected onsite and disposed at designated areas. Waste collection will be undertaken privately by contracted garbage collectors.

2.1.8 Electrical system

The development will be connected to the electricity main line of the Kenya Power and Lighting Company. The various components of the electrical system shall comprise of single and twin socket outlet, one- and two-way switch outlets wall mounted security bulkhead fitting, lockable meter boards with glass view panel, gate lights and security alarm panel outlet. The necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to.

2.1.9 Water reticulation system

The project site has an existing piped water connection which is adequate to meet the domestic demand. Additionally, the proposed development has considered a water tank with a capacity of 450 cm^3

2.1.10 Storm water run-off

All storm water drainage will be channeled into open storm water drain systems with a 300mm diameter encase in 150 concrete surrounds. All Integrated Circuits and manholes in the driveway will have heavy duty covers.

2.2 Description of the Project's construction activities

2.2.1 Pre-construction investigations

The implementation of the proposed project's design and construction phase will start with thorough investigation of the site's biological and physical resources in order to minimize any unforeseen adverse impacts during the project cycle.

2.2.2 Site clearance

The portion of land in which the project is to be constructed is bear with minimal vegetation cover. Site clearance process shall therefore entail removal of any obstruction on the way of the intended construction activity. The site clearance will result in solid waste generation, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

2.2.3 Sourcing and transportation of building materials

Building materials will be transported to the proposed project site from their extraction, manufacture, or storage sites using transport trucks. The building materials to be used in construction of the proposed project will be sourced from neighboring counties and surrounding areas. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

2.2.4 Project raw material

The main material inputs in the proposed Project include: Masonry stone, Sand, Cement, Ballast, Gravel, Soil, Timber, Steel (reinforcement, casement, wiring and fittings), Glass, PVC materials (tiles, pipes, conduits, and fittings), Concrete tiles and paving block, Paint, Plant materials – glass, tree seedlings etc and Water amongst others

2.2.5 Storage of materials

Building materials will be stored at a designated contractor's yard on site. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled on site. To avoid piling large quantities of materials on site, the contractor will order bulky materials such as sand, gravel and stones in bits. Materials such as cement, paints and glasses among others will be stored in temporary storage structures, which will be constructed within the proposed project site for this purpose.

2.2.6 Excavation and foundation works

Excavation will be carried out to prepare the site for construction of foundations, septic systems and drainage systems. This may involve the use of heavy earthmoving machinery such as excavators and bulldozers.

2.2.7 Masonry, concrete work and related activities

The construction of the building walls, foundations, floors, pavements, drainage systems, boundary wall and parking area among other components of the proposed project will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and will be supplemented by machinery such as concrete mixers.

2.2.8 Structural steel works

The building will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection.

2.2.9 Roofing

Roofing activities will include raising the roofing materials such as tiles and structural timber to the roof and fastening the roofing materials to the roof.

2.2.10 Electrical work

Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc. In addition, there will be other activities involving the use of electricity such as welding and metal cutting.

2.2.11 Plumbing

Installation of pipe-work for water supply and distribution will be carried out within the units and associated facilities. In addition, pipe-work will be done to connect the units to septic tank and for drainage of storm water from the rooftops into the peripheral storm water drainage

system. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

2.2.12 Landscaping

To improve the aesthetic value or visual quality of the site once construction ceases, the proponent will carry out landscaping. This will include establishment of flower gardens and grass lawns and will involve replenishment of the topsoil. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping.

2.3 Description of the project's operational activities

2.3.2 Solid waste and waste water management

The Proponent will provide facilities for handling solid waste generated within the facility. These will include dustbin cubicles for temporarily holding waste within the development before final collection and disposal by appropriate contracted firm, while storm water from the proposed project area will be channeled into peripheral storm water drainage systems.

2.3.3 General repairs and maintenance

The units and associated facilities will be repaired and maintained regularly during the operational phase of the proposed project. Such activities will include repair of building walls and floors, repairs and maintenance of electrical gadgets and equipment, repairs of leaking water pipes, painting, maintenance of flower gardens and grass lawns, and replacement of worn-out materials among others.

2.4 Description of the project's decommissioning activities

2.4.1 Demolition works

Upon decommissioning, the proposed project components including buildings, pavements, drainage systems, parking areas and perimeter fence will be demolished.

2.4.2 Dismantling of equipment and fixtures

All equipment including electrical installations, furniture partitions, pipe-work and sinks among others will be dismantled and removed from the site on decommissioning of the project. These materials shall be disposed in a manner acceptable to NEMA.

2.4.3 Site restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil and re-vegetation using indigenous plant species.

CHAPTER THREE: BASELINE INFORMATION

3.1 Introduction

Baseline information is needed on all central issues in the Environmental assessment, taking into account a broad definition of the environment. Baseline information provides a reference for all assessments, for accurately predicting and for the comparison of alternatives and mitigation measures. It is used as a starting point in the prediction of likely impacts resulting from the project and of naturally occurring changes in the environment. Baseline information was collected from documents and data banks, supplemented by field studies.

The environmental resources examined in baseline analysis include:

(a) Physical resources (climate, soils geology, ground water and surface water)

(b) Ecological resources (aquatic biology e.g. fisheries, wildlife, forests and endangered vegetation species, protected coastal resources.

(c) Economic development (infrastructural facilities such as water supply, sewerage, flood control, roads, land use, power sources, agricultural development, mining and tourism).

(d) Social and cultural resources (e.g. population numbers, locations, composition, employment, health facilities, socio-economic conditions e.g. social well-being, physical or cultural heritage, current use of lands and resources for traditional purposes by indigenous people, sites that are for historical, archeological, paleontological of architectural significance**.**

3.2 Description of the existing site

The site is located along Westlands Road. The property currently hosts Office building

3.3 Physical resources

This section borrows from the Geotechnical Engineering and Hydrogeological/Geophysical Survey reports that we commissioned by the proponent

3.3.1 Topography

The landform area of the site is a low hilly landform unit. The terrain is higher and the terrain has certain undulations. The topography of the site is high in the southwest and low in the northeast elevation1699.90m～1702.40m, with a relative height difference of 2.50m. The southwest side of the proposed site is Westlands Road, the red line is close to the road, and the other three sides are civil and commercial buildings. The red line is about 10m from the northwest side of the building, about 6m from the northeast side of the building, and about 3m from the southeast side of the building.

Figure 4: Landform of the proposed site

3.3.2 Hydrogeology

The hydro-geology of an area is normally intimately dependent upon the nature of the parent rock, structural features; weathering processes recharge mechanism and the form and frequency of precipitation.

The site is located in a hydrogeological zone that is characterized by a medium groundwater potential. Aquifers are found above as well as below the Nairobi Trachytes. The main aquifer is the Upper Athi Series. The Kerichwa Valley Tuffs behave like a sponge and the contact between them and the underlying, impermeable phonolite is thus a perfect aquifer. There is a fair chance of striking 5m3 /hr above the Nairobi Trachytes at a depth of up to 250 m. The Nairobi Trachytes may yield some water but generally it is considered to be a rather unproductive formation. Below the Nairobi Trachytes, at a depth exceeding 250 m the Upper Athi Series may provide an additional supply, which can increase the total yield to more than 5 m^3 /hr. The maximum reported (tested) yield in the area is 18m3 /hr for boreholes in the vicinity of the site.

3.3.3 Soil

Survey shows that within the exploration depth range, the upper part of the site's rock and soil layer is composed of Quaternary Holocene clay, and the underlying bedrock is Tertiary (N) breccia and phonolite. According to the geological age, genetic type, lithology and distribution and burial characteristics of the rock and soil layers, the exposed soil layers at the site are divided into 3 engineering geological layers. Among them, the ③ layer of phonolite is divided into 2 engineering geological sub-layers according to the degree of weathering; now The composition and characteristics of foundation soil are described from top to bottom as follows:

(a) Layer—Clay (Q4el): Grey-brown, hard plastic, medium dry strength and toughness, uneven soil quality, partially sandwiched with strongly weathered fragments, thickness 2.00~3.10m, average 2.31m.

(b) Layer - Strongly weathered breccia (N): brownish gray, breccia structure, massive structure, developed joints and fissures, short columnar core, column length 10-70cm, some broken pieces, block diameter 2-8cm, the rock is soft, easy to break when hammered, the hammering sound is mute, and drilling is easier. The top elevation of the floor is 1697.00~1700.01m, with an average of 1698.38m; the depth of the top of the floor is 2.00~3.10m, with an average of 2.31m; the thickness is 8.40~15.20m, with an average of 10.53m.

(c) 1st Layer - Strongly weathered phonolite (N): brownish gray, porphyritic structure, massive structure, mineral composition is mainly alkaline feldspar, alkaline extrusive rock, the original rock structure is partially destroyed, weathering cracks are relatively developed, and the rock Most of the cores are in the shape of short columns, with a single column length of

10-30cm, some of which are in the shape of broken pieces, with a diameter of 2-8cm. The rock quality is soft and the hammering sound is dull. The top elevation of the floor is 1687.89~1689.62m, with an average of 1688.62m; the depth of the top of the floor is 11.50~13.30m, with an average of 12.16m; the thickness is 3.20~6.50m, with an average of 5.04m.

(d) Layer 2 - Weathered phonolite (N): blue-grey, porphyritic structure, massive structure, mineral composition is mainly alkaline feldspar, it is an alkaline extrusive rock, the original rock structure is partially destroyed, weathering cracks are relatively developed, and the rock The cores are mostly in the shape of short columns or columns, with a single column length of 10-50cm, some of which are in the shape of broken pieces, with a diameter of 2-8cm. The rock is hard, makes a hammering sound, and is not easily broken. The top elevation of the layer is 1682.10~1684.69m, with an average of 1683.44m; the depth of the top of the layer is 15.40~18.50m, with an average of 17.25m; this layer has not been exposed, and the exposed thickness is 6.50~14.60m, with an average of 9.09m.

3.3.4 Geology

The site is underlain by the `Nairobi Volcanics'. In the investigated area the volcanics comprise the following members: the middle and upper Kerichwa Valley Tuffs, Nairobi Trachytes, Kiambu Trachytes and Nairobi Phonolites. The basement system rocks are to be found at greater depths.

In the investigated area, the Middle and Upper Kerichwa Valley Tuffs overlie the Nairobi Trachytes, which in turn overlie the Kiambu Trachytes. The Nairobi trachytes, which form part of the Ngong volcanics, are the most prevalent in the area. The Kerichwa Valley Series are mainly composed of sediments, tuffs and welded tuffs.

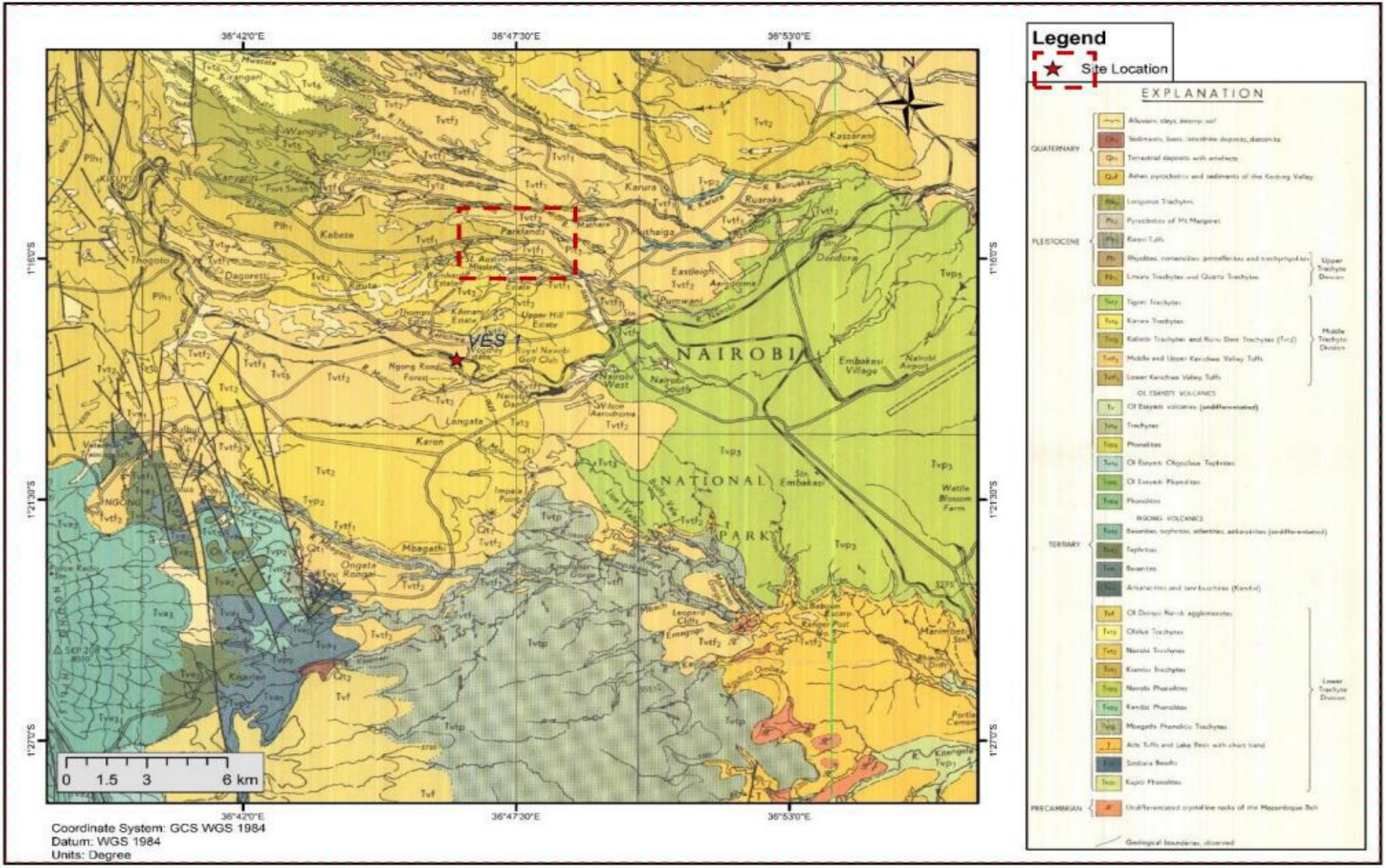


Figure 5: Geology of the study area

3.3.5 Site and foundation stability

According to regional geological data, no signs of Holocene active faults were found within 10km of the site. There are two small faults, the Kikuyu fault and the Limuru fault, about 22km away in the near field area, and the Kedong fault, which is the eastern branch of the East African Great Fault, about 42km away. They are both Holocene active faults. Affected by the east branch fault zone of the East African Rift Valley, the tectonic and seismic activities in the site are strong, seismic activity is frequent along the fault zone, there are many low-magnitude earthquakes, and most of them are shallow earthquakes. Therefore, the regional stability is poor.

There are no adverse geological phenomena such as landslides, debris flows, and goafs at the proposed site. The existing adverse geological phenomena are mainly active faults. The active faults are far away from the field area, 22km and 42km respectively. Therefore, the site stability is average.

The proposed site is a low hilly area, with terrain higher in the southwest and lower in the northeast. The terrain has certain undulations. The strata exposed within the exploration depth range are mainly Quaternary Holocene clay, and the underlying bedrock is Upper Tertiary (N) breccia. Xiangyan. The distribution of each layer is relatively stable, and no special rock and soil is found. Strongly weathered breccia and phonolite are seriously affected by weathering and structure, but the foundation bearing capacity is high and the soil quality is uniform in most areas. Therefore, the foundation stability is better.

Comprehensive analysis shows that the stability of this area is poor, the site stability is average, and the foundation stability is good. The construction of this project can be carried out under the condition that effective anti-seismic measures are taken to ensure the structural safety of the building (structure).

3.3.6 Adverse geological effects

There are no adverse geological phenomena such as landslides, debris flows, and goafs at the proposed site, and the existing adverse geological effects are mainly active faults. The faults in the near field area are mainly part of the faults in Kenya on the East Branch of the East African Rift Valley. This fault is a group of faults in the north-south direction, consisting of multiple faults. It is still active today and is a Holocene active fault. Among them, the Kikuyu fault and Limuru fault are small faults, about 22km away from the field area, and the Kedong fault is a large fault, about 42km away from the field area. According to Section 5.8.3 of the "Code for Geotechnical Engineering Investigation" (GB50021-2001) (2009 edition), the active fracture level in the near field area is I. According to Article 4.1.7 of the "Code for Seismic Design of Buildings" (GB 50011-2010) (2016 Edition), the distance between the site and the fracture is much greater than 100m, which complies with the avoidance distance.

3.3.7 Conclusions and suggestions

(a) Conclusion

1) The landform area of the site is a hilly landform unit with high terrain and large terrain undulations. The terrain of the site is high in the north and low in the south, with the ground elevation ranging from 1699.90m to 1702.40m, and a relative height difference of 2.50m. There are two small faults, the Kikuyu fault and the Limuru fault, about 22km away in the near field area, and the Kedong fault, which is the eastern branch of the East African Great Fault, about 42km away. They are both Holocene active faults. Affected by the east branch fault zone of the East African Rift Valley, the tectonic and seismic activities in the site are strong, seismic activity is frequent along the fault zone, there are many low-magnitude earthquakes, and most of them are shallow earthquakes. The stability of this area is poor, the site stability is average, and the foundation stability is good. The construction of this project can be carried out under the condition that effective anti-seismic measures are taken to ensure the structural safety of the building (structure).

2) The shallow soil exposed within the exploration depth range is Quaternary Holocene (Q4el) clay, with Tertiary System (N) breccia and shale on the underlying bedrock. The proposed building has an uneven foundation.

3) Qualitative prediction of the foundation deformation of the proposed building is mainly controlled by the tilt value and average settlement. Qualitative analysis shows that the tilt value and average settlement amount are within the allowable range of the specification. The proposed building needs to conduct settlement observations during construction and use until the settlement is relatively stable.

4) No buried rivers, ditches, tombs, air-raid shelters or other buried objects that would be detrimental to the project were found at the actual survey sites. The unfavorable geological effects of the site are mainly active faults, and the distance between the site and the faults is much greater than 100m, which is consistent with the avoidance distance.

5) Exploration of groundwater within the depth range. It is mainly weathered fissure water and bedrock fissure water existing in strongly weathered breccia fissures. According to the water quality analysis results, the total salinity of groundwater is 0.126g/L, which is classified as fresh water according to the salinity degree, and the water chemical type is Cl-Na type.

6) The ground measured in the borehole during the survey. The initial water level is 1.75-8.10m deep and the elevation is 1687.30-1696.02m; the stable water level is 1.45-7.70m deep and the elevation is 1687.60-1696.62m. site. The seasonal changes in groundwater level and water volume are obvious. In the rainy season, when there is abundant rainfall, the water level is higher and the water volume is larger. In the dry season, the water level

drops rapidly, and the water volume is very small or even exhausted. The water level varies greatly year by year. It is recommended that the average annual water level variation range of the proposed site be considered to be 1.0 to 4.0m. The site has no sources of pollution to groundwater and surface water.

7) The site environment type is Category II; the groundwater on the site is slightly corrosive to the concrete structure, and is slightly corrosive to the steel bars in the reinforced concrete structure when it is immersed in water for a long time and when dry and wet alternately; the groundwater level is shallow soil and is slightly corrosive to the concrete and reinforced concrete structures. All steel bars are slightly corrosive.

8) The geotechnical engineering survey grade of the proposed apartment in this survey can be classified as Class B; the seismic fortification category of the building in this project can be classified as standard fortification category, that is, Category C; the foundation design grade of the proposed building in this project is Class B; The design grade of the pile foundation of the proposed building is Grade B. The seismic fortification intensity of the site is 7 degrees, the basic design earthquake acceleration value is 0.10g ~ 0.15g, the soil type of the site is medium hard soil, the building site category is Category I1, and it is a general earthquake-resistant area for buildings.

(b) Recommendations

1) It is recommended that the proposed apartment use natural foundation or pile foundation. If a natural foundation is used, choose the ② layer of strongly weathered breccia as the basic bearing layer, and use Raft foundation or box foundation; If a pile foundation is used, select layers of weathered phonolite as the pile end bearing layer.

2) If a pile foundation is used, the type of pile foundation can be rotary bored bored piles.

3) The anti-floating waterproof level during site construction and the burial depth of the anti-floating waterproof level during use shall be 1.00m below the outdoor floor after completion of construction in different areas. The rainy season water level variation should be considered during design. Experts may also be organized to determine the anti-floating design water level. Get the value for joint review.

4) The safety level of the foundation pit support structure is Level 2. It is recommended to adopt grading in sections or regions according to the distance between the side walls of the foundation pit and the surrounding buildings (structures) and the degree of influence. The grading should be combined with hanging Mesh concrete (soil) and shotcrete (rock) surface protection, the ground around the foundation pit should be protected by mortar and other ground protection measures to prevent rainwater from penetrating. Heavy-duty vehicles, stacking or loading are not allowed to be driven within the range that affects the

stability of the slope. Standing water. The specific support plan is determined by the professional design unit (personnel).

5) It is recommended to avoid the rainy season for foundation pit excavation, and use drainage ditches combined with water collection wells to drain water from the foundation pit. If there are locations with abundant groundwater in the broken bedrock zone, tube wells should be used for dewatering.

6) It is recommended to determine various construction parameters of bored piles through test piles. Pile foundation construction should be carried out in strict accordance with the requirements of specifications and procedures. After digging to the design elevation, the soil on the protective wall and the residual ballast and water at the bottom of the hole should be removed. The concealed project acceptance should be carried out. After the acceptance is passed, the bottom sealing and pile pouring should be carried out immediately. body concrete.

7) During foundation pit construction, the internal force, deformation, overall and side wall stability of the retaining structure, the horizontal and vertical displacement of the soil inside and outside the foundation pit and adjacent underground pipelines, the settlement and cracks of adjacent buildings, and the unloading of the foundation pit should be dealt with Rebound observation, changes in groundwater level and pore water pressure within the scope of foundation pit excavation, and monitoring of whether leakage, water leakage, piping, erosion and other phenomena occur.

8) It is recommended to carry out special design of foundation pit and foundation pit support design plan, and a joint review of experts should be organized to demonstrate the feasibility of the plan.

9) Test piles should be carried out before pile foundation construction. The vertical ultimate bearing capacity of a single pile should be based on the static load test. The characteristic value of the single pile bearing capacity should be half of the standard value of the single pile ultimate bearing capacity. The number of test piles should meet the specification requirements. . After the construction of engineering piles is completed, relevant inspections should be carried out according to specifications and design requirements.

10) After excavation of the foundation pit, please notify our hospital in time to inspect the trench.

3.4 Ecological resources

3.4.1 Flora

Although the area is a built up environment, the original vegetation was mainly grassland with woody layers. The project site currently has an existing building. The development will not

unduly interfere with the general ecology of the area. Though the proposed project site is has minimal planted vegetation.

3.4.2 Fauna

There are no animals in the environs except may be birds, insects, and small rodents. Therefore there is no fauna threatened by the proposed project.

3.4.3 Sensitive ecosystems or places of cultural importance

The proposed site has no sensitive ecosystem, however, the operations of the project may affect the neighborhood residents. There are no places of cultural importance in the environs.

3.5 Physical infrastructure

3.5.1 Roads

The project area is served by Westlands Road. The figure below shows the Northwest Direction of the Westlands Road with a clear entry point to the proposed site

Figure 6: Site access

3.5.2 Foul water

The area is served by Nairobi Water and Sanitation Company sewer line,as shown in the figure below;

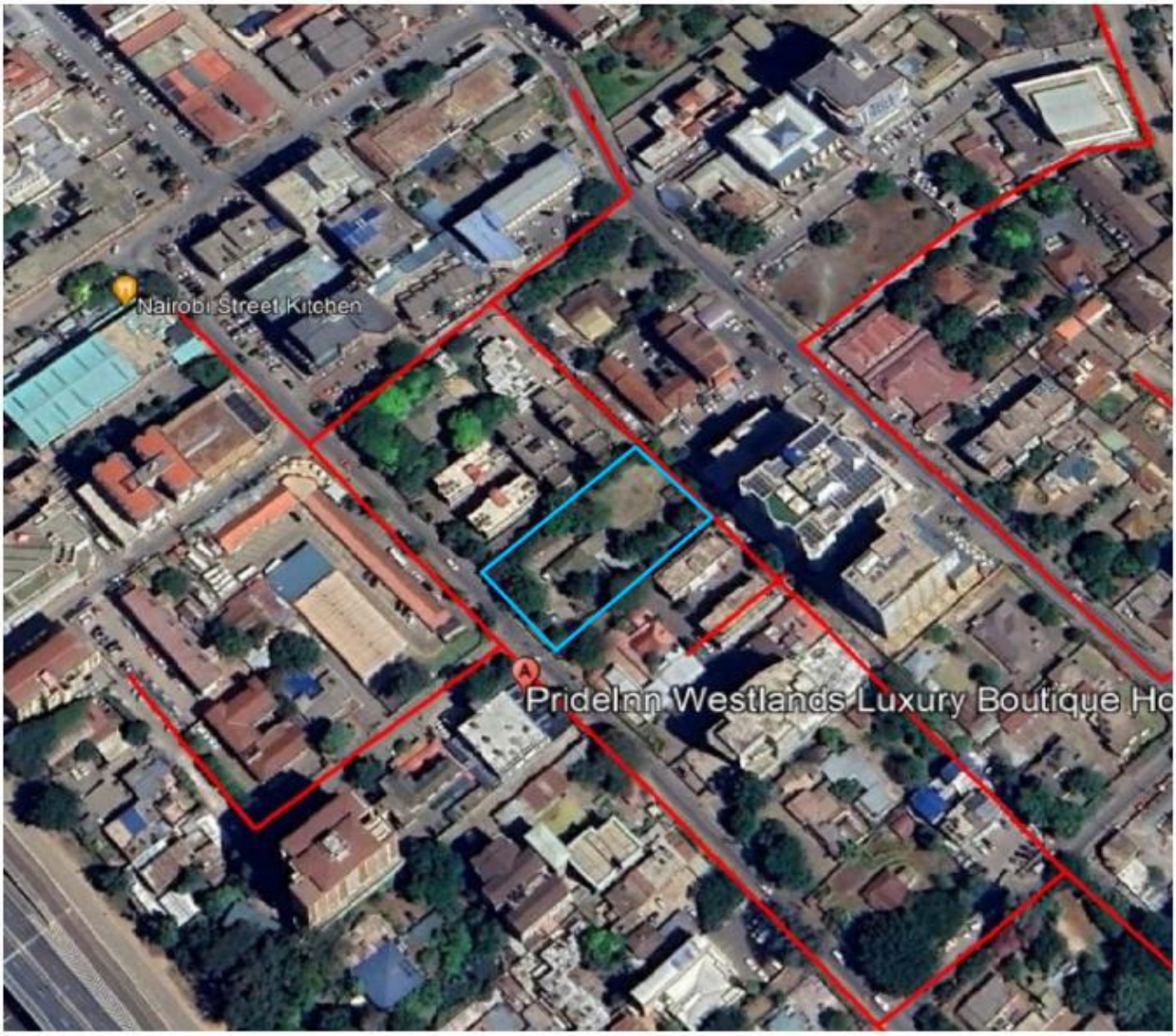


Figure 7: Layout showing layout of sewer network

3.5.3 Water supply

The plot is served by piped water supply from Nairobi Water and Sewerage Company. The borehole will be used for domestic water supply for the apartments to supplement the supply from Nairobi Water & Sewerage Company which is insufficient.

CHAPTER FOUR: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1 Introduction

There is a growing concern in Kenya and at global level that many forms of development activities cause damage to the environment. Development activities have the potential to damage the natural resources upon which the economies are based. A major national challenge today is how to maintain sustainable development without damaging the environment. The Environmental Impact Assessment is a useful tool for protection of the environment from the negative effects of developmental activities.

It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. It is a condition of the Kenya Government to conduct Environmental Impact Assessment on the development Projects. According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations 2003 (Legal No. 101), new projects require an Environmental Impact Assessment project report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual Licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

4.2 Environmental policy Framework

Environmental Impact Assessment (EIA) is a methodology used to identify the actual and probable impacts of the projects and program on the environment and to recommend alternatives and mitigating measures. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of Environmental Management and Coordination Act (EMCA) of 1999. The EIA Regulations must be administered, taking into cognizance provisions of EMCA 1999 and other relevant national laws. The intention is to approve and license only those projects that take into consideration all aspects of concern to the public as they impact on health and the quality of the environment.

4.3 Institutional framework

Environmental Impact Assessment Study is regulated through a number of institutions that are established through laws and policies. The Institutions that are relevant for the proposed project are described below;

Institution	Responsibilities
National Environment Management Authority	✧ General supervision and, co-ordination of all matters relating to the environment. ✧ NEMA is the principal instrument in Government in the implementation of all policies relating to the environment. ✧ NEMA is also responsible for monitoring compliance with all the environmental regulations.
National Environmental Complaints Committee (NECC)	The NECC'S mission is to facilitate access to environmental justice to the public by providing a forum for environmental conflict resolution and contributing to environmental policy. The Committee performs the following functions ✧ Investigate complaints or allegations regarding the condition of the environment in Kenya and suspected cases of environmental degradation. ✧ The NECC also undertakes public interest litigation on behalf of the citizens in environmental matters.
County Environment Committee	The Committee is responsible for proper management of environment within the County and is tasked with developing action plans
National Environmental Tribunal	This tribunal guides the handling of cases related to environmental offenses in the Republic of Kenya. The Tribunal hears appeals against the decisions of the Authority. Any person who feels aggrieved may challenge the tribunal in the High Court.
Department of Occupational Health and Safety	Monitor the implementation of health and safety plans for construction workers and members of public coming into contact with construction activities. The Directorate enforces Occupational Safety and Health Act, 2007 (OSHA, 2007) with its subsidiary legislation which aims at prevention of accidents and diseases at work. It also administers the Work Injury Benefits Act, 2007 (WIBA, 2007) which provides for compensation of workers who have been injured or have suffered a disease out of and in the course of employment.
County Government of Nairobi	✧ Monitor developments within the County. ✧ Ensure adherence to the development control policies

	during the implementation of the project and issue relevant permits and licenses.
Ministry of Health	Surveillance of public health with respect to workers and affected communities, especially in regard to HIV/AIDS and other communicable diseases.
National Construction Authority	The National Construction Authority (NCA) is a government organization which regulates, streamlines and builds capacity in the construction industry.

4.4 Environmental Legal Framework

Environmental Management and Co-ordination Act No. 8 of 1999, provide a legal and institutional framework for the management of the environmental related matters. It is the framework law on environment, which was enacted on the 14th of January 1999 and commenced in January 2002. Topmost in the administration of EMCA is National Environment Council (NEC), which formulates policies, set goals, and promotes environmental protection program. The implementing organ is National Environment Management Authority (NEMA). EMCA comprises of the parts covering all aspects of the environment.

Part VIII, section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 requires that operators of projects which discharge effluent or other pollutants submit to NEMA accurate information about the quantities and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewages system upon issuance of prescribed permit from the Local Authorities.

4.4.1 Environmental Management and Coordination Act (EMCA), 1999

Environmental Management and Co-ordination Act No. 8 of 1999, provides a legal and institutional framework for the management of the environmental related matters. It is the framework law on environment, which was enacted on the 14th of January 1999 and commenced in January 2002. Top most in the administration of EMCA is National Environment Council (NEC), which formulates policies, set goals, and promotes environmental protection program.

The implementing organ is National Environment Management Authority (NEMA). EMCA comprises of the parts covering all aspects of the environment. The Second Schedule of the Act specifies the projects for which an EIA and environmental audit must be carried out. According to the Act, Section 68, all projects listed in the Second Schedule of the Act must

undertake an Environmental Impact Assessment, keep accurate records and make annual reports to NEMA or as NEMA may, in writing, require.

The main objectives of the Act are to:

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

4.4.2 The Environmental (Impact Assessment and Audit) Regulations, 2003

The Environmental (Impact Assessment and Audit) Regulations, 2003, provide the basis for procedures for carrying out Environmental Impact Assessments (EIAs) and Environmental Audits (EAs). It states in Regulation 3 that "the Regulations shall apply to all policies, plans, program, projects and activities specified in Part IV, Part V and the Second Schedule of the Act". Regulation 4(1) further states that:

"No proponent shall implement a project:

a) likely to have a negative environmental impact; or
b) for which an environmental impact assessment is required under the Act or these Regulations; unless an environmental impact assessment has been concluded and approved in accordance with these Regulations"

Compliance

- **The Proponent has commissioned the carrying out of an Environmental Impact Assessment for submission to NEMA for approval.**
- **The Proponent undertakes to protect the environment during the implementation (Construction and Operation) of the project and also carry out annual Environmental Audits.**

4.4.3 Waste Management Regulations, 2006

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

Compliance

- **The proponent has undertaken to ensure that all waste generated is collected and handled appropriately and disposed of at a designated waste disposal site**

4.4.4 Noise and Excessive Vibrations

Part II of the Noise and Excessive Vibrations regulations, regulation 3 (1) states that Except as otherwise provided in these Regulations, 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.

Regulation 4 of the Noise and Excessive vibrations: - states that except as otherwise provided in the Regulations, no person shall-

a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or
b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source; Regulation 11 on Machinery: - states that any person wishing to operate or repair any machinery, motor vehicle, construction equipment or other equipment, pump, fan, air-conditioning apparatus or similar mechanical device; or
c) engage in any commercial or industrial activity, which is likely to emit noise or excessive vibrations. Proponents shall carry out the activity or activities within the relevant levels prescribed in the First Schedule to the Regulations as shown in the **Table 5** below:

Table 4: Sound levels

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

Compliance

- **The project contractor shall undertake to ensure that all noise and vibration will be kept below the maximum allowable threshold.**

4.4.5 Water Quality Regulations, 2006

Part II of the Water Quality Regulations 4 (1) states that every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act. Regulation 4 (2) further states no person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. Regulation 6 (b) further states that no person shall abstract ground water or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an Environmental Impact Assessment license issued in accordance with the provisions of the Act; or (c) cultivate or undertake any development activity within a minimum of six meters and a maximum of thirty meters from the highest ever recorded flood level, on either side of a river or stream, and as may be determined by the Authority from time to time.

Compliance

- **The Proponent undertakes to safeguard the underground water sources ensuring that no solid waste or waste water effluent emanating from the proposed project is discharged haphazardly.**

4.4.6 The Occupational Safety and Health Act, 2007

This is an Act of Parliament to make provision for health, safety and welfare of persons employed in factories and other places, and for matters incidental thereto and connected therewith.

4.4.6.1 Building Operations and Works of Engineering Constructions

The provisions of the Factories and Other Places of Work Act relevant to engineering construction works are contained in the Abstract of the Act for Building Operations, and Works of Engineering Construction Rules. These are summarized in Table 6 below.

Table 5: Summary of Building Operations, and Works of Engineering Construction Rules

Legal Requirements	Description
General Requirements	
Give notice of particular operations or works	Notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction and building works except where the construction works will be complete in less than six weeks or notice had already been given to the Occupational Health and

	Safety Officer (Section 60 of the Act).
General Register	A general register of every person undertaking building operations or construction works is kept in adherence to the prescribed form L.D.B.C.R.2. This register is kept at the site of operations or at the office of the person undertaking the operations or works. The register should contain: • The certificate of registration of the workplace; • Every other certificate issued by the Chief Inspector under this Act; • The prescribed particulars as to the finishing (washing, white washing, color washing, painting or varnishing) of the facility; • The prescribed particulars as to every accident and case of occupational disease occurring in the workplace of which a notice is required to be sent to a labor officer under the provisions of any law for the time being in force; • All reports and particulars required by any other provision of this Act to be entered in or attached to the general register; • Such other matters as may be prescribed (Section 62 of the Factories and Other Places of Work Act).
Special rules and welfare	Printed copies or prescribed abstracts of the Factories and Other Places of Work Act must be kept posted at the site of operations or works (Section 61 of the Factories and Other Places of Work Act).
Safety Requirements	
Air receivers	These should be of sound construction and be properly maintained. They should be thoroughly examined by a competent person at intervals of 24 months and the reports of such examinations attached to the General Register (Section 39 of the Factories and other Places of Work Act).
Cylinders for compressed, liquefied and dissolved gases	Such cylinders should be of good construction, sound material, and adequate strength and free from patent defect. The cylinders should conform to

	standards specified under the Standards Act or to a prescribed standard specification, approved in writing, by the Director, Kenya Bureau of Standards. They should be thoroughly examined by a competent person at regular intervals and a maintenance register kept (Section 39A of the amendment of the Factories and Other Places of Work Act).
Notification of accidents	The particulars of an accident-causing death or disablement of a worker for more than three days from earning full wages at the work place where he was employed must be sent in the prescribed form (L.D.B.C.R 6) to the Occupational Health and Safety Officer and entered in the General Register. Certain dangerous occurrences must also be reported whether or not they cause disablement (Section 62 of the Factories and Other Places of Work Act).
Health Requirements	
Sanitary accommodation	Sufficient and suitable sanitary conveniences must be available for persons employed. These must be kept clean and well lit (Sections 16 and 18 of the Factories and Other Places of Work Act).
Miscellaneous Requirements	
Prohibition of deduction from wages	The occupier must not make a deduction from wages in respect of anything he has to do or provide in pursuance of the Factories Act or permit any person in his employment to receive payment from other employees for such services (Section 66 of the Factories and Other Places of Work Act).
Duties of persons employed	An employee must not willfully interfere with or misuse any means, appliance, convenience or other thing provided in pursuance of the Act for securing health, safety or welfare provided for his use under the Act. He must not willfully and without reasonable cause do anything likely to endanger himself or others (Section 65 of the Factories and Other Places of Work Act).

Inspection	The Occupational Health and Safety Officer has the power to inspect every part of the premises by day or by night. He may require the production of registers, certificates and other papers. May examine any person alone or in the presence of any other person as he thinks fit and may require him to sign a declaration of truth of the matters about which he is examined. Every person obstructing an Occupational Health and Safety Officer is liable to a penalty (Section 69 of the Factories and Other Places of Work Act).

4.4.6.2 Medical Examination Rules

These are described in Legal Notice No. 24 of the Kenya Gazette Supplement No. 22 of April 2005. The Medical Examination Rules apply to all those employees in employment or who have been in employment in every workplace to which the provisions of the Factories and Other Places of Work Act (Cap 514) apply. The Rules describe the following:

- Occupations requiring medical examination;
- Duties of employer and employees with regard to medical examination;
- Reports on examination;
- Certificate of redeployment;
- Certificate of fitness;
- Notification of occupational diseases; and
- Offences and penalties.

4.4.7 Public Health Act (Cap. 242)

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drainers or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Any noxious matter or waste water flowing or discharged from any premises into the public street or into the gutter or side channel or watercourse, irrigation channel, or bed not approved for discharge is also deemed as nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbor rats or other vermin.

Compliance

- **The Proponent undertakes to safeguard the environment ensuring that all solid waste or waste water effluent emanating from the proposed project is discharged appropriately.**

4.4.8 Physical and Land Use Planning Act, 2019

The County Governments are empowered to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

The Act states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective Local Authority.

Finally, the Act states that if connection with a development application, County Governments is of the opinion that the proposed development activity will have injurious impact on the environment, the application shall be required to submit together with the application an environment impact assessment EIA report. EMCA, 1999 echoes the same by requiring that such an EIA is approved by the NEMA and should be followed by annual environmental audits.

Compliance

- **The Proponent has obtained and shall apply for any other required approvals of the project development and licenses from all relevant County Governments.**

4.4.9 Licenses and permits

Ideally, the Proponent should demonstrate compliance to the legislation through acquiring of the appropriate licenses and permits. Further all contractors and consultants who will be engaged during the planning and design, construction, operation and maintenance and decommissioning should demonstrate compliance with the necessary pieces of legislation. Those who will be involved should therefore provide the Proponent with all legal documents that shows that they are legally in the business or services that they intend to deliver to the Proponent. These includes: NEMA registration certificates and licenses, trade licenses, etc.

Compliance

- **The Proponent shall apply for any other required approvals of the project development and licenses from all relevant County Governments.**

CHAPTER FIVE: PUBLIC PARTICIPATION

5.1 Introduction

One of the key information sources used during the Environmental impact assessment exercise was public participation. Views from the 'would be affected' people were sought from the public through: -

- The administration of pre-designed questionnaires in between Monday 15th - Friday 19th January 2024. These have been appended.
- Public participation at the project site, which was carried out on Friday 19th January 2024. The Minutes of the public participation forum have been annexed
- Direct interviews with stakeholders and members of the public

The exercise was conducted by an experienced registered environmental expert. The objective of the consultation and public participation was to:-

- Disseminate and inform the stakeholders about the project with special reference to its key components and location
- Gather comments, suggestions and concerns of the interested and affected parties
- Propose solutions and mitigation measures to the various concerns
- Incorporate the information collected in the EIA study

In addition, the Environmental Impact Assessment public consultation exercise enabled: -

a) The establishment of a communication channel between the general public and the Lead Expert, the project proponents and the Government.
b) the concerns of the stakeholders to be known to the decision-making bodies at an early phase of project development

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned.

5.2 Issues raised

5.2.1 Air pollution

Air pollution was noted as a possible cause of concern. Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site by use of heavy vehicles and machinery/equipment at the construction site. These emissions can have significant respiratory and cardio-pulmonary effects on the local population and thus adequate mitigation measures should be implemented.

5.2.2 Noise pollution

Noise pollution was cited as a possible cause of concern. Although the level of discomfort caused by noise is subjective and relies mainly on the distance between the noise source and

recipients, the real impact of noise on the area's residents will depend on the nature of equipment used and the timing of their use. Even then, it is possible to avoid excessive noise through implementation of appropriate noise abatement measures during construction.

5.2.3 Strain the existing facilities

The facilities cited are the existing sewerline and the westlands roads. It was noted that they were designed to accommodate the smaller population. The straining, according to the residents, might occasion cloaking and blockages for the sewer network and heavy traffic congestion.

5.2.4 Public health concerns

It was observed that the facility neigbours sensitive facilities like pride inn hotel, as such there was a possibility for construction workers to access the hotel for sanitary convenience. Additionally, the hotel maintains a high level of hygiene and it was their desire that the same is considered for it to maintain its class.

It was therefore suggested that the developer should provide adequate sanitary facilities for the construction workers on the site.

It was further suggested that the contractor should ensure that high level of hygiene is maintained

Table 6: List of Neighbours Consulted

Name	Organization	Distance to site (Meters)	Summary of the Comments	Tel No.
1. Mr. Rodney	Rainbow Tower Management Ltd (Mgt)	20	✧ He does not anticipate any negative impact from the proposed development. ✧ The development shall add value to the business in the area	0714751351
2. Margret Njoki	Faith Case	100	✧ He does not anticipate any negative impact from the proposed development. ✧ The development shall add value to the business in the area	0720221195
3. Muthoni Mwaniki	Tintora B	100	✧ He anticipates proposed development shall occasion noise pollution; solid waste ✧ Suggested putting in place measures to reduce noise pollution and solid waste management	0721516364
4. Wilson Kerry	Parklands Plaza Ltd	50	✧ He observed that overtime, the environment has been degraded by urbanization. ✧ Suggested the restoration of the any damage that will arise from the proposed development.	0702900733
5. Earnest Muilista	Carpenter	100	✧ He does not anticipate any adverse environmental impacts. He observed that the business will occasion business opportunities to the neighbourhood	0798188820
6. Lazarus Kangere	Self employed	100	✧ He observed that the main issues of congestion had been considered and such measures to be implemented during implementation of the project.	0715342432
7. George Khamisi	Elder	300	✧ He noted that there are likely to be dust being emanated from the proposed project.	0775819237
8. John Kingori			✧ He anticipates the project to create employment opportunities	0727746426
9. Maureen	Primp and Coddle	200	✧ She anticipates traffic and noise	0706547150

Njoki	Beauty Bar		pollution. She noted suggested that construction activities should be carried out during the day	
10. Kerubo Ondieki	Orbit house	1000	✧ He anticipates noise and dust and suggested sprinkling water on the surface to contain fugitive dusts.	0787041069
11. Rachel Maithya	GTC	500	✧ She observed the impacts to be noise and traffic congestion. ✧ As part of the mitigation measures, the Traffic management plan should be implemented	0716093355
12. Aswani Aseka	NIT	100	✧ He does not anticipated any adverse negative environmental impacts	0772113360
13. Pride Inn Restaurat		Adjacent	✧ He observed likelihood of noise pollution from excavation and construction and suggested the need for put in place measures to reduce to curb the npise pollution and fugitive dusts	
14. Muli Thomas	Business operator	50	✧ Observed that the development shall lead into more customer base	0783105219
15. Raju Limbani	Businessman/Resident	200	✧ Observed the development shall result into the strain on utilities including electricity, water, sewer; invasion of privacy, cutting down trees and noise pollution ✧ Urged the developer to ensure construction activities are carried out between 7:00 a.m - 5:00 p.m	
16. Ken	Westlands Banquet Center	Adjacent	✧ He noted that the development shall occasion dust and noise pollution as well as strain the existing infrastructure	0704274939
17. Koyo Owino	Resident	200	✧ Observed that the proposed development shall block natural light and invasion of privacy ✧ Suggested that the construction activities be restricted to 7:00 a.m to 5:00 p.m	0722289627
18. Bernard Alusa		200	✧ Noted that the likely impact shall include road blockage by heavy	0724144911

			trucks and the dust that are being generated from construction activities	
19. Dennis	Mabati Rolling Mills (MRM)	50	✧ He noted that the proposed development shall provide employment to the locals and accord them opportunities to be closer to respective work places	0768558521
20. Joseph Maina	Regent Management Limited	500	✧ Suggested the need to address the sewerage disposal and traffic congestion	0729038776
21. Zipporah Waweru	MESPT	Adjacent	✧ Observed that the existing infrastructure shall be strained by the existing development ✧ Suggested the need for the developer to upgrade the existing infrastructure	0735333154
22. Augustine Juma	GTC	500	✧ Observed that the development shall occasion increased human traffic and waste generation. ✧ Suggested the need to minimize dust emission through watering of construction sites and traffic vehicular movement ✧ He also observed that the development shall that the development shall improve the economy of the neighbourhood through among others, employment opportunities	0724547916
23. Leonard Wambua	Hydroway limited	Adjacent	✧ Observed that the development shall generate dust and noise which will affect the tenants ✧ Proposed the that the noise to be contained during the project implementation	0710196003
24. Peter	Verity Management Limited	100	✧ Observed that the development shall create employment opportunities for the area	0708377390

Figure 8: Photos of public participation forum held on Friday 19-01-2024

CHAPTER SIX: ASSESSMENT OF ENVIRONMENTAL IMPACTS

6.1 Introduction

This Section identifies and discusses both positive and negative impacts associated with the proposed project. Onsite and off-site impacts can occur due to project location and during the construction and operation phases of the proposed Project. On-site impacts result from project siting and from the construction activities carried out within the construction site. The impacts of off-site work results from activities carried out outside the construction site, yet directly related to the proposed project. Assessment of impacts depends on the nature and magnitude of the activity being undertaken and also on the type of pollution control measures that are envisaged as part of the project proposal. The potential impacts from the proposed Project area are identified and assessed based on the nature, magnitude and merits/or demerits of the various activities associated with the Project.

This Chapter therefore describes the anticipated positive and negative impacts of the proposed project due to project location and during construction, operation and decommissioning phases.

6.2 Negative impacts during construction phase

The following negative impacts are associated with the construction of the proposed project.

6.2.1 Traffic congestion and possible accidents

The proposed development is located in along Westlands Road. The Traffic Impact Assessment Study estimated that the site will generate a total of 150 equivalent car units two-way in the AM and PM peak hours. The distribution of the traffic generated by the proposed expansion is expected to be in similar ratios to the distribution of the existing peak hour traffic travelling along all the roads and through all the intersections that are being analysed in this assessment.

On the impact on existing pedestrians, the additional traffic that will be generated by the proposed apartments will have a minimal impact on the existing space available for pedestrians. There is currently no major conflict between pedestrians and vehicles within the study area and this is unlikely to change. The additional traffic volumes will not result in any conflict. There will be negligible pedestrians generated by the proposed site on the external road network. The unskilled workers will be provided with dedicated arranged transport.

6.2.2 Noise pollution and vibration

Significant increases in noise and vibration levels may be expected during construction of the proposed project. Such noise and vibrations may be generated from excavators, loaders; concrete mixer trucks; concrete pumps; concrete vibrators; dump trucks; hammering; vibrators; compactors, diesel generators (DGs); water pumps and construction workers.

Though the level of discomfort caused by noise and vibrations is subjective, the most commonly reported impacts of increased noise levels are interference in oral communication, hearing loss, anxiety and disturbance of sleep. Noise and vibrations may also have an impact

on the workers in the proposed project. Nonetheless, all the noise and vibrations generating activities shall be undertaken during day hours and appropriate measures shall be instituted to counter the said pollution.

6.2.3 Construction Waste

Construction activities create solid wastes that need to be disposed. Such waste include: Sand, Concrete, Oil, Grease, Gravel, Stones, Bricks, Plastic, Paper, Wood, Metals, Glass, and Cleared biomass among others. These wastes may have a direct impact on the community. Disposal of the same solid wastes offsite could also be a social inconvenience if done in wrong places. The off-site effects could be un-aesthetic view, pest breeding, unhygienic condition, choking of nearby drains and pollution of physical environment. The severity of such impacts will depend upon the magnitude and type of construction waste.

6.2.4 Impact on air quality (generation of exhaust and dust emissions)

Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Fugitive dust (depending on the timing of construction) and vehicular emissions are the major components of air pollution. The following construction related activities are generally associated with these emissions:

- Site clearance, excavation and use of heavy vehicles and machinery/equipment at construction site;
- Procurement and transport of construction materials such as sand, cement, steel, masonry stone to the construction site; and
- Operating of construction machinery and equipment.

During the period of maximum construction activity, the fuel consumption is expected to rise significantly and the background concentrations of suspended particulate matter (SPM), respirable particulate matter (RPM), sulphur dioxide (SO2), nitrogen dioxide (NO2) and both carbon monoxide (CO) and lead (Pb) are also expected to rise. These emissions if not appropriately mitigated can have significant respiratory and cardio-pulmonary effects on the local population, the health effects may range from subtle biochemical and physiological changes to difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac conditions. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, activities associated with site clearance, excavations, spreading of the topsoil during construction, frequent and fast vehicle movement in the loading and offloading areas. Because large quantities of building materials are required, some of which are sourced outside Nairobi, such emissions can be enormous and may affect a wider geographical area.

It is however expected that dust and exhaust gas emissions from construction machines will be temporary. On completion of construction, the adverse impacts of SPM, RPM and engine emissions on ambient air close to the construction site will be eliminated.

6.2.5 Soil erosion and water logging

Soil erosion is likely to occur during construction at the construction site once exposed by excavation works especially during rainy and windy seasons due to the slope gradient of the

proposed project plot. Considering the land clearing, excavation and other construction processes, soil will be exposed to erosion agents leading to water logging of the proposed site that may also occur in the event of heavy rainfall hence, the need to provide cut off trenches/storm water drains channeling the water.

6.2.6 Extraction and use of building materials

Building materials such as hard core, ballast, cement, rough stone and sand required for the construction of the proposed project will be obtained from quarries, sand harvesters and forests. Since substantial quantities of these materials will be required for construction of the proposed project, the availability and sustainability of such resources at the extraction sites will be negatively affected-as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

6.2.7 Increased water demand

During the construction phase, both the construction workers and the construction works will create additional demand for water in addition to the existing demand. Water will mostly be used in the creation of concrete for construction works and for wetting surfaces or cleaning completed structures. It will also be used by the construction workers for washing and drinking.

6.2.8 Energy consumption

The proposed project will consume fossil fuels for construction machines (mainly concrete mixers, heavy and light trucks; concrete pumps; concrete vibrators; dump trucks; compactors, diesel generators (DGs); water pumps) to run. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. The proposed project will also use electricity supplied by Kenya Power and Lighting Company (KPLC) Ltd. Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources. In this regard, there will be need to use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability.

6.2.9 Workers accidents and public safety

In any civil works, public as well as construction staff safety risks can arise from various construction activities such as:-

- Deep excavations;
- Operation and movement of heavy equipment and vehicles;
- Injuries from accidental falling objects; and
- Injuries from hand tools.

Because of the non-complexity of the construction of such premises, such activities will be controlled and consequently the associated risks will be minimal. Proper supervision, high workmanship performance, and provision of adequate safety measures will suppress the likelihood of such impacts on public and occupational safety.

6.2.10 Public health concerns

The construction workers will generate faecal waste during their day-to-day operations. The generated waste needs proper handling to prevent contamination with water and other environmental parameters hence which may otherwise cause diseases, such cholera, diarrhoea, typhoid and dysentery.

Furthermore, construction activities usually involve people from different regions, with different backgrounds, whereby they interact on daily basis. If these workers are not properly educated on HIV/AIDS, their health will be at risk. Provisions of such contraceptives by a licensed institution and frequent training on prevention methods will reduce the risks that the workers will be exposed to.

6.2.11 Surface and ground water hydrology and water quality degradation

Changes in surface hydrology alter the flow of water through the landscape. Construction of impervious surfaces such as parking lots, roads and buildings increase the volume and rate of runoff, resulting in habitat destruction, increased pollutant loads, and flooding. Built or paved areas and changes in the shape of the land also influence groundwater hydrology (i.e. recharge rates, flow, conditions).

Project related excavation could lead to surface and ground water quality degradation. Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface waters. The excavated area, if linear could act as a conduit to extend groundwater contamination to new areas. Spills of hazardous materials in excavated areas during construction could introduce contaminants to ground water.

Development activities such as office construction as well as the spillover effects of development such as increased demand for drinking water and increased water use can impact water quality by contributing sediment, nutrients, and other pollutants to limit water supplies, increasing the temperature of the water, and increasing the rate and volume of runoff.

6.3 Positive impacts during construction phase

A number of positive impacts are associated with the proposed project during construction phase. These are as discussed below:

6.3.1 Employment opportunities

The construction of the proposed project is expected to provide direct and indirect employment to a number of workers. However, the exact number cannot be predetermined at this stage. These range from unskilled casual workers, semi-skilled and formal employees.

6.3.2 Provision of market for supply of building materials

The proposed project will require supply of large quantities of building materials most of which will be sourced locally in the surrounding areas. Producers and suppliers of construction materials will thus get a ready market for their merchandise.

6.3.3 Improving growth of the economy

Through the use of locally available materials during the construction phase of the project including cement, concrete and ceramic tiles, timber, sand, ballast electrical cables etc, the project will contribute towards growth of the economy by contributing to the gross domestic product. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of these raw materials will be payable directly to the producers.

6.3.4 Informal sectors benefits

There are usually several informal businesses which come up during the construction periods of such projects. These include activities such as food vending who benefit directly from the construction staff members who buy food and other commodities from them. This will promote the informal sector in securing some temporary revenue and hence livelihood.

6.4 Negative impacts during operation phase

The following negative impacts are associated with the proposed project during its operation phase:

6.4.1 Solid waste generation

During the operation phase, no major solid waste associated adverse impacts on the environment are envisaged. However, possible sources of pollution include various composite solid waste from the domestic uses, grounds managements and obsolete or damaged equipment. In all, the impacts are expected to be minor but their impact maybe significant in the absence of a proper waste management plan which may have adverse environmental and human health effects.

6.4.2 Electricity consumption

During operation, the residents will use a lot of electrical energy mainly for domestic purposes including lighting, cooking, running of air conditioning equipment, running of refrigeration systems, pumping water into reservoirs etc. Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.

6.4.3 Increased storm water flow

The building roofs and pavements will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the proposed development. This will lead to increased amounts of storm water entering the stream through open storm water drains.

6.4.4 Compromised privacy to the neighbouring developments

With the towering heights of the proposed development's components, privacy for its close neighbors shall be highly compromised. Neighbors and occupants of Orbit Place, Pride Inn, Nairobi Institute of Technology, and other low rise residential developments be on the receiving end of this impact.

6.4.5 Increased Water use
Activities during the operation phase of the project will involve the use of large quantities of water as a result of activities that will take place and the large number of people that stay there. Water shall be used for daily normal household and general housekeeping functions.

6.4.6 Strain to existing services and facilities
With development of the office, hotel, apartment and parking spaces and related developments such as communal facilities clearly means that many people are expected to visit and reside on the site. This will increase the density of resident population in the area and if this population is not provided with the appropriate services and facilities then pressure on existing facilities is bound to increase.

6.5 Positive impacts during operation phase
Just as in the construction phase, there are positive impacts associated with the proposed project during operation phase. These positive impacts are discussed below.

6.5.1 Employment opportunities
Employment opportunities are one of the long-term major impacts of the proposed project. A number of people will be employed by the Proponent or Estate Management in different non-professional areas. These include: caretakers, cleaners, security personnel, gardeners, house helps among others.

6.5.2 Increase in revenue to national and local governments
The commissioning of the proposed project will result in positive gains for numerous authorities- Kenya Revenue Authority (KRA), KPLC and Nairobi City County through payment of relevant taxes, rates and fees to the respective institutions.

6.5.3 Induced physical infrastructure development
The operation of the proposed project may induce improvements in infrastructure around the facility e.g.:-
- Pavement of the access roads
- Safeguarding of the electricity lines

All these activities once implemented will benefit the surrounding community and not just the residents. Regular maintenance of roads, storm water drainage and power lines around the area and upgrading of infrastructure also support the case in point. However, it must be pointed out that these developments will require adequate co-operation from relevant authorities.

6.5.4 Optimal use of land
Change in land use from idle land to land on which a modern development will be constructed will optimize land use in the area

6.5.5 Provision of modern housing
The well-designed residential development to be built at the proposed project site will add to the existing residential character of the estate. This is in line with the vision of the existing

government which implies generally of the need to engage private developers in the provision of housing to the citizenry within a set time frame.

6.5.6 Improved land value

Land property prices around the project site once construction is complete is expected to increase. This is a great boom to the current land owners since it will increase the future land property prices.

6.5.7 Increased security

Security around the project site will be increased due to the introduction of streetlights and day and night security guards around the premises.

6.6 Negative impacts during decommissioning phase

The negative impacts discussed below are associated with the proposed project during decommissioning phase.

6.6.1 Noise and vibration

The demolition works will lead to significant deterioration of the acoustic environment within the proposed project site and the surrounding areas. This will be as a result of the noise and vibrations that will be experienced during demolition.

6.6.2 Solid waste generation

Demolition of the project buildings and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

6.6.3 Health and safety

Risk of accidents and ill health as a result of the demolition activities is likely to be experienced. This could be as a result of accidents involving construction equipment.

6.6.4 Air quality

Dust will be generated during demolition works of the proposed project from the demolition activities. This will mainly affect demolition workers. In addition, soil will be used in rehabilitation and re-instatement to pre-project status, this will add to the amount of dust that will be generated during rehabilitation. However, it will be minimal.

Exhaust emission will also be experienced during decommissioning from the trucks that will be transporting the demolished objects to the disposal sites and storage areas. Large quantities of dust will be generated during demolition works. This will affect both demolition staff as well as the neighbouring residents.

6.6.5 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

6.7 Positive impacts during decommissioning phase

In the event that the entire development or part of it is to be relocated, found to be economically unviable or condemned as structurally unstable. It can be abandoned and/or demolished. The following are positive impacts associated with decommissioning of the proposed Project.

6.7.1 Rehabilitation

Decommissioning will involve phasing out the envisaged operations of the facility. This may involve conversion of the facility to other uses or rehabilitation of the project site in line with the projected plans. This involves new landscaping schemes and demolition of some structures within the facility.

6.7.2 Employment opportunities

For demolition to take place properly and in good time, several people will be involved. As a result, large number of jobs will be created in various positions both in supervisory and non-supervisory positions.

CHAPTER SEVEN: IMPACTS MITIGATION AND MONITORING

7.1 Introduction

This Chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative Environmental Health and Safety impacts associated with the activities the proposed commercial development project during its construction, operation and decommissioning phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the Environmental Management Plan (EMP)

7.2 Mitigation of construction phase impacts

7.2.1 Minimization of Traffic congestion and possible accidents

The proponent has assigned qualified consultants to carry out Traffic Management Plan for the proposed project. The report observed as that the site will generate a total of 150 equivalent car units two-way in the AM and PM peak hours. The distribution of the traffic generated by the proposed expansion is expected to be in similar ratios to the distribution of the existing peak hour traffic travelling along all the roads and through all the intersections that are being analyzed in this assessment.

The addition of the Apartment traffic onto the road network does not trigger any road infrastructure upgrades, however the additional traffic generated by the expansion utilities a lot of the remaining capacity of the road infrastructure, hence, once fully operational, it is recommended that a Traffic Impact Assessment be conducted again with new traffic counts at the time. Therefore, no road infrastructure upgrades are required to accommodate the plant expansion traffic.

The above notwithstanding, the following measures are recommended to minimize traffic congestion and resultant accidents;

a) Develop a construction schedule which must be communicated to the relevant stakeholders including the local community members.

b) Develop a Traffic Management Plan covering the routes to be used by the Project vehicles, vehicle safety, speed limits on roads, driver and passenger behaviour, use of drugs and alcohol, hours of operation, rest periods and location of rest stops, and accident reporting and investigations.

c) Speed limits for construction vehicles (of less than 30 km/h) should be adhered to along the Westlands Road.

d) Undertake consultations with communities along key transport routes to inform them about the potential for increased traffic movements prior to any changes. Put up road signs such as "Heavy Trucks Turning Ahead" to warn Boda Bodas and other road users of danger/ risk of accidents occurrence ahead especially during the construction phase.

e) Prepare and implement an appropriate community Grievance Redress Mechanism (GRM). The GRM should be communicated to all the local community members.

7.2.2 Minimization of noise and vibration

The contractor of the proposed project shall put in place several measures that will mitigate noise and vibration pollution arising during the construction phase. The proponent shall ensure that he complies with all relevant requirements in the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 by: -

- Complying with maximum permissible noise levels for constructions sites as per Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009
- Apply for a License from NEMA whereby maximum permissible noise levels are to be exceeded
- In this regard the following noise-suppression techniques will be employed to minimize the impact of temporary construction noise at the Project site:

➢ All construction activities shall be carried out during the day between 08:00 hrs and 17:00 hrs
➢ All transportation of construction materials are to be conducted at traffic off peak hours only and on weekdays only to avoid making noise to residents during weekends and when they are back home on weekdays.
➢ All noisy machinery shall be shielded by portable barriers and located as far from existing sensitive receptors as possible.
➢ Priority shall be given to the use of equipment designed with noise control elements.
➢ Ensure use of well serviced and maintained vehicles and equipment to ensure smooth idling and maintenance.

7.2.3 Minimization of construction waste

Solid waste management during the construction phases of the project must adhere to the Environmental Management and Coordination (Waste Management) Regulations, 2006. It is recommended that construction waste be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed of. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects.

Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or homeowners. The Proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

Additional recommendations for minimization of solid waste during construction of the proposed project include:-

- Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time;
- Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements;
- Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste; and
- Use of construction materials containing recycled content when possible and in accordance with accepted standards.

7.2.4 Minimization of dust generation and emission

Controlling dust during construction is useful in minimizing nuisance conditions and consequently health (respiratory and eye) complications. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (Nitrogen oxides, Carbon dioxide, Sulphur oxides, and diesel related Particulate Matter (PM) that would occur in the exhaust from heavy equipment are also included. The proponent shall be committed to implementing measures that shall reduce air quality impacts associated with construction. Dust emissions will be controlled by the following measures: -

- Provide hoarding/dust screens or boundary wall along site boundary
- Water all active construction areas when necessary;
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard;
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction site;
- Down wash of trucks (especially tyres) prior to departure from site;
- Post signs that limit vehicle speeds onto unpaved roads and over disturbed soils;
- Use of electrically operated construction machinery to avoid externalities produced by diesel engines. This procedural change may reduce problems related to emission, idling and maintenance; and
- Rapid and efficient on-site construction so as to reduce duration of traffic interference and therefore reducing emissions from traffic delays.

All personnel working on the proposed project will be trained prior to starting construction on methods of minimizing air quality impacts during construction. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Minimization of exhaust emissions will be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road. In addition, truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points.

The following measures shall be implemented during construction: -

- The engine size of the construction equipment shall be the minimum practical size;
- The number of construction equipment operating simultaneously shall be minimized through efficient management practices;
- Ensure that the smallest practical number is operating at any one time;
- Construction equipment shall be maintained in tune per the manufacture's specifications;

- Idling of heavy duty diesel trucks during loading and unloading shall be minimized; and
- Alternatively fueled construction equipment shall be used where feasible.

7.2.5 Minimization of run-off and soil erosion

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site during construction. These measures will include terracing and leveling the project site to reduce run-off velocity and increase infiltration of rain water into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

7.2.6 Efficient sourcing and use of raw materials

The Proponent will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms, whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction of purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

7.2.7 Minimization of water use

A combination of water saving appliances and water management measures will be planned in all the units in the proposed project. The message of water conservation should be spread to all users by way of awareness campaigns. Rain water harvesting can serve as a solution to the water problem and also by capturing the run off.

Rainwater harvesting helps in utilizing the primary source of water and prevent the runoff from going into septic tank or storm drains. Rainwater harvesting may comprise of the following two components:

- Storing rainwater in open or closed ground water reservoirs for use during construction
- Rain water harvesting for artificial recharge of ground water.

Efficiency of rainwater harvesting and recharging ground water can be increased by the following methods:

- Use vegetated swales and depressions to reduce runoff;
- Reduce and filter surface runoff; and
- Catch drainage all along the periphery of plot to prevent surface runoff.

7.2.8 Minimization of energy consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of its use.

7.2.9 Minimization of risks of accidents and injuries to workers

To reduce the construction workers accidents and hazards during the construction phase of the proposed project, the proponent shall be committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Safety and Health Act (2007). In this regard, the proponent shall be committed to provision of appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

7.2.10 Minimizing public health concerns

Workers should receive awareness training as part of their induction and then at least every 6 months on potential high risk communicable and vector borne diseases, symptoms, preventative measures and transmission routes as well as treatment options. This will be particularly important for diseases with which non-local workers are unfamiliar and in case of any emerging disease outbreaks.

In the event of a new disease, increased transmission or outbreak compared to the baseline, the Project should interact with local health care facilities and workers to ensure there is an appropriate response in place to make workers aware and to ensure proper precautionary measures are implemented.

A Worker Code of Conduct should be developed providing a worker code of behaviour including worker-worker interactions, worker-community interactions and development of personal relationships with members of the local communities.

Accommodation should be provided to workers from outside the Project area in accordance with international good practice on workers' accommodation, including IFC / EBRD standards to prevent transmission of diseases associated with poor living conditions. The following will be implemented at a minimum in order to minimize disease transmission:

- Providing workers with appropriate sanitary facilities, which are appropriately designed to prevent contamination.
- Developing a robust waste handling system to avoid the creation of new vector breeding grounds or attracting rodents to the area.
- Implementing measures to reduce the presence of standing water onsite through environmental controls and source reduction to avoid the creation of new breeding grounds.

Ensuring appropriate food preparation and monitoring measures are in place.

If deemed necessary providing insecticide-impregnated bed nets as a physical barrier to repel and kill mosquitos for workers that have been provided accommodation.

The workforce will be provided with access to selected treatment at health facilities on site as deemed necessary for this Project. The requirements for these health facilities should be based on a risk assessment taking into account access to existing health facilities and travel time to facilities that offer international standards of care. Access to health care should include direct employees, and sub-contractors working on site.

Pre-employment screening protocols will be put in place. This should include pre-employment medicals and follow up medicals as appropriate. The screening protocols should consider heath conditions related to the nature of the work undertaken, employee country of origin and legal requirements. Workers should not be denied employment on the basis of the outcomes of the screening but should be provided treatment or alternative roles as appropriate.

The proponent should prepare and implement a vector borne disease management plan during the construction phase focusing on malaria and chikungunya, which includes vector control, avoidance, diagnosis, treatment and training.

The proponent should implement TB awareness and prevention measures including testing and referral for treatment for all personnel working on the Project. This approach should be explained clearly to the workforce along with making it clear that there are no consequences for their employment.

The proponent should monitor the emergence of major pandemics through World Health Organisation (WHO) alerts and in the event of a pandemic, review mobilisation and demobilization of ex-patriate Project personnel and/or implement appropriate control measures and Emergency Response Plans.

Specific Measures for HIV/AIDs Prevention and Control

The Project should implement an HIV/AIDs and Sexually Transmitted Diseases (STD) awareness programme to minimise the spread of HIV infection and other STDs. The programme should be prepared with the assistance of a specialist in sexually transmitted diseases. A typical programme would include, among other things, the following measures:

- An HIV/AIDS awareness and on-going education on transmission of HIV/AIDS and STDs, to employees, through workshops, posters and informal information sessions;
- Encouragement of employees to determine their HIV status;
- Supply of condoms/ femidoms at the construction site(s)/; and
- Development of a comprehensive Worker Management Plan, including rules for onsite behaviour, entrance and exit policies and prohibition of sex workers on site.

As part of the HIV/AIDs and STD awareness programme, information should be provided to workers on STD prevalence rates in Kenya and/ or the relevant Counties as well as the

expectations of local communities if a woman is made pregnant by a worker (e.g. marriage, financial implications etc.).

A grievance mechanism should be developed, whereby affected people can raise issues and concerns associated with social vices, prostitution and the behaviour of workers and drivers.

7.2.11 Minimization of hydrology and water quality degradation

Several measures shall be put in place to mitigate the impacts that are likely to lead to surface and ground water quality degradation. The proponent will prepare a hazardous substance control systems and emergency response plans that will include preparations for quick and safe clean -up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during construction, and will include an emergency response programme to ensure quick and safe cleanup of accidental spills. The plan will identify areas where re-fuelling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted.

If suspected contaminated groundwater is encountered in the depths of the proposed construction areas, samples will be collected and submitted for laboratory analysis of petroleum hydrocarbons, metals, volatile organic compounds and semi-volatile organic compounds. If necessary, ground water will be collected during construction contained and disposed of in accordance with all applicable regulations. Appropriate personal protective equipment will be used and waste management will be performed in accordance with applicable regulations. Oil absorbent material, taps and storage drums will be used to contain and control any minor releases of engine and other equipment oil.

7.3 Mitigation of operation phase impacts

7.3.1 Ensuring efficient solid waste management

During the operation phase of the proposed project, domestic waste will be generated. The Environmental Management and Coordination (Waste Management) Regulations, 2006 gives guidance on how various wastes should be managed.

The proponent of the proposed project will be responsible for efficient management of solid waste generated by the proposed project during its operation. In this regard, the proponent will provide waste handling facilities such as waste bins and skips for temporarily holding domestic waste generated at the site. In addition, the proponent will ensure that such wastes are disposed of regularly and appropriately.

Since the proposed project once complete will be generating a lot of waste, an integrated solid waste management system is recommendable. First, the proponent will give priority to reduction at source of the materials. This option will demand a solid waste management awareness programme in the management and the employed staff. Secondly, recycling, reuse and composting of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. The recyclables will be sold to waste buyers within Nairobi and its environs. The third priority in the hierarchy of options is combustion of the waste that is not recyclable in order to produce energy. Finally, sanitary land filling will be the last option for the proponent to consider. In order to achieve the above three recommendations, the following will be done:

Public awareness

- Public awareness on waste segregation and disposal rules of the proposed project in form of leaflets and periodic awareness talks will be given to tenants; and
- Sign boards and information boards in English and local language (Kiswahili) will be put up in required areas

Waste segregation

- Segregation or sorting of waste at its source should be practiced in order to encourage reuse/recycling and to minimize the negative effects of the waste and increase its economic value.
- Within public areas dedicated bins will be placed to collect wastes.

Collection bins

- Daily/Weekly collection of wastes shall take place from all the bins;
- Daily sweeping and collection of waste from roads and other common areas shall be done; and
- For waste collection either carts or a dedicated truck shall be used. Separate collection for bio-degradable and non-biodegradable wastes should be encouraged.
- A waste transfer station whereby wastes are protected from scavengers and natural elements shall be designated.

Waste treatment and disposal

- Solid waste generated by the proposed project should be collected and disposed of by a private firm at a Nairobi County Government designated dumping site.

7.3.2 Ensure efficient energy consumption

The proponent will install an energy-efficient lighting system at the proposed development. This will contribute immensely to energy saving during the operational phase of the proposed project. In addition, occupants of the units will be sensitized to ensure energy efficiency in their domestic operations. To complement these measures, it will be important to monitor energy use during the operation and set targets for efficient energy use.

7.3.3 Ensure efficient water use

The Proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the occupants will be sensitized to use water efficiently. Other measures to conserve water include:

- Reduce water delivery in taps, through the installation of low flow devices or aerators on taps;
- A manually pressed button flush valve which stops on release of button;
- Sensors on urinals in public toilets, which ensure flushes, occur only when required in public areas of the proposed project; and
- Water efficient plumbing.

7.3.4 Strained services and facilities

It is recommended that the proponent should liaise closely with other development partners and relevant Government Departments and the County Government to upgrade the existing shared facilities including roads, water distribution systems etc.

The proponent should as well explore alternative means which are environmentally sound like employing the Green Energy Technologies when and where applicable like the proposed use of Solar Panels in water heating among others. This will rather reduce the over dependence on fossils based energy sources which are arguably presently threatened with the idea of having a private borehole in itself being a way of relieving an existing water supply system.

7.4 Mitigation of decommissioning phase impacts

7.4.1 Minimization of noise and vibration

Significant impacts on the acoustic environment will be mitigated as described in Section 5.2.2.

7.4.2 Reduction of dust concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described in Section 7.2.4.

7.4.3 Efficient solid waste management

Solid waste resulting from demolition or dismantling works will be managed as described in Section 7.2.3.

CHAPTER EIGHT: ANALYSIS OF PROJECT ALTERNATIVES

This section analyses the project alternatives in terms of site, technology scale and waste management options and shall involve studying design alternatives and analyzing them based the environmental costs and benefits this shall involve studying the technology, design, capital investments, operation and maintenance requirements among others.

8.1 No project alternatives

This means that the status quo remains and the proponent will have to contend with the land being idle. The disadvantages of a "no project alternative" outweigh the advantages, including the following;

a) The proponent would be at loss financially since they have already invested a lot of resources in terms of professional

b) The professional's firms engaged in the project would lose out on potential revenue.

c) The proponent would lose out on the opportunity to invest and increase his income.

d) Potential job opportunities would be missed.

e) The government would lose out on taxes and the opportunity to encourage investment in the private sector.

f) The value of land would remain underutilized

8.2 Alternatives to site

A change of site alternative will require that the project be implemented at an alternative site other than the proposed site. Change of site will mean the proponent has to purchase an alternative piece of land. The result will be an increase in time and resources required to complete the transactions. The unpredictability of financial resources and the lengthy duration required in acquiring and completing official transaction on it may presents great challenges to having an alternative site for this project. Proposed site was chosen because the proponent already owns the plot. Besides, there is no guarantee that an appropriate land will be available at a reasonable cost within the project area.

Alternative to technology

The project team comprising of various consultants and professionals will make use of recommended technology in the design, construction and operation phases of the project. The team will ensure that the project complies with all stipulated specifications and standards. The procedures used will ensure that the project conforms to the principle of best practice. The building will be designed in a way to ensure comfort within existing climatic conditions and to ensure no need of air conditioning which is expensive to run and maintain.

8.3 Waste water management alternatives

The following locally available technologies are discussed below:-

Alternative One - Use of stabilization ponds/lagoons

This refers to the use of a series of ponds/lagoons which allow several biological processes to take place, before the water is released to the outside environment. The lagoons can be used for aquaculture purposes and irrigation. However, they occupy a lot of space but are less costly. No chemicals are used/heavy metals sink and decomposition processes take place. They are usually a nuisance to the public because of smell from the lagoons/ponds. This option is not preferable in the area because the required space is not available and the area is a cosmopolitan area.

Alternative Two - Use of Constructed/Artificial wetland

This is one of the powerful tools/methods used in raising the quality of life and health standards of local communities in developing countries. Constructed wetland plants act as filters for toxins. The advantages of the system are the simple technology, low capital and maintenance costs required. However, they require space and a longer time to function. Long term studies on plant species on the site will also be required to avoid weed biological behavioral problems. Hence it is not the best alternative for this kind of project.

Alternative Four - Use of septic tanks

This involves the construction of underground concrete-made tanks to store the sludge with soak pits. It is expensive to construct and regular empting in large discharge points. Given the kind of liquid waste emanating from the proposed project this option is not preferred since it will be uneconomical.

Alternative Five - Waste water treatment plant

This involves the construction of a plant and use of chemicals to treat the effluents to locally/internationally accepted environmental standards before it is discharged into the river nearby. It is usually expensive to construct and maintain, but it is the most reliable, efficient and cost-effective in the long term.

Alternative six - Connection to the sewer line system

Connection to the sewer line option is a viable option since Westlands area is served by existing sewer line.

Alternative seven: Use of Bio-digester

Bio digester is an on-site sanitation unit that utilizes anaerobic technology for the disposal of toilet (black) wastewater as well as of kitchen and bathroom (grey) water, in a closed system. This is an incredibly ethical sanitation technology which treats wastewater in an environmentally friendly manner, facilitating its use for irrigation or its return to water bodies without polluting them. The process also generates organic fertilizer and biogas (a form of fuel) by allowing naturally occurring bacteria to break down solid waste. From the analysis and economic as well as environmental; considerations use of bio digester system is a viable option for the proponent to adopt in order to supplement connection to the sewer system.

8.4 Solid waste management alternatives

A lot of solid wastes will be generated from the proposed development. An integrated solid waste management system is recommendable. First, the proponent will give priority to Reduction at Source of the waste materials. This option will demand a solid waste management awareness programme in the management and the workers. Notices for proper waste management/handling may be posted at strategic places for the sake of visitors. Secondly, Recycling, Reuse and compositing of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place especially in the kitchen section. The recyclables will be sold to waste buyers within Nairobi City. The third priority in the hierarchy of options is combustion of the waste that is not recyclable. Finally, sanitary land filling will be the last option for the proponent to consider.

8.5 Comparison of Alternatives

The Proposed Project Is The Best Alternative Since It Will Lessen The Housing Shortage Being Experienced In The Country, Lead To Revenue For The Proponent And The Government, Improvement In Service Delivery And Will Create Employment Opportunities For More People

CHAPTER NINE: ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

The proposed project activities will have some impacts on the biophysical environment, health and safety of its employees and members of the public, and socio-economic well-being of the local residents. Thus, the environmental management plan focuses on reducing the negative impacts and maximizing the positive impacts associated with the project activities through a programme of continuous improvement.

An environmental management plan has been developed to assist the proponent in mitigating and managing environmental impacts associated with the life cycle of the Project. The EMP has been developed to provide a basis for an Environmental Management System (EMS; ISO 14001 principles) for the project. It is noteworthy that key factors and processes may change through the life of the project and considerable provisions have been made for dynamism and flexibility of the EMP. As such, the EMP will be subject to a regular regime of periodic review.

Tables 7, 8 and 9 form the core of this EMP for the construction, operational and decommissioning phases of the project. In general, the Tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, their financial costs, as well as the persons responsible for their implementation and monitoring. The EMP will be used as checklist in future environmental audits.

9.2 Construction phase EMP

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the construction phase of the project are outlined in **Table 6** below:

Table 7: Construction Phase Environmental Management Plan

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Kshs)
Minimization of Traffic congestion and possible accidents				
Traffic congestion	Minimize the haulage and transportation of construction of materials during peak hours using public roads	Contractor, Civil engineer & Project Manager	Throughout construction period	100,000 per month
	Adopt a Traffic Management Plan to enhance the traffic movement within the site and the public road			
	Use of signs for diversion and to warn motorists against dangers at or near construction site			
	Ensure that the speed limits for construction vehicles (of less than 30 km/h) should be adhered to along the Westlands Road.			
	Prepare and implement an appropriate community Grievance Redress Mechanism (GRM). The GRM should be communicated to all the local community members.			
Minimization of noise and vibration				
Noise and vibration	Comply with maximum permissible noise levels for constructions sites as per Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009	Project Manager & Contractor	Throughout construction period	200,000

	Apply for a License from NEMA whereby maximum permissible noise levels are to be exceeded			
	All construction activities shall be carried out during the day between 08:00 hrs and 17:00 hrs			
	Priority shall be given to the use of equipment designed with noise control elements			
	Construction vehicles and machinery are to be switch off engines of vehicles or machinery not being used.			
	Ensure use of well serviced and maintained vehicles and equipment to ensure smooth idling and maintenance.			
	All noisy machinery shall be shielded by portable barriers and located as far from existing sensitive receptors as possible			
3. Minimization of construction waste				
	Use of an integrated solid waste management system i.e., through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling.	Resident Project Manager & Contractor	Throughout construction period	500,000
	Through accurate estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size,	Resident Project Manager & Contractor	One-off	-
	Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed of.	Resident Project Manager & Contractor	One-off	-

	Ensure that damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects.	Resident Project Manager & Contractor	One-off	-
	Donate recyclable/reusable or residual materials to local community groups, institutions and individual local residents or home owners.	Resident Project Manager & Contractor	One-off	-
	Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time	Resident Project Manager & Contractor	Throughout construction period	-
	Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements	Resident Project Manager & Contractor	One-off	200,000
	Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste	Resident Project Manager & Contractor	Throughout construction period	-
	Use construction materials containing recycled content when possible and in accordance with accepted standards.	Resident Project Manager & Contractor	Throughout construction period	-
	Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at the site	Resident Project Manager & Contractor	Throughout construction period	-
	Dispose waste more responsibly by dumping at designated dumping sites or landfills only.	Resident Project Manager & Contractor	Throughout construction period	3,000 per trip

	Waste collection bins to be provided at designated points on site		Throughout construction period	150,000
Minimization of dust generation and emission				
Dust Generation	Ensure strict enforcement of on-site speed limit regulations	Resident Project Manager & Contractor	Throughout construction period	500,000
	Avoid excavation works in extremely dry weathers			
	Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles			
	Provide hoarding/dust screens or boundary wall along site boundary			
Minimization of run-off and soil erosion				
Increased storm water, runoff and soil erosion	Surface runoff and roof water shall be harvested and stored in underground reservoir tanks for reuse.	The Civil Engineer, Mechanical Engineer & Resident Project Manager	2 months	300,000
	A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure will be designed.		1 months	500,000
	Apply soil erosion control measures e.g. leveling project site to reduce run-off velocity & increase infiltration of storm water into the soil.		1 months	200,000

	Ensure that construction vehicles are restricted to existing graded roads to avoid soil compaction within the project site.	The Civil & Mechanical Engineer, Resident Project Manager	Throughout construction period	-
	Ensure that any compacted areas are ripped to reduce run-off.		2 months	100,000
	Site excavation works to be planned such that a section is completed and rehabilitated before another section begins.	Resident project Manager	Throughout construction period	5,000 per unit
	Open drains all interconnected will be provided on site.	Civil Engineer	Throughout construction period	1,500,000
	Roof catchments will be used to collect the storm water for some domestic uses.	Civil Engineer	Throughout construction period	
	Construction of water storage tanks to collect storm water for domestic uses.	Civil Engineer	Throughout construction period	
Efficient sourcing and use of raw materials				
High demand of raw material	Source building materials from local suppliers who use environmentally friendly processes in their operations.	Resident Project Manager & Contractor	Throughout construction period	-
	Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered.		Throughout construction period	-

	Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.	Resident Project Manager & Contractor	Throughout construction period	100,000
	Use at least 5%-10% recycled, refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills		Throughout construction period	-
Minimization of water use				
	Water from the existing boreholes to be utilized and augmented by main line	Mechanical Engineer & Resident Project Manager	Throughout construction period	-
	Harness rainwater for domestic use & gardening			10,000
	Install water conserving taps that turn-off automatically when water is not being used	Resident Project Manager & Contractor	One-off	10-40% higher than price of ordinary taps
	Promote recycling and reuse of water as much as possible		Throughout construction period	-
	Install a discharge meter at water outlets to determine and monitor total water usage	Resident Project Manager & Contractor	One-off	3,000 per unit
	Promptly detect and repair of water pipe and tank leaks		Throughout construction period	1,000 per month
	Ensure taps are not running when not in use			5,0000
Minimization of energy consumption				

Increased energy consumption	Ensure electrical equipment, appliances and lights are switched off when not being used	Resident Project Manager & Contractor	Throughout construction period	0
	Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric energy			200% higher than normal bulbs
	Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts			10,000
	Monitor energy use during construction and set targets for reduction of energy use.			20,000
Minimization of risks of accidents and injuries to workers				
Approval of building plans	Ensure that all building plans are approved by the County Government and the Occupational Health and Safety Office	Developer	One-off	50,000
Registration of the premises	Registration of the proposed project under the Occupational Safety and Health Act	Developer	One-off	15,000
General register	A general register should be kept within the facility as stipulated in Sec 62 (1) of the Occupational Safety and Health Act, 2007.	Resident Project Manager & Contractor	One-off	5,000
Incidents, accidents and Dangerous occurrences.	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Resident Project Manager, Developer & Contractor	Continuous	1000/month

	Enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.	Resident Project Manager, Developer & Contractor	Continuous	20,000
Insurance	Ensure that the premises are insured as per statutory requirements (third party and workman's compensation)	Developer	Annually	0
Site organization	Develop a clear site organization plan and construction schedule	The Contractor, Resident Project Manager& Site Safety Officer	Continuous	150,000
	Deliver and store materials at appropriate locations		Continuous	-
	Hire the right number of workers with clear work schedule and appropriate dress gear		Continuous	-
Safety, health and environment (SHE) policy	Develop, document and display prominently an appropriate SHE policy for construction works	Resident Project Manager, Developer & Contractor	One-off	100,000
Health and safety committee	Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented	Resident Project Manager	One-off	50,000
Machinery/equipment safety	Ensure that machinery, equipment, personal protective equipment, appliances and hand tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded	Resident Project Manager, Developer & Contractor	One-off	0

	Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain	Resident Project Manager	Continuous	5,000 per training
	All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury	Resident Project Manager	Continuous	20,000 per examination
	Arrangements must be in place to train and supervise inexperienced workers regarding construction machinery use and other procedures/operations	Resident Project Manager	Continuous	
	Equipment such as fire extinguishers must be examined by authorized agency. The equipment may only be used if a certificate of examination has been issued	Resident Project Manager	Continuous	-
	Reports of such examinations must be presented in prescribed forms, signed by the examiner and attached to the general register	Resident Project Manager	Continuous	-
Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Resident Project Manager	Continuous	-
	Ensure that items are not stored/stacked against weak walls and partitions	Resident Project Manager	Continuous	-
Safe means of access and safe place of employment	All floors, steps, stairs and passages of the units must be of sound construction and properly maintained	Resident Project Manager & Contractor	Continuous	0
	Securely fence or cover all openings in floors		One-off	0

	Provide all staircases within the units with suitable handrails on both sides		One-off	-
	Ensure that construction workers are not enclosed such that they would not escape in case of an emergency	Resident Project Manager & Contractor	Continuous	-
	All ladders used in construction works must be of good construction and sound material of adequate strength and be properly maintained	Resident Project Manager & Contractor	One-off	-
Emergency preparedness and evacuation procedures	Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency	Resident Project Manager & Contractor	One-off	50,000
	Such procedures must be tested at regular intervals	Resident Project Manager & Contractor	Every 3 months	-
	Ensure that adequate provisions are in place to immediately stop any operations where there in an imminent and serious danger to health and safety and to evacuate workers	Resident Project Manager & Contractor	Continuous	100,000
	Ensure that the most current emergency telephone numbers posters are prominently and strategically displayed within the construction site	Resident Project Manager & Contractor	One-off	2,000
	Provide measures to deal with emergencies and accidents including adequate first aid arrangements	Resident Project Manager & Contractor	Continuous	50,000
First Aid	Well stocked first aid box which is easily available and accessible should be provided within the construction site	Resident Project Manager & Contractor	One-off	20,000

	Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Resident Project Manager & Contractor	One-off	100,000
Fire protection	Firefighting equipment such as fire extinguishers should be provided at strategic locations such as stores and construction areas.	Resident Project Manager & Contractor	One-off	100,000
	Regular inspection and servicing of the equipment must be undertaken by a reputable service provider and records of such inspections maintained	Resident Project Manager & Contractor	Every 3 months	50,000
	Signs such as "NO SMOKING" must be prominently displayed within the construction site, especially in parts where inflammable materials are stored	Resident Project Manager & Contractor	One-off	5,000
Ventilation	Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air	Resident Project Manager & Contractor	One-off	0
Lighting	There must be adequate provision for artificial or natural lighting in all parts the housing units in which persons are working or passing	Resident Project Manager & Contractor	One-off	0
Electrical Safety	Circuits must not be overloaded	Resident Project Manager & Contractor	Continuous	0
	Distribution board switches must be clearly marked to indicate respective circuits and pumps		One-off	0
	There should be no live exposed connections	Resident Project Manager & Contractor	Continuous	0

	Electrical fittings near all potential sources of ignition should be flame proof		One-off	0
	All electrical equipment must be earthed		One-off	0
Chemical Safety	Develop a suitable system for the safe collection, recycling and disposal of chemical wastes, obsolete chemicals and empty chemical containers	Resident Project Manager & Contractor	One-off	0
	Ensure that all chemicals used in construction are appropriately labeled or marked and that material safety data sheets containing essential information regarding their identity, suppliers' classification of hazards, safety precautions and emergency procedures are provided and are made available to employees and their representatives		One-off	0
	Keep a record of all hazardous chemicals used at the site, cross-referenced to the appropriate chemical safety data sheets	Resident Project Manager & Contractor	Continuous	500
	There should be no eating or drinking in areas where chemicals are stored or used	Resident Project Manager & Contractor	Continuous	0
	Provide workers in areas with elevated noise and vibration levels, with suitable ear protection equipment such as ear masks		One-off	15,000
Supply of clean drinking water	Ensure that construction workers are provided with an adequate supply of wholesome drinking water which should be maintained at suitable and accessible points.	Resident Project Manager & Contractor	One-off	10,000/month

Washing facilities	Ensure that conveniently accessible, clean, orderly, adequate and suitable washing facilities are provided and maintained within the site	Resident Project Manager & Contractor	One-off	15,000
Ergonomics	Provision for repairing and maintaining of hand tools must be in place	Resident Project Manager & Contractor	One-off	5,000
	Hand tools must be of appropriate size and shape for easy and safe use		One-off	0
	Height of equipment, controls or work surfaces should be positioned to reduce bending posture for standing workers		One-off	0
Minimizing public health concerns				
Public Health	Providing workers with appropriate sanitary facilities, which are appropriately designed to prevent contamination.	Resident Project Manager & Contractor	Continuous throughout construction period	100,000
	Developing a robust waste handling system to avoid the creation of new vector breeding grounds or attracting rodents to the area.			
	Implementing measures to reduce the presence of standing water onsite through environmental controls and source reduction to avoid the creation of new breeding grounds.			
HIV/Aids	An HIV/AIDS awareness and on-going education on transmission of HIV/AIDS and STDs, to employees, through workshops, posters and informal information sessions;	Resident Project Manager & Contractor	Continuous throughout construction period	100,000
	Encouragement of employees to determine their HIV status;			

	Supply of condoms/ femidoms at the construction site(s)/; and			
	Development of a comprehensive Worker Management Plan, including rules for onsite behaviour, entrance and exit policies and prohibition of sex workers on site.			
Minimization of hydrology and water quality degradation				
	Hazardous substance control and emergency response plan that will include preparations for quick and safe clean-up of accidental spills.	The Mechanical Engineer, Resident Project Manager, Contractor	Continuous	-
	Hazardous-materials handling procedures to reduce the potential for a spill during construction to be prescribed	The Mechanical Engineer	Continuous	-
	Identify areas where refueling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted	The Mechanical Engineer	Continuous	-
	Ground water will be collected during construction contained and disposed of in accordance with all applicable regulations	The Mechanical Engineer	Continuous	-

9.3 Operational Phase EMP

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase of the project are outlined in **Table 8**.

Table 8: Operational Phase EMP

Expected Negative Impact	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Minimization of health and safety impacts				
Implement all necessary measures to ensure health and safety of the general public during operation of the project as stipulated in Occupational Safety and Health Act , 2007		Proponent	Continuous	-
2. Ensure the general safety and security of the premises and surrounding areas				
Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises.		Proponent	Continuous	100,000-200,000/month
3. Minimization of solid waste generation and ensuring more efficient solid waste management				
Solid waste generation	Provide solid waste handling facilities such as waste bins and skips	Proponent/Estate Management	One-off	500,000
	Ensure that solid waste generated at the area is regularly disposed of appropriately at authorized dumping sites	Proponent/Estate Management	Continuous	200,000/month
	Ensure that occupants of the units manage their waste efficiently through recycling, reuse and proper disposal procedures.	Proponent/Estate Management	Continuous	-
	Donate redundant but serviceable equipment to charities and institutions	Proponent/Estate management	Continuous	0

Sewage disposal	Provide adequate and safe means of handling sewage generated at the units	Proponent & Contractor	One-off	300,000
	Conduct regular inspections for sewage pipe blockages or damages and fix appropriately	Proponent & Contractor	Continuous	-
5. Minimize energy consumption				
Energy resource utilization	Switch off electrical equipment, appliances and lights when not being used	Tenants/Proponent/Estate management	Continuous	-
	Install occupation sensing lighting at various locations such as storage areas which are not in use all the time	Proponent/Estate management	One-off	10-40 % higher than ordinary lighting
	Install energy saving fluorescent tubes at all lighting points within the units & staircases instead of bulbs which consume higher electric energy	Proponent/Estate management	One-off	10-40 % higher than ordinary lighting
	Monitor energy use during the operation of the project and set targets for efficient energy use	Proponent/Estate management	Continuous	2,000/month
	Sensitize tenants to use energy efficiently		Continuous	1,000/month
Minimize water consumption and ensure more efficient and safe water use				
Water consumption	Promptly detect and repair water pipe and tank leaks	Tenants/Estate management	Continuous	-
	Residents to conserve water		Continuous	-
	Ensure taps are not running when not in use		Continuous	-
	Install water conserving taps that turn-off automatically when water is not being used	Proponent/Estate Management	One-off	10-40 % higher than ordinary taps
	Install a discharge meter at water outlets to determine and monitor total water usage	Proponent/Estate Management	One-off	3,000

Minimize fire hazards				
Fire protection	Firefighting equipment such as fire extinguishers, smoke detectors, should be provided at strategic locations such as each floors lobby, corridors	Proponent/ Property manager	One-off	150,000
	Regular inspection and servicing of the equipment must be undertaken by a reputable service provider and records of such inspections maintained	Proponent/ Property manager	Every 3 months	50,000
	Signs such as "NO SMOKING" must be prominently displayed within the buildings where applicable	Proponent/ Property manager	One-off	5,000

9.4 Decommissioning Phase EMP

In addition to the mitigation measures provided in Tables 7 and 8, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in Table 9 below:

Table 9: Decommissioning Phase EMP

Expected Negative Impacts	Recommendation Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Demolition waste management				
Demolition waste	Use of an integrated solid waste management system i.e., through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land	Resident Project Manager & Contractor	One-off	20,000

	filling.			
	All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible	Resident Project Manager & Contractor	One-off	0
	All foundations must be removed and recycled, reused or disposed of at a licensed disposal site	Resident Project Manager & Contractor	One-off	0
	Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site	Resident Project Manager & Contractor	One-off	0
	Donate reusable demolition waste to charitable organizations, individuals and institutions	Resident Project Manager & Contractor	One-off	0
2. Rehabilitation of project site				
Vegetation disturbance	Implement an appropriate re-vegetation programme to restore the site to its original status	Resident Project Manager & Contractor	One-off	0
	Consider use of indigenous plant species in re-vegetation		One-off	0
	Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent area and the development.	Resident Project Manager & Contractor	One-off	0

CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The proposed project shall have several positive impacts emanating from both the construction and operational phases. These positive impacts include creation of employment; provision of quality shelter, and increase in Revenue among others as has been outlined in the report.

The proposed project will also have some negative impacts which in turn need to be minimized and mitigated during the construction and the operational phases. Several of these negative impacts are rated low and short-term thus, have minimal impacts. The negative environmental impacts that will result from establishment of the project include increased population without commensurate services and facilities; increased pressure on infrastructure; air pollution; water pollution and generation of wastes among others.

The proponent of the proposed project shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project as outlined within the project report.

10.2 Recommendations

It is recommended that the proponent shall focus on implementing the measures outlined in the EMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects. It is also recommended that the positive impacts that emanate from such activities shall be maximized as much as possible. It is expected that these measures will go a long way in ensuring the best possible environmental compliance and performance standards.
Other specific recommendations that the proponent should implement include:

- Consult all relevant service providers and authorities (i.e., Nairobi City County, KPLC, Water and Sewerage Company, NEMA, amongst others) so as to harmonize the projects infrastructural and socio-economic developments with existing facilities.
- Adhere to all relevant construction, occupational, health and safety regulations and any other relevant law.
- Ensure Water and Energy Management Systems are put in place as outlined within the report and incorporate rain water harvesting facilities.
- Ensure solid waste management during construction and operational phases of the project adhere to the Environmental Management and Coordination (Waste Management) Regulations, 2006.
- Ensure strict adherence to provisions of Environmental Management and Coordination (Noise and Excessive Vibrations Pollution) Regulations, 2009.
- Ensure waste water is disposed off as per standards set in the Environmental Management and Coordination (Water Quality) Regulations, 2006.
- Ensure strict adherence to Occupational Health and Safety Act, 2007

REFERENCES

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- Kenya gazette supplement Acts *Water Act, 2002. Government printer, Nairobi*
- The Occupational Safety and Health Act, 2007. Government Printer, Nairobi.

APPENDICES

Ownership documents
Architectural drawings/Plans
Public Consultation Questionnaires
Minutes of the public consultation meeting