Ministry of Defence

NAIROBI RIVERS COMMISSION

Let the Rivers Flow

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

FOR THE PROPOSED DESIGN AND CONSTRUCTION OF SOCIAL AMENITIES IN SUPPORT OF PROTECTION, RESTORATION, REHABILITATION, AND BEAUTIFICATION WORKS WITHIN THE NAIROBI RIVERS BASIN, NAIROBI COUNTY

Prepared by

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Prepared For

Ministry of Defence

Ministry of Defence
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This Environmental Impact Assessment (EIA) Study has been prepared in compliance with the Environmental Management and Coordination Act (EMCA), Cap 387.

June 2025

Project Contract No: DHQ/INFRAS/T/011/24/25

Certification

This Environmental Impact Assessment (EIA) Study Report is hereby submitted to the National Environment Management Authority (NEMA) in full compliance with the provisions of the Environmental Management and Coordination Act (EMCA), Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003. The report presents an independent assessment of the potential environmental and social impacts associated with the proposed design and construction of social amenities for the protection, restoration, rehabilitation, and beautification of the Nairobi Rivers Basin within Nairobi County.

To the best of the consultant's knowledge and belief, the information contained in this report is a true, comprehensive, and accurate representation of the findings and analyses conducted in relation to the proposed project. The assessment has been undertaken using scientifically accepted methodologies and is based on the documentation, data, and details provided by the project proponent, as well as site visits, stakeholder consultations, and expert evaluations carried out during the study period. We, the undersigned, hereby confirm that the information contained in this Environmental and Social Impact Assessment (ESIA) report accurately reflects the findings, assessments, and recommendations arising from the ESIA study.

Project Proponent

Ministry of Defence
Ulinzi House , Lenana Road
P O Box 40668 – 00100 Nairobi-Kenya.

Name: ……..…Designation: ……..

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Project Contactor

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Executive Summary

Nairobi, once referred to as the "Green City in the Sun," derives its name from the Maasai phrase *Enkare Nairobi*, meaning "a place of cool waters." However, in recent years, rapid urbanization and encroachment have significantly degraded the tributaries and catchment areas of the Nairobi River System. In response, the Government of Kenya (GoK) has initiated an ambitious rehabilitation and restoration programme in line with the country's Vision 2030 development blueprint. The GoK acknowledges the critical role that water and sanitation play in supporting key economic sectors and improving the livelihoods of Kenyans. The current focus of the programme is the stretch from Nairobi Zone 1 to Nairobi Zone 5, which encompasses the Nairobi River corridor from its source at **Ondiri Swamp** in Kikuyu, flowing through **Kangemi and Kileleshwa**, past the **Arboretum and city centre**, to **1st Avenue Eastleigh**, and extending to **Dandora Falls**.

Bordering the Nairobi River and both contributing to and bearing the consequences of its pollution are residents of the city's expansive informal settlements. These unregulated communities, often located along the riverbanks, face heightened vulnerability to environmental hazards such as flooding, and exposure to waterborne contaminants. The combination of inadequate sanitation infrastructures, poor waste management, and limited access to sanitation exacerbates the health and safety risks faced by these communities.

Therefore, the rehabilitation of this strategic zone (**NRBZ1 Ondiri Swamp-NRBZ5- Dandora Falls**) is expected to yield substantial environmental, social, and economic benefits for the city dwellers. Achieving these outcomes requires a multifaceted approach, implemented through a series of well-designed catalytic projects and targeted interventions. The proposed rehabilitation programme will be carried out in phases, beginning with the Nairobi River Zones, followed by Ngong River and finally Mathare River.

In adherence to the applicable national regulatory frameworks, the Nairobi River Regeneration Initiative, under the stewardship of the Ministry of Defence (MoD) as the lead project management team, commissioned **Earthcare Services Limited** (ESL), a NEMA-registered firm of environmental experts to undertake an Environmental and Social Impact Assessment (ESIA) for the proposed Nairobi River Regeneration Programme and its associated amenities.

The scope of the programme encompasses the development of support infrastructure and amenities, including non-motorized access paths and community centres; the expansion of the Kariobangi Sewer Treatment Plant; comprehensive landscaping works; the installation of a new sewer trunk line along the Nairobi River; dredging and widening of the river channel; as well as the protection and conservation of the river's source at Ondiri Swamp.

Project Scope and objectives

The project's development objective is to enhance the environmental quality of Nairobi City, particularly its polluted rivers, through various strategies, including the expansion of waste treatment systems and the integration of urban development initiatives. The proposed project is a transformative initiative designed to revitalize Nairobi's rivers into vibrant, sustainable urban waterfronts. It is guided by key strategic and specific objectives, including but not limited to the following:

- Construction of pedestrian walkways and cycle lanes along the river riparian zone, including the installation of security lighting;
- Installation of a new trunk sewer line extending from Naivasha Road to Dandora Falls, traversing areas that were not previously approved or licensed under the planned design by Athi Water Works Development Agency;
- Expansion of the existing wastewater treatment facility at the Kariobangi Sewage Treatment Plant;
- Construction of pedestrian bridges to improve connectivity across the river corridor;
- River dredging and widening, coupled with riverbank protection and stabilization measures;
- Implementation of modern landscaping solutions to enhance the urban environment;
- Establishment of scenic, flower-lined riverbanks to promote aesthetic and recreational value;
- Construction of social amenities and support infrastructure, including public markets and other community-serving facilities, aimed at enhancing socio-economic development and improving the quality of life for local residents, and
- Protection and conservation of the Nairobi River's source at Ondiri Swamp.

Project Location

The designated area of focus for this project encompasses zones NRBZ1 to NRBZ5 (as illustrated in Design Map Annex 7), following the Nairobi River corridor from its source at **Ondiri Swamp (K0+000~K10+000) is 10.0km long)**, through **Kangemi** and **Kileleshwa**, past the **Arboretum** and Nairobi's **Central-Business District (K10+000~K16+600) is 6.6km)**, extending through **1st Avenue Eastleigh**, and terminating at **Dandora Falls (K16+600~K26+580) 9.98km**). The proposed rehabilitation and associated works will be executed in sequential phases, beginning with the Nairobi River corridor (zones NRBZ1 to NRBZ5), followed by interventions along the Ngong River, and subsequently the Mathare River. These two rivers, all tributaries of the greater Nairobi River system, form an integral part of the broader Nairobi Rivers Basin targeted for restoration programme.

Project Estimated Cost

The proposed project is estimated to cost approximately **Ksh 37,599,568,421.99** encompassing construction, procurement, and other related activities necessary for successful implementation of the proposed project. A detailed Bill of Quantities (BoQ) outlining the cost breakdown is provided in the report annexure.

Project Components

Scope	Narrative
Construction of New Trunk Sewer	The proposed project will include the construction of a new reinforced concrete box culvert trunk sewer with enhanced conveyance capacity, intended to replace the existing trunk sewer currently operating beyond its design limits. The new system is designed to accommodate wastewater volumes of up to 310,000 cubic meters per day. The proposed trunk sewer will be constructed along the Nairobi River riparian reserves, specifically targeting sections that were not included or licensed under the ongoing construction works by Athi Water Works Development Agency. The areas of interest for this intervention will include the following zones: • Nairobi River -Naivasha Road to Museum Hill (approximately 10.7km) • Kirichwa Kubwa River–Dagoretti to Chiromo at confluence with Nairobi River (approximately 9km), • Nairobi River–Museum Hill to Dandora Falls as double trunk, and (approximately 16.7km). The alignment will include manholes at regular intervals for inspection and maintenance, as well as provisions for future network expansion. The proposed trunk sewer line will serve a wide range of urban and peri-urban areas along the Nairobi River Basin. The upper catchment service areas, located south of Waiyaki Way, include neighborhoods such as Westlands, Lavington, Kangemi, Kawangware, Waithaka, Uthiru, Kinoo, and Kikuyu. The central Nairobi River catchment encompasses densely populated and commercially active zones, including the Nairobi Central Business District (CBD), Kamukunji, Gikomba, Eastleigh, various Nairobi Eastlands estates, Moi Air Base, Kariobangi, Dandora, and Korogocho. In the lower catchment area, the sewer infrastructure will extend services to the rapidly growing settlements of Mwiki, Njiru, Chokaa, and Ruai, thereby contributing to improved sanitation and environmental health across the broader Nairobi metropolitan region. The new trunk sewer canal will serve an area of 119.90 km², with a current (2025) population of 495,934 and a projected population of 1,952,559 by 2065.

Scope	Narrative
Construction of new wastewater treatment plant at Kariobangi	As part of the Nairobi River Regeneration Programme, the proposed project includes the expansion of the existing Kariobangi Sewage Treatment Plant (STP) to achieve a wastewater treatment capacity of 60,000 cubic meters per day. The expanded facility will employ the Anaerobic-Anoxic-Oxic (AAO) biological treatment process, a proven and efficient technology for nutrient removal and high-quality effluent discharge. • **Site Context**: The expansion will take place within the footprint of the existing Kariobangi STP, which already functions as a wastewater treatment facility. This approach leverages existing infrastructure and minimizes the project's spatial and environmental footprint. • **Sludge Management**: The new design will incorporate advanced sludge treatment systems to ensure that the by-product is adequately stabilized and suitable for reuse. • **Automation and Monitoring**: The upgraded plant will feature automated control and monitoring systems across all treatment units. These systems will enhance operational safety, ensure compliance with effluent quality standards, and allow for real-time performance tracking and remote system management. This expansion is a critical infrastructure investment aimed at improving environmental health, reducing pollution loads into the Nairobi River, and promoting sustainable urban sanitation services.
Rehabilitation of Dandora Garbage Dumpsite (Phase I)	The Dandora landfill, having been exposed to the natural environment for an extended period, has progressively expanded toward the banks of the Nairobi River. As a result, solid waste and leachate have been directly discharged into the river system, making the landfill a significant source of pollution. As part of this project, targeted cleanup operations will be undertaken to remove a portion of the accumulated waste. Following waste removal, the exposed slopes will be stabilized and covered to mitigate further environmental degradation, prevent erosion, and reduce the infiltration of leachate into the river. **Activities** • Solid waste accumulation along the Nairobi River, from chainage 24+350 to 25+100, will be cleared within a 50-meter buffer zone extending toward the Dandora landfill, measured from the centerline of the river channel. The removed waste will be safely relocated and deposited at designated sections of the landfill, well away from the riverbank. **Drainage System:** To ensure effective surface water management and slope stability, a reinforced concrete drainage ditch measuring 800mm × 800mm will be constructed at the base of the slope. **Leachate drainage**: As part of the landfill remediation works, a leachate collection system will be installed at the base of the garbage slope within the designated rehabilitation area. The system includes the following components: • A 400mm-thick sand and gravel layer to function as the leachate collection and diversion medium.

<table>
<tr><th>Scope</th><th>Narrative</th></tr>
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A DN300 HDPE perforated corrugated pipe (commonly referred to as a "flower pipe") embedded within the sand-gravel layer for leachate conveyance.
A 300mm fine sand layer beneath the pipe to act as the leachate support and filtration base.

Collected leachate will be directed through the main collection pipe to a leachate collection pool, which is designed with a total storage capacity of 200 cubic meters (m^3). This system will ensure efficient drainage, minimize infiltration into the river, and support safe and environmentally sound leachate management. (For details see Annex 7).
</td></tr>
<tr><td>River Flood Control Works</td><td>
River training through development of weirs, constructed wetlands, garbage interception dams and riverbank stabilization is proposed for the project. A total of 14 garbage interception dams have been identified for the project as shown in the sub table.
<table>
<tr><th>Name</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>Kirinyaga road bridge</td><td>-1.2788632</td><td>36.8219819</td></tr>
<tr><td>Globe round about</td><td>-1.27855</td><td>36.8216967</td></tr>
<tr><td>Globe round about</td><td>-1.2784209</td><td>36.8213756</td></tr>
<tr><td>Chiromo interchange</td><td>-1.27387</td><td>36.8106833</td></tr>
<tr><td>James Gichuru road bridge</td><td>-1.2674269</td><td>36.7745738</td></tr>
<tr><td>Kabasasiran road bridge</td><td>-1.2673412</td><td>36.7674523</td></tr>
<tr><td>Mau Mau informal settlement</td><td>-1.2700454</td><td>36.7628446</td></tr>
</table>
</td></tr>
<tr><td>Decentralized Wastewater Treatment Plants (Car Wash Wastewater Management System)</td><td>
As part of the environmental protection measures under the Nairobi River Regeneration Programme, a targeted intervention has been included to address pollution from wash activities within the river basin.

A total of 40 brick-constructed car wash wastewater grease traps will be installed at strategically identified high-traffic car wash zones across the basin. Each grease trap is designed with the following specifications:

Effective volume: 6 cubic meters
Dimensions: 4.74 meters (length) × 1.94 meters (width) × 2.25 meters (depth)

Operational Flow: Car wash wastewater is first collected via newly constructed open drainage ditches located in the parking lots or car wash bays. The wastewater then flows into the grease traps, where residual oil and sediment are effectively separated. The treated effluent is subsequently directed into the main sewer trunk line, thereby reducing the risk of direct pollution to the Nairobi River and improving the quality of urban runoff.
</td></tr>
<tr><td>Urban Transport Infrastructure</td><td>
The design scope for the proposed subcomponent project includes the following key components aimed at enhancing accessibility, safety, and urban connectivity along the Nairobi River corridor:

Pedestrian Walkways- Dedicated footpaths to ensure safe and continuous pedestrian movement along the riverbanks,
Bicycle Lanes–Segregated cycling tracks to promote non-motorized

</td></tr>
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Scope	Narrative
	transport and reduce vehicular congestion, • **Reconstruction of Demolished Bridges**–Restoration of both motor vehicle and pedestrian bridges that were removed during the river widening operations, • **Street Lighting**–Installation of adequate and energy-efficient lighting infrastructure to improve nighttime visibility and public safety, and • **Signage and Wayfinding Systems**–Placement of directional and informational signs to guide users and enhance navigation within the river corridor. The proposed design includes the construction and rehabilitation of a total of 27 bridges along the Nairobi River corridor. These include both vehicular bridges and pedestrian bridges, some of which are designated as landscape bridges. • The proposed motor vehicle bridges are designed with a width of 14.5 meters, accommodating standard traffic lanes and enhancing roadway capacity, and • The pedestrian bridges are designed with a width of 3 meters, ensuring safe and accessible crossings for non-motorized users. •

Comprehensive Urban Landscape	The design scope of this component is situated within the core section of the project area, specifically between the intersection of Museum Hill and 1st Avenue Eastleigh. The primary development focus will include the construction of four thematic parks and supporting infrastructure aimed at enhancing recreational and cultural amenities along the Nairobi River corridor. Key elements of the construction include:
	
	• **Red Ribbon Park**: This park features a variety of landscapes and aesthetic elements including:
	  ○ Landscape bridges
	  ○ Red ribbon pergolas
	  ○ Breadfruit pergolas
	  ○ Rest pavilions
	  ○ Greening and landscaping features
	• **Historical and Cultural Park**: Designed to celebrate and preserve local heritage, this park includes:
	  ○ Visitor service centers
	  ○ Public squares
	  ○ Historical and cultural landscape walls
	  ○ Leisure benches
	  ○ Pavilions and pergolas
	  ○ Extensive greening and soft landscaping
	
	These parks aim to provide vibrant public spaces that integrate cultural, historical, and environmental values, contributing to urban regeneration and community well-being.

Restoration and Protection Catchment area (Ondiri Swamp)	The proposed project encompasses two environmentally sensitive and endangered wetland areas: Ondiri Swamp and Kikuyu Springs. Each of these wetlands covers an area of approximately 250,839 square meters, with a circumference of 2,379 meters. These wetlands are critical ecological zones and will be subject to targeted protection and conservation measures as part of the project implementation. The proposed enclosure structures will consist of wood polymer composite fence posts measuring 2,600 mm in length with a 100 mm × 100 mm cross-section,

Scope	Narrative
	spaced 3,000 mm apart. Each post will be anchored in a concrete foundation with a 200 mm diameter and 450 mm depth. The fence body will be constructed using 2.5 mm high-strength barbed wire, securely fastened to the posts to form a durable and continuous protective barrier with at least six (6) main entrance.
Constructed Wetland	The project will also include the construction of an artificial wetland located at the intersection of Kangora Road and Convent Drive in the upper reaches of the Nairobi River. The wetland is designed to treat 4,500 m³ of water per day, with a hydraulic retention time of four (4) days. It will be enclosed with a protective fence and equipped with an entrance gate. Water will enter the wetland through a DN500 inlet pipe and exit via a DN500 drainage pipe. The structure will be bordered by mortar-laid stone retaining walls, and appropriate wetland vegetation will be planted to support natural filtration and ecological restoration.
Rive Bank Expansion and Dredging	In response to the challenges posed by the narrow channel and limited flood-carrying capacity of the Nairobi River, bank expansion and dredging works will be undertaken along the river section between chainages **10+112 and 26+580 Km** (**Detailed Map Anex 7**). These works aim to widen and deepen the river channel, thereby increasing its flow capacity and overall volume. This intervention is designed to reduce the risk and impact of flooding on adjacent communities and infrastructure, and to enhance the river's flood management performance to meet the discharge requirements of a 50-year return period flood event. The total length of the bank expansion and dredging works along the core segment of the Nairobi River, spanning from chainage 10+112 to 16+550, is approximately 6.25 kilometers. This includes a 140-meter stretch within the National Museum Park area. The river channel excavation will be carried out in accordance with the designated riverbed control width, ranging from 12 to 17 meters. Excavation depths will vary between 3 and 5 meters, with riverbank slopes maintained at a gradient of 1:1 to ensure stability and structural integrity. In the downstream section of the Nairobi River (chainage 16+550 to 26+580), the river channel excavation will follow a riverbed control width ranging from 20 to 22 meters. The excavation depth will range between 3 and 5 meters, with riverbank slopes maintained at a 1:1 gradient. The top of the riverbanks will be excavated based on actual site conditions and slope stability requirements. The total length of bank expansion and dredging in this downstream section is approximately 10.03 kilometers.
Rive Bank Protection Sub-project	The core section of the river, spanning from pile number 10+112 (upstream of Dr. Riverside Road Bridge) to 16+550 (upstream of Lamu Road Bridge), will primarily utilize prefabricated ecological frame retaining wall slope protection. In areas with severe scouring along the concave riverbanks, upturned concrete retaining wall footings will be applied. The total length of the managed core section is 6.153 km, with newly constructed bank protection works totaling 11.599 km comprising 5.765 km on the left bank and 5.834 km on the right bank. The downstream section of the river extends from pile number 16+550 (downstream Lamu Road Bridge) to 26+580 (upstream of Dandora Falls). In this segment, gabion stone cage retaining walls will be primarily used for slope protection. For areas with severe scouring along concave banks, inclined concrete footings will be combined with slope protection measures.

Scope	Narrative
	The total length of the river channel under comprehensive management in this section is 10.030 km, with a total of 19.808 km of newly constructed bank protection works 9.906 km on the left bank and 9.902 km on the right bank. Of this, 3,887 meters will utilize gabion net revetments, while 15,881 meters will consist of combined C20 concrete and gabion net structures. For detailed engineering specifications, design layouts, and alignment plans related to bank protection works, refer to Annex 7 of this report
Construction of Ecological Weir	As part of the project's landscape enhancement and ecological restoration efforts, a total of 12 new ecological weirs are proposed for construction along the Nairobi River. These weirs are strategically distributed across the river corridor as follows: a) **Upstream Section:** 2 ecological weirs o Weir 1: Pile No. 3+950 o Weir 2: Pile No. 4+860 b) **Core (Middle) Section:** 9 ecological weirs o Weir 3: Pile No. 10+720 o Weir 4: Pile No. 11+905 o Weir 5: Pile No. 12+225 o Weir 6: Pile No. 12+420 o Weir 7: Pile No. 12+600 o Weir 8: Pile No. 13+585 o Weir 9: Pile No. 14+250 o Weir 10: Pile No. 15+300 o Weir 11: Pile No. 15+773 c) **Downstream Section:** 1 ecological weir o Weir 12: Pile No. 25+700 These structures are designed to enhance river aesthetics, support aquatic habitats, and contribute to the broader ecological integrity of the Nairobi River Basin. The dam structure of each ecological water retaining weir will be constructed using **C25** buried stone concrete, ensuring durability and stability. The central portion of the weir will feature an overflow rolling section, designed to facilitate controlled water flow and reduce erosion. This overflow section will be constructed in a stepped configuration, enhancing both hydraulic efficiency and visual appeal while promoting aeration and ecological integration with the surrounding environment. (**Refer to Annex 7** for detailed typical design drawing of ecological weir)
Solid Waste Management Sub-project	As part of the project's integrated solid waste management strategy, a total of five (5) garbage interception dams will be constructed along the Nairobi River. The locations are strategically selected to optimize accessibility, minimize ecological disruption, and facilitate efficient waste removal and maintenance. The layout is as follows: i. Garbage Interception Dam at chainage K4+445 – located in the upstream section ii. Garbage Interception Dam – located upstream on a tributary section iii. Garbage Interception Dam at chainage K15+532 – located in the core section iv. Garbage Interception Dam at chainage K21+688, and v. Garbage Interception Dam at chainage K25+870 – both located in the downstream section These structures are positioned near road access points to facilitate dredging and waste transfer operations, while minimizing water level rise and mitigating ecological disturbance in the surrounding restoration zones. Foe detailed structural design of the garbage interception dam See annex 7 of the report.

Scope	Narrative
Ancillary Buildings	As part of the broader Nairobi River Regeneration Programme, the project will include the development of critical support infrastructure to enhance safety, resilience, and operational efficiency. These facilities are strategically located to serve the project corridor and the surrounding communities: **Fire and Emergency Response Center** o Location: Ladhies Road, Nairobi, o Proximity: Situated to the south of Kamukunji Police Station o Purpose: To provide rapid response capabilities in the event of fire, flooding, or other emergencies along the Nairobi River corridor and adjacent urban settlements.

Additional components of the project will include, but are not limited to, the provision of affordable and social housing (to be implemented separately at a later stage), alongside integrated smart infrastructure and support systems aimed at optimizing operational efficiency and facilitating comprehensive environmental monitoring:

a) Smart Water Management System,
b) Automatic Water Quality Monitoring Stations,
c) Hydrological Automatic Monitoring Stations,
d) Meteorological Automatic Monitoring Stations,
e) Video Surveillance Equipment,
f) Smart Water Management Software Platform, and
g) Ancillary Buildings to Support Smart Water Services.

These components will enable real-time data collection, enhance water resource management, support early warning systems, and contribute to the long-term sustainability and resilience of the Nairobi River Regeneration Programme.

Positive Impacts

The main positive impacts of the proposed project will include but not limited to:

- **Improved water quality and ecosystem health**: Reduction in pollution through sewage infrastructure upgrades and waste management interventions.
- **Flood control and disaster risk reduction**: Riverbank expansion and dredging will enhance the Nairobi River's capacity to manage high water volumes, reducing the risk of flooding in adjacent communities.
- **Enhanced public health and sanitation**: Improved waste and wastewater management (including expansion of the Kariobangi Sewage Treatment Plant) will reduce exposure to waterborne diseases and environmental health risks.
- **Increased urban green spaces and recreational areas**: Construction of parks, pedestrian walkways, and cycle lanes will provide recreational facilities and promote healthier lifestyles.
- **Biodiversity conservation and wetland protection**: Restoration and protection of critical wetland habitats like Ondiri Swamp and Kikuyu Springs.
- **Economic opportunities and employment creation**: Job creation during construction, operation, and maintenance phases. Long-term economic growth through improved infrastructure and enhanced property values along the regenerated river corridor.
- **Improved infrastructure and connectivity**: Construction and rehabilitation of 27 bridges, non-motorized access roads, drainage systems, and street lighting will improve urban mobility and safety.

Summary of Potential Negative Impacts and Mitigation Measures

Phase	Potential Impact	Proposed Mitigation Measures
Construction Phase	Soil Erosion and Sedimentation	• Construct temporary surface drainage systems (e.g., diversion ditches, berms) to direct runoff away from exposed soils, • Install silt traps, sedimentation basins, and check dams to capture sediments before discharge into natural watercourses, • Apply mulch, erosion control blankets, or geotextiles on exposed soils and embankments to reduce surface runoff velocity and protect against rainfall impact, • Reinforce river dredging and widening areas with appropriate bank protection techniques as specified in engineering designs, • Limit stockpiling of soil and construction materials near drainage lines or riverbanks. All stockpiles shall be surrounded by silt fences, • Conduct regular inspections, especially after rainfall events, to ensure that erosion control structures are functional and properly maintained.
	Air Pollution (Dust, machinery emissions and foul smell)	• Regularly spray water on unpaved haul roads and access roads at least once daily to suppress dust. Erect hoardings around areas with high dust-generating activities to contain dispersion, • Maintain construction vehicles and machinery in good working conditions through regular servicing, and switching off engines when not in use to minimize emissions, • Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin, • During periods of high wind, dust-generating operations shall be prohibited within 200 meters of residential areas, • Cover stockpiles of loose materials with dust shrouds or tarpaulins to prevent wind-blown dust, and • Provision of appropriate PPEs for construction workers • Vehicles transporting pre-treated sediment to the temporary storage site will be fully covered with tarpaulin sheets to prevent spillage during transport. Additionally, the vehicles will not be overloaded, ensuring that they operate within their capacity limits, • Odor levels will be regularly monitored in sensitive areas, • Ensure that sediment at the temporary storage site is covered with a layer of mulch, followed by soil, and compacted with ventilation holes to minimize odor emissions, and • The sediment pre-treatment sites will be located at least 200m downwind from residential areas and other sensitive receptors such as schools and Hospitals.
	Water Pollution	• Store fuels, oils, paints, and other hazardous materials in secure, covered areas with secondary containment to prevent accidental spills leaking into the river, • Designate specific refueling areas with spill containment systems, away from the riverbanks and stormwater drains, • Maintain on-site spill kits and train personnel in spill prevention, containment, and response procedures, • Provide mobile toilets and handwashing stations for construction workers, to be regularly serviced by licensed waste handlers, • Clean up exposed waste near the river and construct leachate collection systems including HDPE pipes and concrete drainage channels,
	Noise Pollution	• Inform residents prior to construction about the anticipated noise levels and duration,

Phase	Potential Impact	Proposed Mitigation Measures
		• Conduct regular interviews with residents adjacent to construction sites to identify concerns. This will be used to adjust working hours of noisy machinery, • Regularly monitor noise levels at sensitive areas as per EMCA (Noise and Vibration) Regulation 2009. If noise is exceeded by more than 3-dB, equipment and construction conditions shall be checked, and appropriate mitigation measures instituted to rectify the situation, • The construction activities shall be restricted to daytime from 700hrs to 1700hrs. No night construction activities unless authorization are given by relevant Authorities, • Prioritize machinery and vehicles with noise-reduction technology or certified noise emission ratings, • Ensure all equipment and vehicles are well-maintained to avoid unnecessary noise from faulty parts or worn-out engines, • Fit machines with silencers, mufflers, and acoustic enclosures where applicable, • Stage high-noise operations activities to minimize cumulative noise levels, • Install temporary noise barriers (e.g., hoarding, earth berms, soundproof curtains) near high-noise machinery and along construction boundaries close to sensitive areas, • Provide and enforce the use of ISO certified PPEs (e.g., earplugs or earmuffs) for workers exposed to noise levels above **85 dB(A),** and • Ensure adherence to legal thresholds (e.g., **60 dB(A)** in residential areas during the day) and document findings in environmental monitoring reports.
	Solid and Liquid Waste Management	• Provide suitable waste storage containers at workers' construction sites. Install appropriately color-coded waste collection bins and ensure they are placed away from sensitive receptors., • Regularly transport the construction waste to an approved disposal facility through a registered NEMA waste handler, • Prohibit the burning of construction waste and encourage the reuse and recycling of solid waste to the greatest extent practically possible, • Ensure waste is sorted into categories (organic, recyclable, inert, hazardous) at generation points, • Reuse excavated materials (where uncontaminated) for backfilling or landscaping. Recycle metal, plastic, and wood waste where feasible, • Adhere to the Environmental Management and Coordination (Waste Management) Regulations, 2024, and • The contractor to develop and implement the Construction Waste Management Plan (C-WMP).
	Dredged Sediments	• The contractor will prepare a Construction Waste Management Plan as part of the C-ESMP in alignment with GIIP and national regulation requirements, • Use geotextile tubes, dewatering basins, or settling ponds to separate water from dredged sediments before transportation to landfills or abandoned quarry sites, • Stabilize contaminated sediments with lime, cement, or bentonite to prevent leaching, and • Use engineered containment cells lined with HDPE geomembranes to isolate toxic material.
	Occupational Health & Safety (OHS)	• Provide ISO Certified personal protection equipment (PPEs), such as safety boots, helmets, gloves, protective clothing, goggles, and ear

Phase	Potential Impact	Proposed Mitigation Measures
		protection, in accordance with relevant health and safety regulations (OSHA 2007), for workers, • The contractor will develop an Emergency Response Plan (ERP) to effectively manage emergencies, including those related to environmental and public health risks, such as hazardous material spills and other similar incidents, • Ensure that safety, rescue, and industrial health protocols are prominently communicated to all individuals present on-site, whether regularly or occasionally through training and inductions, • The contractor will provide comprehensive training for all construction workers on basic sanitation and healthcare practices, general health and safety protocols, and the specific hazards associated with their work, • Obtain necessary licenses, permits, and approvals for construction and hazardous operations, • The contractor will develop an OHS policy manual accessible to all workers and contractors and establish an OHS Management team responsible for: o Policy enforcement o Hazard identification o Incident response o Continuous improvement • The contractor shall conduct a baseline Work Hazard Analysis and develop mitigation plans for each hazard, • The contractor shall provide mandatory safety induction for all personnel including task-specific training (e.g., for dredging operators, welders, sewage handlers) and maintain records of all training and certifications, • The contractor shall conduct pre-employment medical checks and periodic health screenings as well as the provision of first aid kits and trained first aiders on site, • The contractor shall provide clean drinking water, sanitary facilities, and rest areas for workers, • Install warning signs and barriers around hazardous areas and moving equipment, • The project EHS personnel shall hold daily safety briefings and toolbox talks.
	Community Health & Safety	• Clear signage will be installed at construction sites to warn the public of potential hazards such as moving vehicles, hazardous materials, and open excavations and to raise awareness about safety, • All active construction sites will be secured, with appropriate fencing and high-visibility tapes to deter public access where necessary, • Secure machinery after construction works and restrict access with trained security, • The contractor to develop and communicate Emergency Preparedness and Response Plans through community Liaison office, • The project team to establish a Grievance Redress Mechanism (GRM), • Track incidents and complaints using a GRM monitoring log, • Provide First Aid facilities and trained personnel near construction zones. •
	Disruption of Utilities/Access	• The contractor will conduct detailed mapping using ground-penetrating radar (GPR) and consult with utility service providers (e.g., Nairobi Water, Kenya Power, Safaricom),

Phase	Potential Impact	Proposed Mitigation Measures
		• The contractor will notify service providers early and plan for temporary rerouting or supporting services during construction, • The contractor will establish on-site emergency repair teams to handle accidental damage to utilities immediately, • Stagger construction works to minimize simultaneous access blockages in the same locality, • The contractor shall provide clearly marked detours, temporary footbridges, and vehicle bypasses, • The contractor will ensure the temporary access paths are suitable for people with disabilities and emergency vehicles, • Engage with community leaders, business owners, and transport operators to understand key access needs and incorporate feedback into planning. •
	Biodiversity Disturbance	• Carry out works of embankment protection section by section while implementing greening works at the same time in order to minimize soil erosion and restore habitats, • Take special precautions during construction to protect local fauna which includes measures to safeguard habitats where small animals, reptiles, and common bird species reside particularly trees and vegetated areas along the riverbanks, • Ensure construction sites are well demarcated prior to any works and, that workers are fully informed of "no-go" areas, • Increase awareness of construction workers on the need to protect the environment, wildlife and vegetation around the construction sites. Training shall be conducted for all construction workers, • In the event that any injured animals are found during construction, these will be immediately reported to the project team, • Engage ecologists to relocate affected fauna where feasible, • Avoid nighttime construction in sensitive habitats to reduce disturbance to nocturnal species, • The contractors will sanitize equipment before moving between work zones to prevent the spread of invasive species along the corridor, • Collaborate with local conservation groups, schools, and residents to support replanting and awareness programs.
	Gender Base Violence	• The contractor will establish workers' safety committee which will include at least one trained female worker representative, • The contractor will develop and implement a workers' code of conduct, including GBVH policies, and mandatory training of all workers on sexual harassment and GBVH protocols.
	Traffic Disruption	• The contractor will prepare and implement a Traffic Management Plan (TMP) in consultation with the county government and traffic police, • Installation of temporary directional signage, safety barricades, and traffic cones, • Use variable message boards or fixed signs to alert drivers and pedestrians of construction zones, • Restrict movement of heavy construction vehicles to off-peak hours (e.g., early morning, late evening), • Where pedestrian bridges are under reconstruction, ensure temporary walkways or footbridge**s** are installed, • Engage traffic marshals and flagmen to control flow at busy intersections,

Phase	Potential Impact	Proposed Mitigation Measures
Operation Phase	Health and Safety (Kariobangi Sewage Operation)	• Use of safety shoes or boots with non-slip soles; • Posting safety instructions in each workshop regarding the storage, transport, handling, or pouring of chemicals; • Inspection of electrical equipment for safety before use, ensuring that all electrical cables are properly insulated, and taking faulty or suspect electrical equipment to a qualified technician for testing and repair; • Wearing safety goggles in areas where eyes may be exposed to dust, flying particles, or splashes of harmful liquids; • Wearing respiratory masks in the sludge dewatering and de-odor areas. Lastly, health and safety protocols will be incorporated into regular staff training programs, • Ensure that the Kariobangi Sewage Treatment Plant functions optimally to treat wastewater before discharge
	Solid Waste Accumulation along Riverbanks & Walkways	• Install labeled and covered bins at strategic intervals along walkways, parks, recreational spaces, and public gathering areas, • Develop and enforce a strict waste collection schedule (daily/weekly depending on foot traffic), • Run regular sensitization campaigns on proper waste disposal through signage, local media, • Collaborate with community-based organizations (CBOs) to monitor waste hotspots and report illegal dumping, • Register and integrate informal waste pickers into formal systems, and • Regularly clear trapped waste to avoid clogging and flooding.
	Sewer Blockage or Leakage (New Trunk Sewer)	• Establish a proactive inspection schedule to monitor leaks, blockages, or structural weaknesses, • Periodically flush and desilt sewer lines to prevent buildup of solids, grease, and debris, • Educate residents and businesses on proper waste disposal to prevent the introduction of non-biodegradable materials into the sewer, • Integrate sewer infrastructure maintenance into broader urban planning and drainage management frameworks.
	Degradation of Green Landscaping	• Engage professional landscapers or trained local personnel to manage upkeep, • Fence or demarcate landscaped areas clearly with signage to prevent foot traffic and unauthorized use, • Engage local residents, youth groups, and schools in “adopt-a-park” or “adopt-a-riverbank” programs, • Provide adequate bins to prevent littering and degradation of vegetation, and • Provide continuous training for maintenance staff on sustainable landscaping techniques.
	Pollution of River Water from Domestic and Commercial Sources	• Ensure all domestic and commercial premises within the riparian zone are connected to the expanded trunk sewer system, • Enforce the use of proper sanitation facilities and prohibit direct discharge into the river, • Monitor commercial and industrial facilities for compliance with NEMA’s Effluent Discharge Standards, • Increase access to regular and reliable solid waste collection services in nearby settlements and market areas, • Prohibit and penalize illegal dumping of waste into storm drains and waterways,

Phase	Potential Impact	Proposed Mitigation Measures
		• Run targeted awareness campaigns on the dangers of water pollution and the importance of proper waste disposal, • Establish river watch groups made up of residents, especially youth, to monitor pollution and report illegal discharge • Provision of designated manual waste disposal facilities or sanitation points within informal settlements located along the river corridor. These facilities will serve as controlled disposal sites, effectively deterring the direct release of raw sewage and greywater into the riverine ecosystem.
	Flood Risk and Water Level Fluctuations	• Conduct regular dredging to remove sediment buildup that reduces river flow capacity, • Install and maintain gabions, levees, and reinforced embankments to contain rising water levels, • Rehabilitate and protect natural vegetation buffers along riverbanks to absorb flood-waters and reduce surface runoff, • Restrict development within designated buffer zones, • Upgrade drainage systems to reduce urban surface runoff into the river, • Enforce zoning that prohibits settlement or construction in high-risk floodplains, • Promote tree planting and soil conservation in upstream catchment areas to improve water retention and reduce runoff, • Continuously collect data on rainfall, water levels, and land use changes using GIS and remote sensing.
	Public Safety Risks (Bridges, Parks, Lighting)	• Conduct routine structural assessments by qualified engineers, • Install high-quality guardrails and anti-slip surfaces, • Post clear signage for load limits, emergency contacts, and usage guidelines, • Ensure universal access to public amenities (ramps, handrails, tactile paving) for children, elderly, and people with disabilities.
	Encroachment on Riparian Zone	• Extend institutional monitoring (e.g., by NEMA, WRA, Nairobi River Commission) for at least 6–12 months after project demobilization, • Replace temporary structures with permanent ecological buffers (e.g., native vegetation belts, gabions, or wetlands), • Conduct awareness campaigns targeting residents near the river to educate them on the legal protections of the riparian zone, • Ensure riparian boundaries are gazetted and integrated into county spatial plans, • Use visible markers, fencing, or signage to clearly define protected riparian areas along the river, • Utilize satellite imagery and GIS systems to monitor land use changes and detect illegal encroachment in real-time, • Formalize handover to responsible agencies or community conservancies with clear maintenance and protection duties, • Schedule periodic patrols by enforcement officers, especially in high-risk or previously encroached areas, • Enforce EMCA, Physical and Land Use Planning Act, and County by-laws that prohibit construction or settlement in riparian zones.
Decommissioning	Solid Waste Generation	• The decommissioning contractor shall develop a site-specific WMP outlining how different types of solid waste (hazardous, recyclable, organic, construction debris) will be handled, stored, transported, and disposed, • The decommissioning contractor will set up clearly labeled bins or collection points to separate waste into categories for appropriate disposal and management,

Phase	Potential Impact	Proposed Mitigation Measures
		• Partner with licensed recycling firms for proper disposal of scrap metal, plastic, and e-waste, • All non-recyclable and non-hazardous waste should be transported to licensed landfills or dumpsites approved by NEMA and Nairobi City County, • The decommissioning contractor shall maintain records of types and volumes of waste generated, recycled, reused, or disposed, • Conduct induction training for decommissioning workers on proper waste handling procedures and the importance of waste minimization, • Remove all debris, packaging, and unused materials from site, and • Restore and rehabilitate waste-handling areas with soil stabilization and vegetation where appropriate.
	Soil and Water Contamination	• Store hazardous substances away from riverbanks, on raised platforms with leak detection and containment systems, • Conduct equipment and machinery fueling and maintenance offsite or in designated impermeable areas, • Carefully remove any buried tanks, drainage structures, or hazardous materials to prevent leaks, • Remediate contaminated areas using appropriate methods (e.g., bioremediation, excavation, soil washing), • Collect and dispose of any hazardous waste (e.g., oils, paints, solvents) through licensed handlers, and • Regular testing of soil and surface/groundwater for pH, hydrocarbons, heavy metals, and nitrates. •
	Air & Noise Pollution	• Use wet methods during structure demolition to suppress dust, • Re-vegetate exposed soil promptly to reduce wind erosion and dust, • Erect temporary noise screens or barriers near residential or sensitive areas (schools, hospitals, etc.), • Provide PPE (earplugs, earmuffs) for staff exposed to loud equipment
	Employment Loss	• Implement a phased demobilization schedule to reduce the sudden loss of employment, • Offer capacity building and vocational training programs during the project life cycle to prepare workers for new job opportunities, • Partner with government agencies and NGOs to support redeployment of skilled labor to other ongoing infrastructure projects or private sector initiatives, • Facilitate access to financing and training for small-scale entrepreneurship in sectors like recycling, urban farming, or eco-tourism, • Inform workers and community members in advance of the project timeline and planned closure activities to reduce uncertainty, and • Work with Nairobi County and national government agencies to absorb affected personnel into ongoing urban or environmental programs
	Community Safety Risks	• Erect proper fencing, warning signs, and access control around all hazardous and active demobilization sites, • Establish a confidential and accessible reporting system for safety concerns, GBV, and other community risks, • Ensure community security around sensitive project components and during off-hours, and • Collaborate with local administration, community health workers, and police to monitor safety issues and promptly address them.

Phase	Potential Impact	Proposed Mitigation Measures
	Disruption of Services	• Conduct thorough utility surveys prior to decommissioning and coordinate with service providers (water, power, telecom) for safe removal or rerouting, • Inform communities, businesses, and institutions well in advance about planned disruptions and provide timelines, • Provide temporary solutions such as water tanks, mobile toilets, generators, or bypass roads where permanent services are disrupted, and • Maintain a standby maintenance team to address accidental service interruptions promptly

Conclusion

A comprehensive Environmental Impact Assessment (EIA) study for the project components and activities has been conducted in compliance with Kenyan regulations and contemporary international EIA best practices. This EIA Report outlines the project plans and activities, documenting both the positive and potential negative effects on the environment (biophysical), socio-economic conditions, and public health. The identified significant negative impacts have been evaluated in detail, and appropriate mitigation measures have been proposed.

Measures to avoid, minimize, and mitigate potential environmental and social impacts of the project have been comprehensively outlined within an Environmental and Social Management Plan (ESMP). The ESMP serves as the principal framework for systematic management, monitoring, and reporting of the project's environmental and social impacts, in accordance with both national and international standards. The plan includes specific actions and performance indicators to ensure compliance with regulatory requirements and best practices throughout the project's implementation.

Public participation for the Nairobi River Regeneration Programme has been conducted in compliance with the Constitution of Kenya and EMCA, Cap 387. Consultations have ensured that stakeholder and project affected parties (PAPs) views are integrated into the Environmental and Social Management Plan (ESMP). However, consultation is a continuous process that will be maintained throughout the project lifecycle to promote transparency, inclusivity, and effective stakeholder engagement. A dedicated Grievance Redress Mechanism (GRM) will be developed and implemented as presented in this report (Chapter 9) at the national, county, and site levels to address any complaints or issues raised by affected stakeholders. The GRM will establish clear procedures for the resolution of grievances and ensure that all complaints are handled in a transparent and timely manner.

The implementation of the ESMP will be overseen by a multi-Agency Project team comprising representatives from relevant line ministries, regulatory agencies, contracted entities (Contractor), environmental and social consultants, as well as specialists in wetland and riverine ecosystems. This collaborative framework is designed to ensure that all identified environmental and social mitigation measures are executed effectively and in accordance with legal and regulatory requirements.

The implementation process will be supported by a robust monitoring system, with continuous performance tracking to assess compliance and the efficacy of the proposed mitigation strategies. Regular progress reports will be compiled and submitted to the appropriate oversight bodies, detailing implementation outcomes, challenges encountered, and any corrective actions taken. This approach ensures adaptive management and accountability throughout the lifecycle of the project.

Recommendations

For proper implementation and overall success of the proposed Nairobi River Regeneration Programme, we highly recommend the following measures, among others:

a) Public participation should remain an ongoing process throughout the project lifecycle. This includes structured community consultations, grievance redress mechanisms, and information dissemination,

b) Ensure that all project activities align with existing national laws (e.g., EMCA Cap 387, Water Act, Physical Planning Act) and international best practices in environmental and social safeguards,

c) Develop and implement a comprehensive monitoring and evaluation system with clearly defined indicators for tracking the effectiveness of mitigation measures in the ESMP,

d) Incorporate employment creation, skill development (transfer), and entrepreneurship initiatives targeting local communities, particularly vulnerable groups,

e) Prepare a detailed decommissioning and maintenance strategy, including restoration of affected ecosystems and infrastructure handover to relevant agencies or community, and

f) Prior to commencement of any construction or rehabilitation activities, secure all required legal and regulatory approvals.

Abbreviation

ACC	Assistant County Commissioner
AAO	Anaerobic-Anoxic-Oxic
AOI	Area of Influence
AWWDA	Athi Water Works Development Agency
BETA	Bottom-Up Economic Transformation Agenda
BOD	Biological Oxygen Demand
BOQ	Bill of Quantity
CAP	Climate Action Plan
CBO	Community Based Organization
CC	County Commissioner
CEC	County Executive Committee
CEEC	China Energy Engineering Group Company
CIDP	County Integrated Development Plan
COD	Chemical Oxygen Demand
CPP	Consultation and Public Participation
CPVC	Chlorinated Polyvinyl Chloride
C-WMP	Construction Waste Management Plan
dBA	A-weighted decibels
DCC	Deputy County Commissioner
DN	Diameter Nominal
DOSH	Directorate of Occupational Health and Safety
DPC	Deputy County Commissioner
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ERP	Emergency Response Plan
ESL	Earthcare Services Limited
ESMP	Environment and Social Management Plan
GBVH	Gender Based Violence and Harassment
GHG	Greenhouse Gas
GIS	Geographic Information System
GoK	Government of Kenya
GPR	Ground Penetrating Radar
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HAPCA	HIV and AIDS Prevention and Control Act
HDPE	High-density polyethylene
ISO	International Organization for Standardization
KALRO	Kenya Agricultural and Livestock Research Organization
KeNHA	Kenya National Highway Authority
KFS	Kenya Forest Services
KIWASCO	Kiambu Water and Sewerage Company
KPLC	Kenya Power and Lighting Company
KSTW	Kariobangi Sewage Treatment Work
KURA	Kenya Urban Roads Authority
MBR	Membrane Bioreactor
MoD	Ministry of Defense
MSME	Micro, Small and Medium Enterprises
NCA	National Construction Authority
NCCAP	National Climate Change Action Plan
NCCG	Nairobi City County Government
NCCRS	National Climate Change Response Strategy
NCWSC	Nairobi City Water and Sewerage Company
NDC	National Determined Contribution
NEMA	National Environment Management Authority

NGAO	National Government Administrative Officers
NGO	Nongovernmental Organization
NLC	National Land Commission
NMK	National Museum of Kenya
NMT	Non-Motorized Transport
NRC	Nairobi Rivers Commission
NUDP	National Urban Development Policy
OSHA	Occupational Safety and Health Act
PAPs	Project Affected Persons
PCU	Project Coordinating Unit
PMU	Project Management Unit
PPE	Personal Protective Equipment
PPGL	Pre-Painted Galvalume Steel
RC	Regional Commissioner
RCP	Representative Concentration Pathways
SBR	Sequencing Batch Reactor
SEA	Sexual Exploitation and Abuse
TDS	Total Dissolved Solids
TMP	Traffic Management Plan
ToR	Terms of Reference
TSS	Total Suspended Solid
UNCRC	United Nations Convention on the Rights of the Child
UPVC	Unplasticized polyvinyl chloride
VCT	Voluntary Counseling and Testing
VOC	Volatile Organic Compounds
WMP	Waste Management Plan
WPC	Wood Plastic Composite
WRA	Water Resources Authority

Table of Contents

List of Figures

List of Tables

List of Plates

1. INTRODUCTION

1.1. Background Information

Nairobi, once referred to as the "Green City in the Sun," derives its name from the Maasai phrase *Enkare Nairobi*, meaning "a place of cool waters." However, in recent years, rapid urbanization and encroachment have significantly degraded the tributaries and catchment areas of the Nairobi River System. In response, the Government of Kenya (GoK) has initiated an ambitious rehabilitation and restoration programme in line with the country's Vision 2030 development blueprint. The GoK acknowledges the critical role that water and sanitation play in supporting key economic sectors and improving the livelihoods of Kenyans. The current focus of the programme is the stretch from Nairobi Zone 1 to Nairobi Zone 5, which encompasses the Nairobi River corridor from its source at **Ondiri Swamp** in Kikuyu, flowing through **Kangemi and Kileleshwa**, past the **Arboretum and city centre**, to **1st Avenue Eastleigh**, and extending to **Dandora Falls**.

Bordering the Nairobi River and both contributing to and bearing the consequences of its pollution are residents of the city's expansive informal settlements. These unregulated communities, often located along the riverbanks, face heightened vulnerability to environmental hazards such as flooding, and exposure to waterborne contaminants. The combination of inadequate sanitation infrastructures, poor waste management, and limited access to sanitation exacerbates the health and safety risks faced by these communities.

Therefore, the rehabilitation of this strategic zone (**NRBZ1 Ondiri Swamp-NRBZ5- Dandora Falls**) is expected to yield substantial environmental, social, and economic benefits for the city dwellers. Achieving these outcomes requires a multifaceted approach, implemented through a series of well-designed catalytic projects and targeted interventions. The proposed rehabilitation programme will be carried out in phases, beginning with the Nairobi River Zones, followed by Ngong River and finally Mathare River.

In adherence to the applicable national regulatory frameworks, the Nairobi River Regeneration Initiative, under the stewardship of the Ministry of Defence (MoD) as the lead project management team, commissioned **Earthcare Services Limited** (ESL), a NEMA-registered firm of environmental experts to undertake an Environmental and Social Impact Assessment (ESIA) for the proposed Nairobi River Regeneration Programme and its associated amenities.

An Environmental Impact Assessment (EIA) is a strategic tool for identifying and evaluating the significant effects both positive and negative, short- and long-term, primary and secondary of any proposed development. It serves as a crucial decision-making instrument aimed at promoting sustainable development. EIA studies assess all actions that may lead to physical, chemical, biological, economic, cultural, and social changes in the environment due to a proposed project. Based on these assessments, mitigation measures are developed and integrated into the project to minimize, reduce, or offset adverse impacts while maximizing potential benefits.

1.2. Project Implementers

The Government of Kenya (GoK) is the project proponent and is represented by a multi-agency team. This team comprises key stakeholders, including the Ministry of Defense (MoD) serving as the lead project management entity and the Nairobi Rivers Commission (NRC), National Government Administrative Officers (NGAO), Water Resources Authority (WRA), Athi Water Works Development Agency (AWWDA), Kenya Power and Lighting Company (KPLC), National Land Commission (NLC), Kenya Forest Service (KFS), Kenya Urban Roads Authority (KURA), Kenya National Highways Authority (KeNHA), Ministry of Water and Sanitation, State Department for Housing and Urban Development, National Environment Management Authority (NEMA), Nairobi County Government (NCCG), and the Nairobi City Water and Sewerage Company Limited (NCWSC) amongst other relevant government department and agencies.

This multi-agency framework ensures coordinated planning, implementation, monitoring, and oversight of the Nairobi River regeneration program, drawing on the institutional expertise of each participating body.

1.3. Project Objectives

The project's development objective is to enhance the environmental quality of Nairobi City, particularly its polluted rivers, through various strategies, including the expansion of waste treatment systems and the integration of urban development initiatives. The proposed project is a transformative initiative designed to revitalize Nairobi's rivers

into vibrant, sustainable urban waterfronts. It is guided by key strategic and specific objectives, including but not limited to the following:

- Construction of pedestrian walkways and cycle lanes along the river riparian zone, including the installation of security lighting;
- Installation of a new trunk sewer line extending from Naivasha Road to Dandora Falls, traversing areas that were not previously approved or licensed under the planned design by Athi Water Works Development Agency (AWWDA);
- Expansion of the existing wastewater treatment facility at the Kariobangi Sewage Treatment Plant;
- Construction of pedestrian bridges to improve connectivity across the river corridor;
- River dredging and widening, coupled with riverbank protection and stabilization measures;
- Implementation of modern landscaping solutions to enhance the urban environment;
- Establishment of scenic, flower-lined riverbanks to promote aesthetic and recreational value;
- Construction of social amenities and support infrastructure, including public markets and other community-serving facilities, aimed at enhancing socio-economic development and improving the quality of life for local residents, and
- Protection and conservation of the Nairobi River's source at Ondiri Swamp and Kikuyu springs.

1.4. Objectives of ESIA

The main objectives of the Environmental Impact Assessment (ESIA) are to: assess the current status of the natural and social environment, as well as the existing environmental quality; evaluate the potential positive environmental impacts of the proposed project; identify, screen, and predict possible negative impacts; propose effective mitigation measures; and develop an Environmental and Social Management Plan (ESMP) for any unavoidable adverse impacts. These efforts aim to support the Environmental Impacts Assessment of the proposed project and provide a sound basis for decision-making.

1.5. Scope

The overall objective of the ESIA study is to ensure the proposed Nairobi River Regeneration Programme project is sustainable, socially and environmentally sound. The study will also ensure that all positive and adverse Environmental and social risks and impacts associated with the construction and operation of the proposed project, including associated /ancillary works and linked activities, if any, are assessed, evaluated and addressed as part of the mitigation measures incorporated into the project's final design, as applicable. The specific objectives of the assignment were to:

- Carry out and ESIA: To comprehensively identify, analyze, and evaluate the potential environmental and social impacts both positive and adverse associated with the proposed Nairobi River Regeneration Programme and its related infrastructure works;
- Prepare Environmental Social Management Plan (ESMP); Develop a detailed and actionable ESMP that outlines specific mitigation, monitoring, and institutional arrangements to manage the environmental and social impacts identified in the ESIA, and
- To propose feasible and effective mitigation measures aimed at preventing, minimizing, or compensating for significant adverse environmental and social impacts and safety risks at the project site and throughout all project activities.

1.6. Terms of Reference (TOR)

In accordance with legal requirements, Earthcare Services Limited (ESL) prepared the Terms of Reference (ToR) for the Environmental and Social Impact Assessment (ESIA) and submitted to the National Environment Management Authority (NEMA) for review and approval. The ToR outlined the framework and methodology for achieving the overall objectives of the EIA process. A summary of the approved Terms of Reference is as outlined below:

a) Description of site location/site, objectives, scope, nature of the proposed project,
b) Describe the proposed project activities during the project cycle; pre-construction, construction operation, decommissioning phases;
c) Analysis of materials to be used in the construction and implementation of the project, and wastes to be generated proposing alternative/appropriate options/technologies;

d) Establish the suitability of the proposed project in the proposed location;
e) Review and establish all relevant baseline information as will be required by NEMA (physical, biological and social cultural and economic) and identify any information gaps;
f) Description and analysis of policy, legal and institutional framework including but not limited to Kenyan policies, laws, regulation and guidelines; international guidelines related to the proposed project, which have a bearing on the proposed project and will also serve as benchmarks for monitoring and evaluation, and future environmental audits;
g) Undertaking In-depth description of the proposed project and associated work together with the requirements for carrying out the works;
h) Analysis of the efficacy of the designs, technology, procedures and processes to be used, in the implementation of the works;
i) Carrying out Consultation and Public Participation (CPP):
j) Identify key stakeholders and affected persons; and hold a public meeting (as need be) and provide /collect written evidence i.e. minutes/questionnaires;
k) Identification and analysis of the proposed project alternatives including but not limited to Project site alternatives, no project alternatives, design alternatives, material alternatives and technologies alternatives;
l) Identify, predict and carry out in-depth analysis of all actual potential and significant impacts on flora, fauna, soils, air, water, the social, cultural; the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated to be generated by the proposed project, both positive and negative throughout the project cycle;
m) Recommend sufficient enhancement and mitigation measures for all the potential positive and negative impacts identified and analyzed; and
n) Develop an ESMMP proposing the measures for eliminating, minimizing adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures;

1.7. Methodology

The Environmental Impact Assessment (EIA) process employed a range of methodologies in compliance with Section 58 of the Environmental Management and Coordination Act (EMCA), Cap 387, and as stipulated in the approved Terms of Reference (ToR). The methodologies utilized included the following but not limited to:

a) **Site Surveys (Fieldwork)**: On-ground inspections and assessments conducted to collect primary data and assess baseline environmental conditions;
b) **Remote Sensing and Geographic Information Systems (GIS):** Application of spatial analysis tools for mapping, monitoring, and analyzing land use, hydrological patterns, and environmental features within the project area;
c) **Interviews, Public Participation, and Stakeholder Engagement**: Structured interviews, community consultations, and stakeholder forums to gather input, identify concerns, and ensure compliance with participatory planning requirements;
d) **Document Reviews:** Examination of relevant legislative, review of project designs, policy, and technical documents, previous studies, and planning reports to inform the assessment and ensure alignment with existing regulatory frameworks.

1.7.1. Desk Reviews

A comprehensive literature review was conducted following the reconnaissance phase. This process involved the systematic examination of relevant legislation and policy frameworks, the project design document, County Integrated Development Plans (CIDPs), and previous studies conducted within the project area particularly those related to sanitation and water quality monitoring. The objective of the review was to determine the baseline environmental conditions and to establish the legal, institutional, biophysical, and socio-economic context of the project area.

1.7.2. Fieldwork Site Reconnaissance

The fieldwork exercise and site reconnaissance for this study were conducted between **March and April 2025**. These visits were essential for collecting primary data and conducting preliminary assessments to support impact identification and analysis. Key aspects evaluated during the site visits included:

- Vegetation composition and faunal activity along the project corridor and its immediate surroundings;
- Terrain morphology and physical features, including land gradient, surface drainage patterns, and edaphic (soil-related) characteristics;
- Current land use patterns and ongoing or existing developments along the project area and its zone of influence;
- Preliminary identification of receptors potentially affected by the project's biophysical and socio-economic impacts; and
- Stakeholder engagement activities, including public consultations and focus group discussions, aimed at gathering community input and concerns.

1.7.3. Remote Sensing and GIS Analysis

Remote sensing analysis was conducted using available satellite imagery covering the Project Area of Interest (AOI). The data obtained was ground-truthed by the consulting relevant stakeholders during field visits to ensure accuracy and contextual relevance. This approach facilitated spatial analysis of key environmental and physical parameters, including land use/land cover classification, hydrological features, and topographical variation within the project zone.

1.7.4. Public Participation and Stakeholder Engagement

Public participation and engagement are a continuous process. The ESIA consulting firm (**Earthcare Services Limited**) conducted comprehensive stakeholder and public engagement activities along the proposed project corridor, specifically targeting key settlements within the riparian zone. These included Korogocho (Ruaraka Sub-County), Dandora (Embakasi North Sub-County), and Gituamba (Kasarani Sub-County).

Public consultation sessions were organized with the support of local community mobilizers and area administrative authorities. Notices detailing the purpose, schedule, and locations of the meetings were disseminated in advance to ensure broad community participation. The engagement process was primarily facilitated through the involvement of local chiefs/Assistant County Commissioner's (ACCs), who played a critical role in mobilizing residents and coordinating communication throughout the public participation phase. However, it's worth noting that public consultation and engagement exercise is a continuous process which will continue throughout the implementation and operation of the proposed project.

1.8. Project Justification

The overall goal of the project is to enhance the health and quality of life for residents of Nairobi and to promote a cleaner urban environment by providing comprehensive sewerage services, including the collection and treatment of wastewater. The construction of new trunk sewers, expansion of the reticulation system, and increased capacity of wastewater treatment plants will significantly reduce pollution levels in the Nairobi Rivers, lower the incidence of waterborne diseases and mortality rates, and ultimately boost the population's productivity. This will be achieved through the rehabilitation Nairobi and expansion of the Kariobangi conventional sewerage treatment plant currently operating at about 30% of its design capacity to the full capacity.

Rapid urban growth and limited sewerage infrastructure, especially in the informal settlement areas have led to the discharge of raw sewage into Nairobi's rivers, causing significant pollution and health issues. The project aims to address these challenges by improving and expanding the sewerage system through infrastructure rehabilitation, new construction, institutional support, and community programs such as market centres and community centres. These efforts will reduce pollution, improve public health, and enhance the quality of life for residents while supporting sustainable urban growth.

The Nairobi River Rehabilitation and Regeneration programme is not only an environmental and infrastructural intervention, but also a strategic enabler of Kenya's **Bottom-Up Economic Transformation Agenda (BETA)**. The programme directly supports BETA's core pillars, especially urban regeneration, job creation, public health, food security, and social equity.

1.9. Project Estimated Cost

The proposed project is estimated to cost approximately **Ksh 37,599,568,421.99** encompassing construction, procurement, and other related activities necessary for successful implementation of the proposed project. A detailed Bill of Quantities (BoQ) outlining the cost breakdown is provided in the report annexure.

Section No.	FINAL SUMMARY	Page NO	Amount
1	PRELIMINARIES	19	**1,037,116,000.00**
2	TRUNK SEWER WORKS	33	**6,051,741,470.00**
3	KARIOBANGI WASTE WATER TREATMENT PLANT	97	**5,054,278,439.31**
4	CATCHMENT RESTORATION AND PROTECTION	102	**642,488,970.00**
5	FLO0D CONTROL AND STORM WATER WORKS	119	**6,421,385,895.30**
6	SOLID WASTE MANAGEMENT WORKS	122	**2,849,153,579.00**
7	CAR WASH GREASE INTERCEPTORS	126	**17,648,460.00**
8	TRANSPORT INFRASTRUCTURE	137	**5,369,112,886.58**
9	COMPREHENSIVE URBAN SCAPE (CORE SECTOR)	153	**1,918,255,646.06**
10	SUPPORTING BUILDINGS AND STRUCTURES	159	**425,520,000.00**
11	SURVEYS, DESIGN AND PROJECT MANAGEMENT	163	**4,997,867,075.74**
12	SUPERVISION	164	**1,315,000,000.00**
13	CONTINGENCIES	165	**1,500,000,000.00**
	Carried to Form of Tender	**KES**	**37,599,568,421.99**

2. DESCRIPTION OF THE PROJECT

2.1. Brief Overview

Nairobi Rivers are polluted with uncollected garbage; human waste from informal settlements; industrial wastes in the form of gaseous emissions, liquid effluents, agro-chemicals, Petro-chemicals, metals and over-flowing sewers. The riparian reserves of the three Nairobi Rivers (Mathare, Ngong and Nairobi) are encroached by numerous informal and formal settlements without adequate sewage and sanitation services. Industrial buildings, Informal economic activities such as markets and "Jua Kali" commercial enterprises along the rivers also discharge their wastes into the rivers. This situation has caused the spread of water-borne diseases, loss of livelihoods, loss of biodiversity, reduced availability and reduced potential of the rivers becoming source of safe potable water, and the insidious effects of toxic substances and heavy metal poisoning which affects human productivity.

2.2. Project Output and Components

The Nairobi River Regeneration Project aims to achieve sustainable economic development within the Nairobi River Basin through a comprehensive and integrated approach to environmental restoration, ecological protection, and urban revitalization. The primary outcome is the restoration and long-term protection of the Nairobi River and its associated ecosystems, while enhancing public health, resilience, and socio-economic opportunities for surrounding communities as outlined in Table 1 below.

Table 1: Project Component and Outputs

Scope	Narrative
Construction of New Trunk Sewer	The proposed project will include the construction of a new reinforced concrete box culvert trunk sewer with enhanced conveyance capacity, intended to replace the existing trunk sewer currently operating beyond its design limits. The new system is designed to accommodate wastewater volumes of up to 310,000 cubic meters per day. The proposed trunk sewer will be constructed along the Nairobi River riparian reserves, specifically targeting sections that were not included or licensed under the ongoing construction works by Athi Water Works Development Agency (AWWDA) under the license Number: (**NEMA/EIA/PSL/5318**). The areas of interest for this intervention will include the following zones: • Nairobi River -Naivasha Road to Museum Hill (approximately 10.7km) • Kirichwa Kubwa River–Dagoretti to Chiromo at confluence with Nairobi River (approximately 9km), • Nairobi River–Museum Hill to Dandora Falls as double trunk, and (approximately 16.7km). The alignment will include manholes at regular intervals for inspection and maintenance, as well as provisions for future network expansion. The proposed trunk sewer line will serve a wide range of urban and peri-urban areas along the Nairobi River Basin. The upper catchment service areas, located south of Waiyaki Way, include neighborhoods such as Westlands, Lavington, Kangemi, Kawangware, Waithaka, Uthiru, Kinoo, and Kikuyu. The central Nairobi River catchment encompasses densely populated and commercially active zones, including the Nairobi Central Business District (CBD), Kamukunji, Gikomba, Eastleigh, various Nairobi Eastlands estates, Moi Air Base, Kariobangi, Dandora, and Korogocho. In the lower catchment area, the sewer infrastructure will extend services to the rapidly growing settlements of Mwiki, Njiru, Chokaa, and Ruai, thereby

Scope	Narrative
	contributing to improved sanitation and environmental health across the broader Nairobi metropolitan region. The new trunk sewer canal will serve an area of 119.90 km², with a current (2025) population of 495,934 and a projected population of 1,952,559 by 2065.
Construction of new wastewater treatment plant at Kariobangi	As part of the Nairobi River Regeneration Programme, the proposed project includes the expansion of the existing Kariobangi Sewage Treatment Plant (STP) to achieve a wastewater treatment capacity of 60,000 cubic meters per day. The expanded facility will employ the Anaerobic-Anoxic-Oxic (AAO) biological treatment process, a proven and efficient technology for nutrient removal and high-quality effluent discharge. • **Site Context**: The expansion will take place within the footprint of the existing Kariobangi STP, which already functions as a wastewater treatment facility. This approach leverages existing infrastructure and minimizes the project's spatial and environmental footprint. • **Sludge Management**: The new design will incorporate advanced sludge treatment systems to ensure that the by-product is adequately stabilized and suitable for reuse. • **Automation and Monitoring**: The upgraded plant will feature automated control and monitoring systems across all treatment units. These systems will enhance operational safety, ensure compliance with effluent quality standards, and allow for real-time performance tracking and remote system management. This expansion is a critical infrastructure investment aimed at improving environmental health, reducing pollution loads into the Nairobi River, and promoting sustainable urban sanitation services.
Rehabilitation of Dandora Garbage Dumpsite (Phase I)	The Dandora landfill, having been exposed to the natural environment for an extended period, has progressively expanded toward the banks of the Nairobi River. As a result, solid waste and leachate have been directly discharged into the river system, making the landfill a significant source of pollution. As part of this project, targeted cleanup operations will be undertaken to remove a portion of the accumulated waste. Following waste removal, the exposed slopes will be stabilized and covered to mitigate further environmental degradation, prevent erosion, and reduce the infiltration of leachate into the river. **Activities** • Solid waste accumulation along the Nairobi River, from chainage 24+350 to 25+100, will be cleared within a 50-meter buffer zone extending toward the Dandora landfill, measured from the centerline of the river channel. The removed waste will be safely relocated and deposited at designated sections of the landfill, well away from the riverbank. **Drainage System:** To ensure effective surface water management and slope stability, a reinforced concrete drainage ditch measuring 800mm × 800mm will be constructed at the base of the slope. **Leachate drainage**: As part of the landfill remediation works, a leachate collection system will be installed at the base of the garbage slope within the

<table>
<tr><th>Scope</th><th>Narrative</th></tr>
<tr><td></td><td>designated rehabilitation area. The system includes the following components:

• A 400mm-thick sand and gravel layer to function as the leachate collection and diversion medium.
• A DN300 HDPE perforated corrugated pipe (commonly referred to as a "flower pipe") embedded within the sand-gravel layer for leachate conveyance.
• A 300mm fine sand layer beneath the pipe to act as the leachate support and filtration base.

Collected leachate will be directed through the main collection pipe to a leachate collection pool, which is designed with a total storage capacity of 200 cubic meters (m^3). This system will ensure efficient drainage, minimize infiltration into the river, and support safe and environmentally sound leachate management. (For details see Annex 7).</td></tr>
<tr><td>River Flood Control Works</td><td>River training through development of weirs, constructed wetlands, garbage interception dams and riverbank stabilization is proposed for the project. A number of garbage interception dams have been identified for the project as shown in the sub table but not limited to.
<table>
<tr><th>Name</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>Kirinyaga road bridge</td><td>-1.2788632</td><td>36.8219819</td></tr>
<tr><td>Globe round about</td><td>-1.27855</td><td>36.8216967</td></tr>
<tr><td>Chiromo interchange</td><td>-1.27387</td><td>36.8106833</td></tr>
<tr><td>James Gichuru road bridge</td><td>-1.2674269</td><td>36.7745738</td></tr>
<tr><td>Kabasasiran road bridge</td><td>-1.2673412</td><td>36.7674523</td></tr>
<tr><td>Mau-Mau informal settlement</td><td>-1.2700454</td><td>36.7628446</td></tr>
</table></td></tr>
<tr><td>Decentralized Wastewater Treatment Plants (Car Wash Wastewater Management System)</td><td>As part of the environmental protection measures under the Nairobi River Regeneration Programme, a targeted intervention has been included to address pollution from wash activities within the river basin.

A total of 40 brick-constructed car wash wastewater grease traps will be installed at strategically identified high-traffic car wash zones across the basin. Each grease trap is designed with the following specifications:

• Effective volume: 6 cubic meters
• Dimensions: 4.74 meters (length) × 1.94 meters (width) × 2.25 meters (depth)

Operational Flow: Car wash wastewater is first collected via newly constructed open drainage ditches located in the parking lots or car wash bays. The wastewater then flows into the grease traps, where residual oil and sediment are effectively separated. The treated effluent is subsequently directed into the main sewer trunk line, thereby reducing the risk of direct pollution to the Nairobi River and improving the quality of urban runoff.</td></tr>
<tr><td>Urban Transport Infrastructure</td><td>The design scope for the proposed subcomponent project includes the following key components aimed at enhancing accessibility, safety, and urban connectivity along the Nairobi River corridor:

• Pedestrian Walkways- Dedicated footpaths to ensure safe and</td></tr>
</table>

Scope	Narrative
	continuous pedestrian movement along the riverbanks, • **Bicycle Lanes**–Segregated cycling tracks to promote non-motorized transport and reduce vehicular congestion, • **Reconstruction of Demolished Bridges**–Restoration of both motor vehicle and pedestrian bridges that were removed during the river widening operations, • **Street Lighting**–Installation of adequate and energy-efficient lighting infrastructure to improve nighttime visibility and public safety, and • **Signage and Wayfinding Systems**–Placement of directional and informational signs to guide users and enhance navigation within the river corridor. The proposed design includes the construction and rehabilitation of a total of 27 bridges along the Nairobi River corridor. These include both vehicular bridges and pedestrian bridges, some of which are designated as landscape bridges. • The proposed motor vehicle bridges are designed with a width of 14.5 meters, accommodating standard traffic lanes and enhancing roadway capacity, and • The pedestrian bridges are designed with a width of 3 meters, ensuring safe and accessible crossings for non-motorized users. •

Comprehensive Urban Landscape	The design scope of this component is situated within the core section of the project area, specifically between the intersection of Museum Hill and 1st Avenue Eastleigh. The primary development focus will include the construction of four thematic parks and supporting infrastructure aimed at enhancing recreational and cultural amenities along the Nairobi River corridor. Key elements of the construction include:
	
	• **Red Ribbon Park**: This park features a variety of landscapes and aesthetic elements including:
	  ○ Landscape bridges
	  ○ Red ribbon pergolas
	  ○ Breadfruit pergolas
	  ○ Rest pavilions
	  ○ Greening and landscaping features
	• **Historical and Cultural Park**: Designed to celebrate and preserve local heritage, this park includes:
	  ○ Visitor service centers
	  ○ Public squares
	  ○ Historical and cultural landscape walls
	  ○ Leisure benches
	  ○ Pavilions and pergolas
	  ○ Extensive greening and soft landscaping
	
	These parks aim to provide vibrant public spaces that integrate cultural, historical, and environmental values, contributing to urban regeneration and community well-being.

Restoration and Protection Catchment area (Ondiri Swamp)	The proposed project encompasses two environmentally sensitive and endangered wetland areas: Ondiri Swamp and Kikuyu Springs. Each of these wetlands covers an area of approximately 250,839 square meters, with a circumference of 2,379 meters. These wetlands are critical ecological zones and will be subject to targeted protection and conservation measures as part of the project implementation.

Scope	Narrative
	The proposed enclosure structures will consist of wood polymer composite fence posts measuring 2,600 mm in length with a 100 mm × 100 mm cross-section, spaced 3,000 mm apart. Each post will be anchored in a concrete foundation with a 200 mm diameter and 450 mm depth. The fence body will be constructed using 2.5 mm high-strength barbed wire, securely fastened to the posts to form a durable and continuous protective barrier with at least six (6) main entrance.
Constructed Wetland	The project will also include the construction of an artificial wetland located at the intersection of Kangora Road and Convent Drive in the upper reaches of the Nairobi River. The wetland is designed to treat 4,500m³ of water per day, with a hydraulic retention time of four (4) days. It will be enclosed with a protective fence and equipped with an entrance gate. Water will enter the wetland through a DN500 inlet pipe and exit via a DN500 drainage pipe. The structure will be bordered by mortar-laid stone retaining walls, and appropriate wetland vegetation will be planted to support natural filtration and ecological restoration.
River Bank Expansion and Dredging	In response to the challenges posed by the narrow channel and limited flood-carrying capacity of the Nairobi River, bank expansion and dredging works will be undertaken along the river section between chainages **10+112 and 26+580 Km** (**Detailed Map Anex 7**). These works aim to widen and deepen the river channel, thereby increasing its flow capacity and overall volume. This intervention is designed to reduce the risk and impact of flooding on adjacent communities and infrastructure, and to enhance the river's flood management performance to meet the discharge requirements of a 50-year return period flood event. The total length of the bank expansion and dredging works along the core segment of the Nairobi River, spanning from chainage 10+112 to 16+550, is approximately 6.25 kilometers. This includes a 140-meter stretch within the National Museum Park area. The river channel excavation will be carried out in accordance with the designated riverbed control width, ranging from 12 to 17 meters. Excavation depths will vary between 3 and 5 meters, with riverbank slopes maintained at a gradient of 1:1 to ensure stability and structural integrity. In the downstream section of the Nairobi River (chainage 16+550 to 26+580), the river channel excavation will follow a riverbed control width ranging from 20 to 22 meters. The excavation depth will range between 3 and 5 meters, with riverbank slopes maintained at a 1:1 gradient. The top of the riverbanks will be excavated based on actual site conditions and slope stability requirements. The total length of bank expansion and dredging in this downstream section is approximately 10.03 kilometers.
River Bank Protection Sub-project	The core section of the river, spanning from pile number 10+112 (upstream of Dr. Riverside Road Bridge) to 16+550 (upstream of Lamu Road Bridge), will primarily utilize prefabricated ecological frame retaining wall slope protection. In areas with severe scouring along the concave riverbanks, upturned concrete retaining wall footings will be applied. The total length of the managed core section is 6.153 km, with newly constructed bank protection works totaling 11.599 km comprising 5.765 km on the left bank and 5.834 km on the right bank. The downstream section of the river extends from pile number 16+550

Scope	Narrative
	(downstream Lamu Road Bridge) to 26+580 (upstream of Dandora Falls). In this segment, gabion stone cage retaining walls will be primarily used for slope protection. For areas with severe scouring along concave banks, inclined concrete footings will be combined with slope protection measures. The total length of the river channel under comprehensive management in this section is 10.030 km, with a total of 19.808 km of newly constructed bank protection work 9.906 km on the left bank and 9.902 km on the right bank. Of this, 3,887 meters will utilize gabion net revetments, while 15,881 meters will consist of combined C20 concrete and gabion net structures. For detailed engineering specifications, design layouts, and alignment plans related to bank protection works, refer to Annex 7 of this report
Construction of Ecological Weir	As part of the project's landscape enhancement and ecological restoration efforts, a total of 12 new ecological weirs are proposed for construction along the Nairobi River. These weirs are strategically distributed across the river corridor as follows: d) **Upstream Section:** 2 ecological weirs o Weir 1: Pile No. 3+950 o Weir 2: Pile No. 4+860 e) **Core (Middle) Section:** 9 ecological weirs o Weir 3: Pile No. 10+720 o Weir 4: Pile No. 11+905 o Weir 5: Pile No. 12+225 o Weir 6: Pile No. 12+420 o Weir 7: Pile No. 12+600 o Weir 8: Pile No. 13+585 o Weir 9: Pile No. 14+250 o Weir 10: Pile No. 15+300 o Weir 11: Pile No. 15+773 f) **Downstream Section:** 1 ecological weir o Weir 12: Pile No. 25+700 These structures are designed to enhance river aesthetics, support aquatic habitats, and contribute to the broader ecological integrity of the Nairobi River Basin. The dam structure of each ecological water retaining weir will be constructed using **C25** buried stone concrete, ensuring durability and stability. The central portion of the weir will feature an overflow rolling section, designed to facilitate controlled water flow and reduce erosion. This overflow section will be constructed in a stepped configuration, enhancing both hydraulic efficiency and visual appeal while promoting aeration and ecological integration with the surrounding environment. (**Refer to Annex 7** for detailed typical design drawing of ecological weir)
Solid Waste Management Sub-project	As part of the project's integrated solid waste management strategy, a total of five (5) garbage interception dams will be constructed along the Nairobi River. The locations are strategically selected to optimize accessibility, minimize ecological disruption, and facilitate efficient waste removal and maintenance. The layout is as follows: i. Garbage Interception Dam at chainage K4+445 – located in the upstream section ii. Garbage Interception Dam – located upstream on a tributary section iii. Garbage Interception Dam at chainage K15+532 – located in the core section iv. Garbage Interception Dam at chainage K21+688, and v. Garbage Interception Dam at chainage K25+870 – both located in the

Scope	Narrative
	downstream section These structures are positioned near road access points to facilitate dredging and waste transfer operations, while minimizing water level rise and mitigating ecological disturbance in the surrounding restoration zones. For detailed structural design of the garbage interception dam See annex 7 of the report.
Ancillary Buildings	As part of the broader Nairobi River Regeneration Programme, the project will include the development of critical support infrastructure to enhance safety, resilience, and operational efficiency. These facilities are strategically located to serve the project corridor and the surrounding communities: **Fire and Emergency Response Center** ○ Location: Ladhies Road, Nairobi, ○ Proximity: Situated to the south of Kamukunji Police Station ○ Purpose: To provide rapid response capabilities in the event of fire, flooding, or other emergencies along the Nairobi River corridor and adjacent urban settlements.

2.3. Project Location

The designated area of focus for this project encompasses zones NRBZ1 to NRBZ5 (as illustrated in Design Map Annex 7), following the Nairobi River corridor from its source at **Ondiri Swamp (K0+000~K10+000) is 10.0km long)**, through **Kangemi** and **Kileleshwa**, past the **Arboretum** and Nairobi's **Central-Business District (K10+000~K16+600) is 6.6km)**, extending through **1st Avenue Eastleigh**, and terminating at **Dandora Falls (K16+600~K26+580) 9.98km**). The proposed rehabilitation and associated works will be executed in sequential phases, beginning with the Nairobi River corridor (zones NRBZ1 to NRBZ5), followed by interventions along the Ngong River, and subsequently the Mathare River. These two rivers, all tributaries of the greater Nairobi River system, form an integral part of the broader Nairobi Rivers Basin targeted for restoration programme.

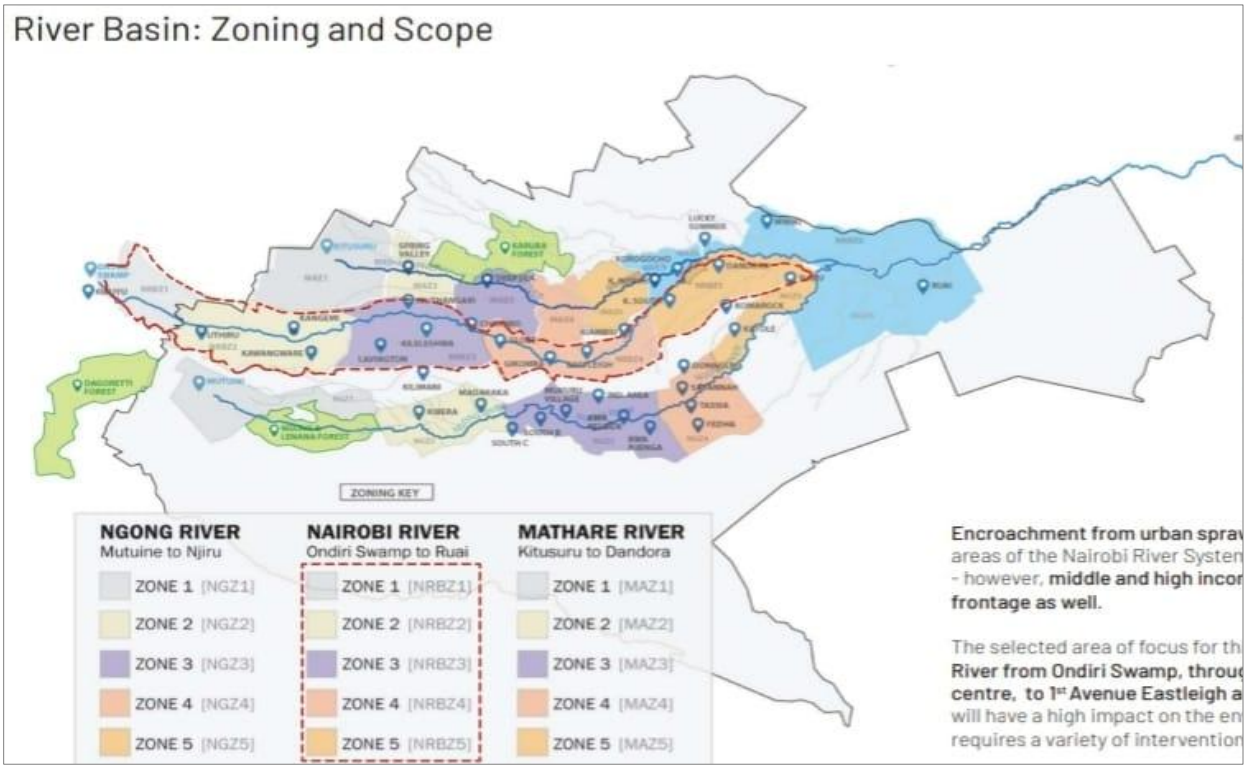

Figure 1: Proposed Project Corridor (Detailed and Visible Map in Annex 7)

2.4. Project Activities

Riverbanks, riparian buffers, and river habitats are critically important when planning any riverfront project. Other important components of ecosystem function that were considered in the design include geology, morphology, hydrology, and land cover which will be integrated into the regenerative design, stormwater management, habitat restoration, public access, stewardship, and redevelopment.

2.4.1. River-Bank Protection

Certain sections of the Nairobi River's banks exhibit active erosion or are highly susceptible to fluvial degradation. The proposed intervention seeks to mitigate these issues by implementing structural stabilization measures and ecological restoration. Specifically, the scope of works for the Nairobi River mainstem will include:

a) Bank stabilization utilizing gabion retaining structures to prevent further erosion and enhance slope integrity.

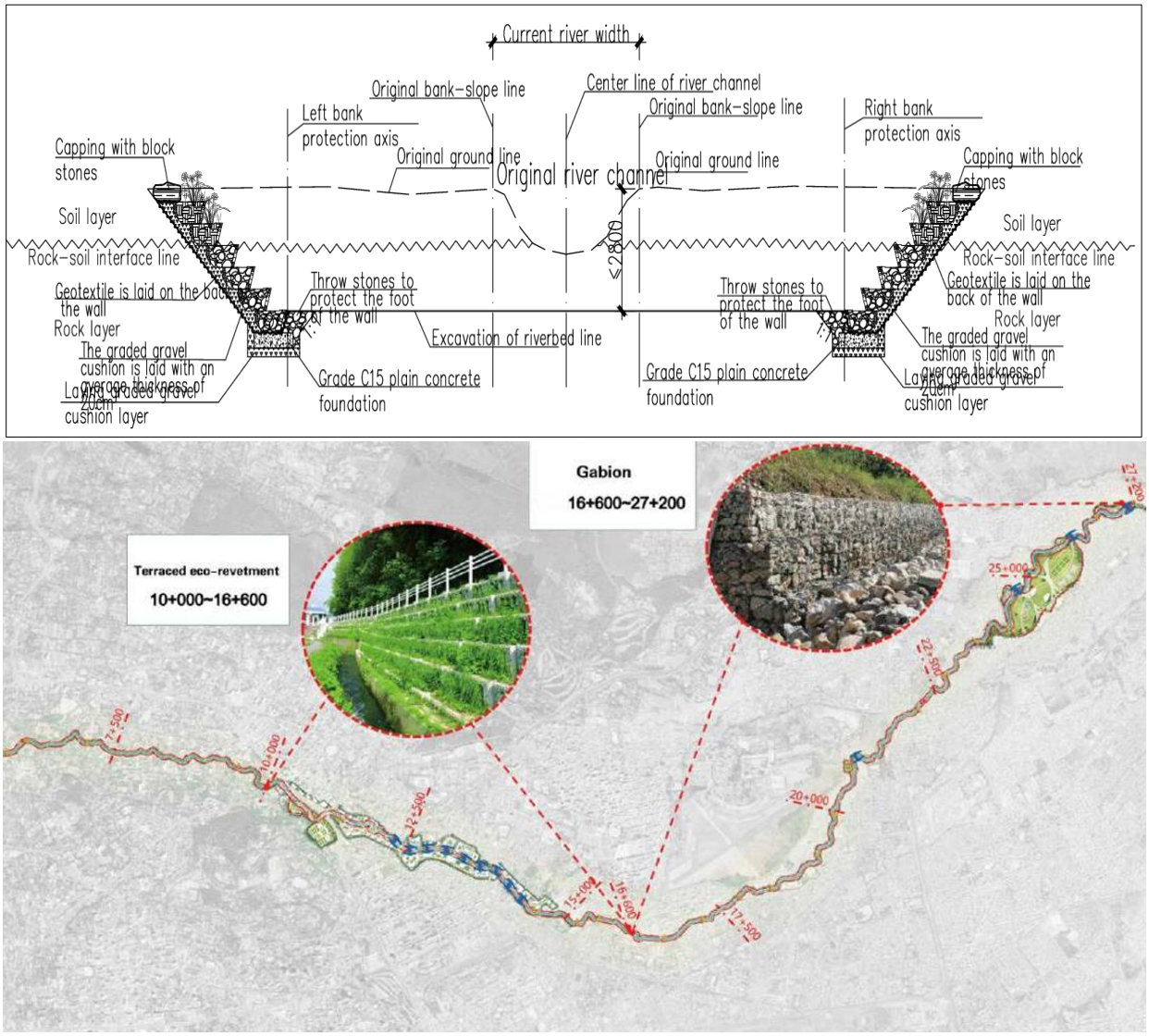

Figure 2: Proposed Embankment Works

2.4.2. River Watercourse Widening and Dredging

As a result of channel clogging caused by the accumulation of solid waste, the Nairobi River has experienced a significant reduction in hydraulic efficiency. The bank expansion and dredging work will be undertaken along the river section between **10+112 and 26+580 Km**, **10+112 to 16+550**, is approximately 6.25-kilometer while in the

downstream section of the Nairobi River (chainage **16+550 to 26+580**), the river channel excavation will follow a riverbed control width ranging from 20 to 22 meters. These works aim to widen and deepen the river channel, thereby increasing its flow capacity and overall volume.

- **Widening** will involve the strategic excavation of riverbanks to increase the channel's cross-sectional area. This intervention will help accommodate higher flow volumes during peak rainfall events, thereby minimizing overbank flooding and associated property and infrastructure damage. Bank profiling will be conducted to ensure stable side slopes and reduce the risk of bank failure, and

- **Dredging** will consist of the removal of accumulated sediments, debris, and other obstructions from the riverbed. This process will restore the original channel depth, reduce flow resistance, and improve water quality by minimizing sediment re-suspension. Dredged material will be tested and appropriately managed or disposed of, in compliance with EMCA (Waste Management) Regulations 2024.

Plate 1: Typical Dredging and Expansion Activities

2.4.3. Construction of Garbage Interception Dam

As part of the project's integrated solid waste management strategy, a total of five (5) garbage interception dams will be constructed along the Nairobi River. The locations are strategically selected to optimize accessibility, minimize ecological disruption, and facilitate efficient waste removal and maintenance. The layout is as follows:

- Garbage Interception Dam at chainage K4+445 – located in the upstream section
- Garbage Interception Dam – located upstream on a tributary section
- Garbage Interception Dam at chainage K15+532 – located in the core section
- Garbage Interception Dam at chainage K21+688, and
- Garbage Interception Dam at chainage K25+870 – both located in the downstream section

These structures are positioned near road access points to facilitate dredging and waste transfer operations, while minimizing water level rise and mitigating ecological disturbance in the surrounding restoration zones. For detailed structural design of the garbage interception dam See annex 7 of the report.

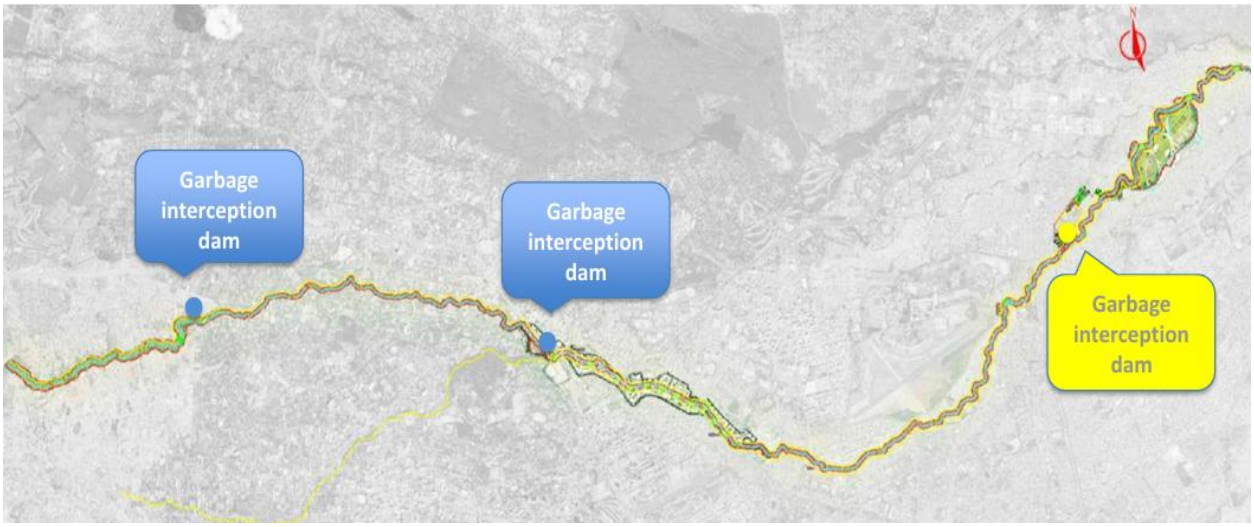

Figure 3: Location for the Proposed Garbage Interception Dams

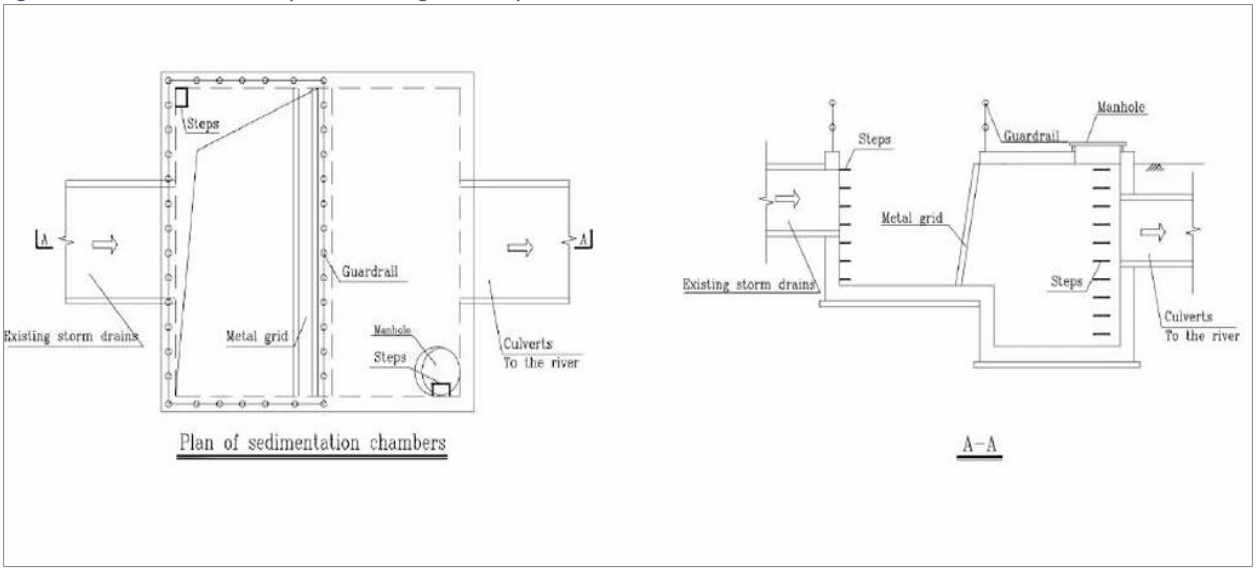

Figure 4: Proposed Sediment Chambers Design

2.4.4. Construction of New Sewer Trunk

The proposed project will include the construction of a new reinforced concrete box culvert trunk sewer with enhanced conveyance capacity, intended to replace the existing trunk sewer currently operating beyond its design limits. The current Nairobi's existing sewer network spans approximately 163 kilometers, covering around 208 km², which accounts for less than 30% of the city's 696 km² area[1]. The new system is designed to accommodate wastewater volumes of up to 310,000 cubic meters per day. The proposed trunk sewer will be constructed along the Nairobi River riparian reserves, specifically targeting sections that were not included or licensed under the ongoing construction works by Athi Water Works Development Agency (AWWD) as outlined in the ESIA report of 2016. The areas of interest for this intervention will include the following zones:

- Nairobi River -Naivasha Road to Museum Hill (approximately 10.7km),
- Kirichwa Kubwa River–Dagoretti to Chiromo at confluence with Nairobi River (approximately 9km), and
- Nairobi River–Museum Hill to Dandora Falls as double trunk, and (approximately 16.7km).

The alignment will include manholes at regular intervals for inspection and maintenance, as well as provisions for future network expansion. The trunk sewer line will serve a wide range of urban and peri-urban areas along the Nairobi River Basin. The proposed trunk sewer will significantly enhance the sewage conveyance capacity along the

[1] Athi Water Services Board Nairobi Rivers Sewerage Improvement Project (Phase II) ESIA Report 2016.

Nairobi Rivers basin, providing sufficient hydraulic headroom to accommodate current and projected future flows, particularly during peak wet weather events. The new alignment will run parallel to the existing trunk line, allowing for uninterrupted service during construction and a phased transition once the new infrastructure is commissioned.

2.4.5. Expansion of Kariobangi Sewage Treatment Works

The Kariobangi Sewerage Treatment Works (KSTW) was established in 1960 and has been operational since 1963. Its primary purpose is to convey and treat wastewater from various regions, including Kariobangi, Westlands, and the City Centre. The core function of the plant is to process domestic effluent, ensuring the proper treatment and management of wastewater. KSTW has a designed capacity of 94,000 m³/per day, although its current operational capacity is 23,000 m³/per day. The plant is equipped with both electro-mechanical and biological systems that work together to effectively process and treat the incoming wastewater[2].

As part of the Nairobi River Regeneration Programme, the proposed project includes the expansion of the existing Kariobangi Sewage Treatment Plant (STP) to achieve a wastewater treatment capacity of 60,000 cubic meters per day. The expanded facility will employ the Anaerobic-Anoxic-Oxic (AAO) biological treatment process, a proven and efficient technology for nutrient removal and high-quality effluent discharge. The facility will be developed on the site of an existing wastewater treatment plant (Kariobangi Sewage Treatment Plant), allowing for the leveraging of existing infrastructure, utilities, and access roads to reduce capital costs and environmental disruption.

The new plant will be designed in accordance with modern standards for wastewater treatment, incorporating advanced sludge treatment technologies to ensure efficient and sustainable resource recovery. A key feature of the design will be the integration of processes that enable recycling of treated sludge into raw material for fertilizer production. The expansion project will use modified oxidation ditch as the main biological process, which is the same process used in the existing Wastewater Treatment Plant (WWTP).

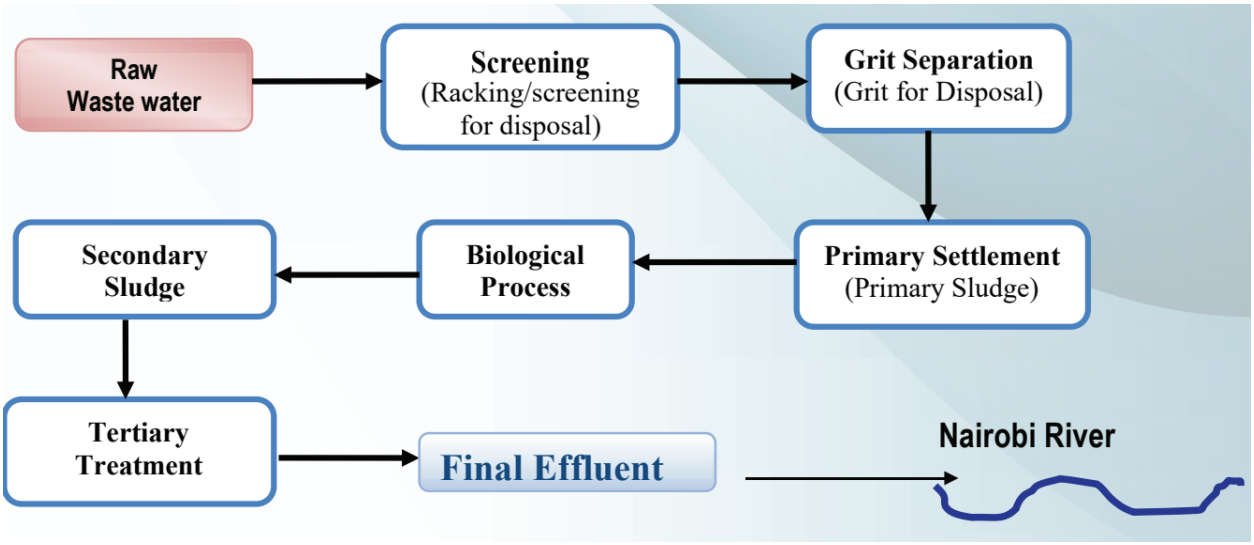

Figure 5: Kariobangi Treatment Process Flow Diagram

[2] https://www.nairobiwater.co.ke/kariobangi-sewerage-treatment-works/

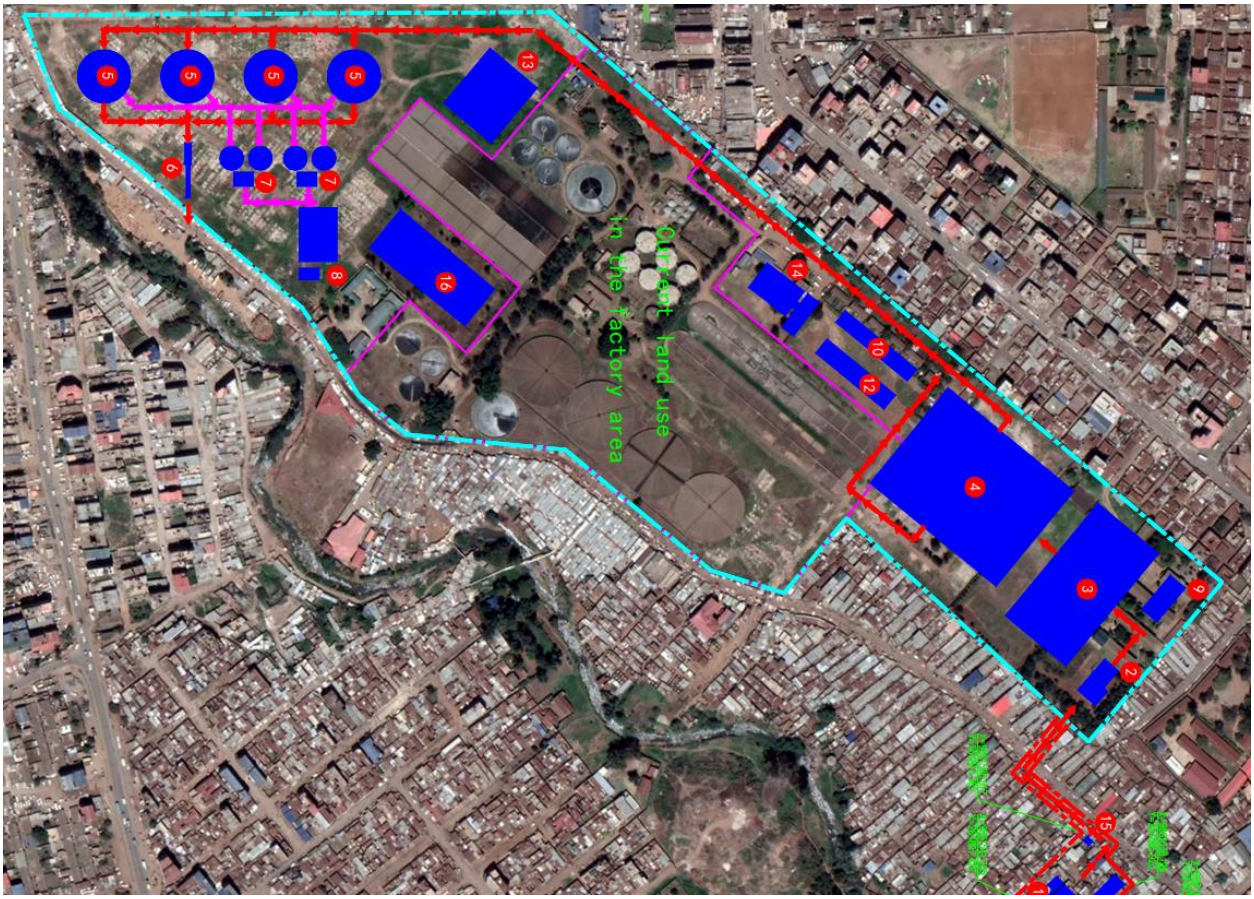

Figure 6: Existing Kariobangi Sewage Treatment Plant (Source: Project Design)

2.4.6. Construction of New Crossing Bridges

As a result of the proposed river widening and channel expansion, a total of 27 bridges along the Nairobi River corridor will be reconstructed to accommodate the increased channel width and to ensure structural integrity and safety under the new hydrological conditions. Additionally, new bridges will be constructed at strategically identified crossing points to enhance connectivity and provide safe, uninterrupted access for both vehicular and pedestrian traffic.

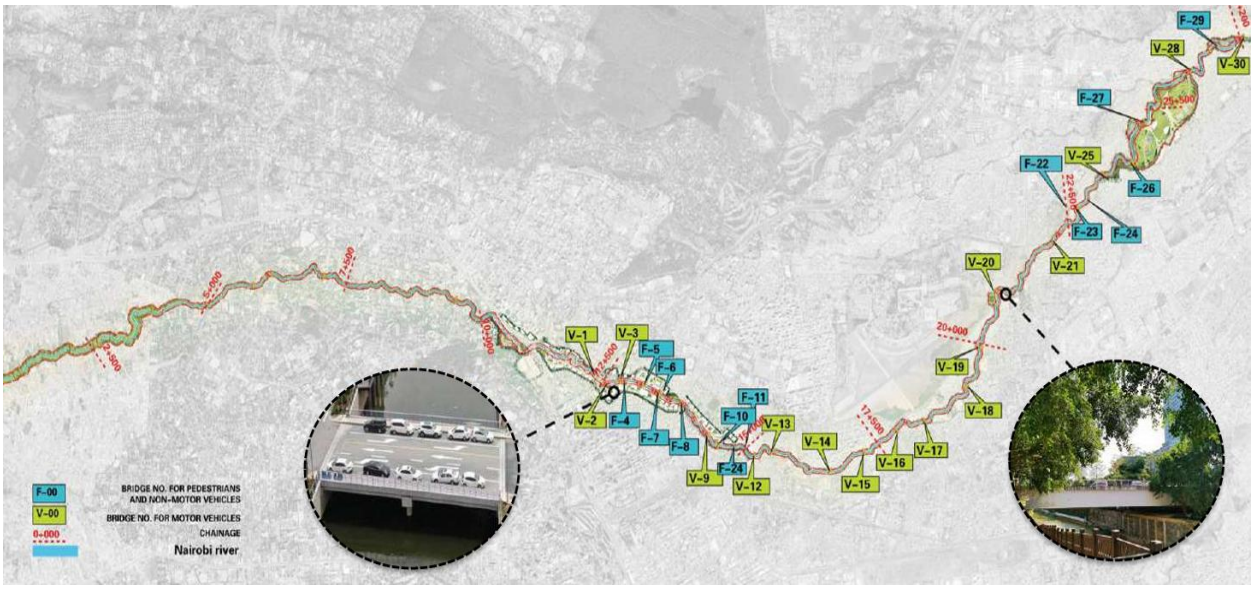

Figure 7: Proposed Location for New Bridges

2.4.7. Dandora Dumpsite Rehabilitation

The Dandora Dumpsite, located to the east of Nairobi, Kenya, is a significant waste disposal site approximately 8 kilometers from the city center. Spanning across 32 acres of land, the dumpsite is situated in proximity to several densely populated informal settlements, including Dandora, Kariobangi North, Korogocho, and Baba Dogo (Njoroge, 2007). In recent years, the Dandora Dumpsite has progressively expanded towards the banks of the Nairobi River, exacerbating pollution in the waterway through the accumulation of solid waste and leachate runoff[3].

As part of this project, targeted cleanup operations will be undertaken to remove a portion of the accumulated waste. Following waste removal, the exposed slopes will be stabilized and covered to mitigate further environmental degradation, prevent erosion, and reduce the infiltration of leachate into the river.

Activities: Solid waste accumulation along the Nairobi River, from chainage 24+350 to 25+100, will be cleared within a 50-meter buffer zone extending toward the Dandora landfill, measured from the centerline of the river channel. The removed waste will be safely relocated and deposited at designated sections of the landfill, well away from the riverbank.

Drainage System: To ensure effective surface water management and slope stability, a reinforced concrete drainage ditch measuring 800mm × 800mm will be constructed at the base of the slope.

Leachate drainage: As part of the landfill remediation works, a leachate collection system will be installed at the base of the garbage slope within the designated rehabilitation area. The system will include the following components:

- A 400mm-thick sand and gravel layer to function as the leachate collection and diversion medium.
- A DN300 HDPE perforated corrugated pipe (commonly referred to as a "flower pipe") embedded within the sand-gravel layer for leachate conveyance.
- A 300mm fine sand layer beneath the pipe to act as the leachate support and filtration base.

Collected leachate will be directed through the main collection pipe to a leachate collection pool, which is designed with a total storage capacity of 200 cubic meters (m^3). This system will ensure efficient drainage, minimize infiltration into the river, and support safe and environmentally sound leachate management. (For details see Annex 7).

Plate 2: Current Dumpsite Solid Waste Along the River (Source: Fieldwork)

[3] Nairobi City County Integrated Development Plan (CIDP) 2023–2027

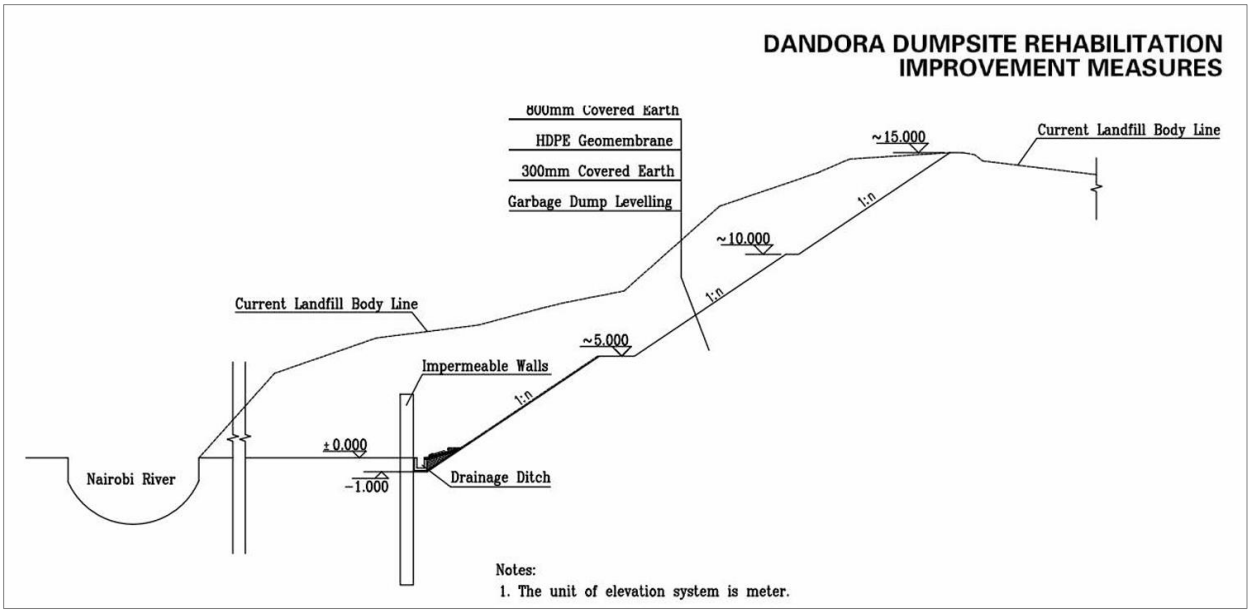

Figure 8: Proposed Slope Stabilization Design (Source: Project Design)

2.5. Associated Infrastructures

On both sides of the Nairobi Rivers Basin, within a 30-meter buffer zone, exist dense informal settlements. These settlements are not only significant contributors to river pollution due to inadequate waste management and lack of sanitation infrastructure but also act as major constraints to the ecological restoration, landscape enhancement, and commercial revitalization of the river corridor. To address these challenges and promote inclusive urban transformation, the project will implement a phased construction of social amenities such as car wash, community centre and ablutions.

2.5.1. Community Centers (Social Hall)

The proposed development (Nairobi River Project) will feature single-storey structures with rooftop amenities, designed as Riverfront Community Centers strategically located along the Nairobi River corridor. These centers aim to support inclusive urban regeneration and foster social cohesion within the surrounding communities. Each center will offer;

- Study areas for students,
- Meeting and multipurpose spaces for community use,
- Gardens and green areas to enhance livability and urban greening, and
- Accessible washroom facilities for public convenience.

In addition to delivering essential services, the centers will function as administrative and coordination hubs for local community programs and activities within each designated zone. By offering spaces for learning, interaction, and resource-sharing, the centers will promote local engagement, enhance social resilience, and improve access to public services for all community members.

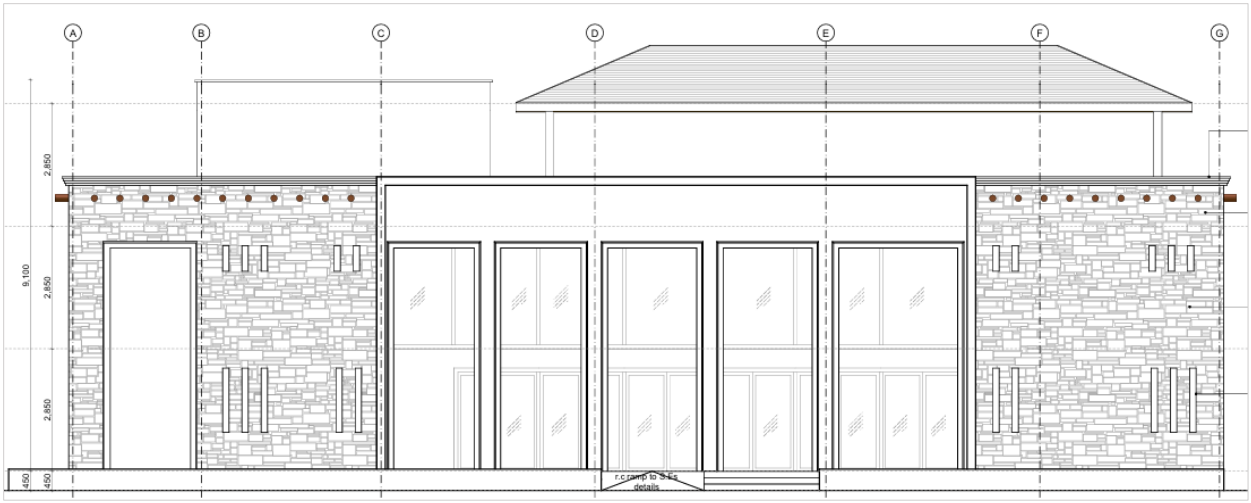

Figure 9: Cross-Sectional Community Centre (Source: Project Design)

2.5.2. Landscaping and Environmental Creation

As part of the Nairobi River regeneration initiative, the proposed project will incorporate a comprehensive landscaping program spanning the entire river corridor. The primary objective is to enhance the visual appeal, ecological function, and recreational value of the riverine environment, while reinforcing the identity of the Nairobi River as a shared public space. Scope of Landscaping Works shall entail but not limited to:

- **Greening and Re-vegetation**: Planting of native and adaptive plant species along embankments and buffer zones to stabilize soil, improve biodiversity, and create shaded areas for pedestrians.
- **Riverwalk and Pathways**: Development of pedestrian-friendly walkways, jogging tracks, and cycle lanes integrated with seating areas and view decks, and
- **Urban Furniture and Lighting**: Installation of benches, bins, artistic features, and eco-friendly lighting to improve usability and safety of the space, particularly during evening hours.

Figure 10: Artistic Impression of the Planned Landscaping Model

The landscaping initiative will not only improve the aesthetic quality of the riverfront but also contribute to urban cooling, flood mitigation, and community well-being, aligning with the principles of sustainable urban design and climate resilience.

2.5.3. Ecological Wiers

As part of the project's landscape enhancement and ecological restoration efforts, a total of 12 new ecological weirs are proposed for construction along the Nairobi River. These weirs are strategically distributed across the river corridor as follows:

a) **Upstream Section:** 2 ecological weirs
   - Weir 1: Pile No. 3+950
   - Weir 2: Pile No. 4+860

b) **Core (Middle) Section:** 9 ecological weirs
   - Weir 3: Pile No. 10+720
   - Weir 4: Pile No. 11+905
   - Weir 5: Pile No. 12+225
   - Weir 6: Pile No. 12+420
   - Weir 7: Pile No. 12+600
   - Weir 8: Pile No. 13+585
   - Weir 9: Pile No. 14+250
   - Weir 10: Pile No. 15+300
   - Weir 11: Pile No. 15+773

c) **Downstream Section:** 1 ecological weir
   - Weir 12: Pile No. 25+700

These structures are designed to enhance river aesthetics, support aquatic habitats, and contribute to the broader ecological integrity of the Nairobi River Basin. The dam structure of each ecological water retaining weir will be constructed using **C25** buried stone concrete, ensuring durability and stability. The central portion of the weir will feature an overflow rolling section, designed to facilitate controlled water flow and reduce erosion. This overflow section will be constructed in a stepped configuration, enhancing both hydraulic efficiency and visual appeal while promoting aeration and ecological integration with the surrounding environment. (**Refer to Annex 7** for detailed typical design drawing of ecological weir).

Figure 11: Proposed Wier Locations (Source: Project Design)

2.5.4. Road Rehabilitation, Public and Non-Motorized Transport Improvements

This component aims to enhance non-motorized transport infrastructure and public safety within the project area. It will involve the construction of dedicated walking and cycling lanes along the river's riparian zone to promote environmentally friendly and health-conscious modes of transportation. Additionally, the project will include the widening and repaving of existing pedestrian walkways to improve accessibility and comfort for users.

2.5.5. Protection of Ondiri Catchment and Kikuyu Spring

Ondiri wetland is located 200m South of Kikuyu town in Kikuyu Sub-County in Kiambu County surrounded by 6 administrative locations namely: Kikuyu, Muguga, Sigona, Karai, Kinoo and Kabete, the size of the wetland is 34.5 ha with a perimeter of 3.3km making it Kenya's largest peat bog. The wetland forms the headwaters of Nairobi River and is part of the Lari-Ondiri fault drainage system recharging the Kikuyu springs through a subterranean passage. The wetland supports an estimated population of 94 species of resident and migratory birds such as Cattle Egret, Sacred Ibis, Hadada Ibis, King fisher's, Hammer kop, Jackson's widow, grey crown cranes (endangered) and African

marsh harrier as well as approximately 68 plant species and 26 species of macro invertebrates. It provides a range of critical ecosystem services and products that are indispensable to human survival, health and welfare[4].

The proposed project encompasses two environmentally sensitive and endangered wetland areas: Ondiri Swamp and Kikuyu Springs. Each of these wetlands covers an area of approximately 250,839 square meters, with a circumference of 2,379 meters.

The proposed sub project activities will involve enclosure structures will consist of wood polymer composite fence posts measuring 2,600 mm in length with a 100mm × 100 mm cross-section, spaced 3,000 mm apart. Each post will be anchored in a concrete foundation with a 200 mm diameter and 450 mm depth. The fence body will be constructed using 2.5 mm high-strength barbed wire, securely fastened to the posts to form a durable and continuous protective barrier with at least six (6) main entrance. Protecting Ondiri Wetland is integral to the broader Nairobi River Regeneration Programme, which seeks to:

- Reduce Pollution by implementing measures to minimize environmental pollution and manage solid waste effectively,
- Preserve habitats for local and migratory bird species, contributing to the region's biodiversity, and
- Develop eco-tourism and community-based conservation initiatives that provide alternative livelihoods while fostering environmental stewardship.

The ongoing efforts to protect and restore Ondiri Wetland are essential for the health of the Nairobi River and the well-being of surrounding communities. Continued collaboration among government agencies, local organizations, and the community will be crucial in achieving the objectives of the Nairobi River Regeneration Programme and ensuring the sustainable management of this invaluable wetland ecosystem.

2.5.6. Constructed Wetlands

The project will also include the construction of an artificial wetland located at the intersection of Kangora Road and Convent Drive in the upper reaches of the Nairobi River. The wetland is designed to treat 4,500 m^3 of water per day, with a hydraulic retention time of four (4) days. It will be enclosed with a protective fence and equipped with an entrance gate. Water will enter the wetland through a DN500 inlet pipe and exit via a DN500 drainage pipe. The structure will be bordered by mortar-laid stone retaining walls, and appropriate wetland vegetation will be planted to support natural filtration and ecological restoration.

2.5.7. Management and Monitoring

The Nairobi Rivers Basin Regeneration Programme will integrate smart technology and data-driven solutions to enable comprehensive, efficient, and sustainable management of the river system. A Smart River Management and Monitoring System will be established, covering the entire stretch of the Nairobi River and its tributaries. This system will also integrate with human intervention leading to skill transfers.

[4] NEMA: Ondiri Wetland Management Plan 2022-2027

Figure 12: Proposed Smart Technology

Through this smart approach, the regeneration programme aims to set a new standard for sustainable urban river control, blending technology, human capacity, and ecological stewardship.

2.5.8. Other Critical Components

Additional components of the project will include, but are not limited to, the provision of affordable and social housing (to be implemented separately as subproject components at a later stage), alongside integrated smart infrastructure and support systems aimed at optimizing operational efficiency and facilitating comprehensive environmental monitoring:

a) Smart Water Management System,
b) Automatic Water Quality Monitoring Stations,
c) Hydrological Automatic Monitoring Stations,
d) Meteorological Automatic Monitoring Stations,
e) Video Surveillance Equipment,
f) Smart Water Management Software Platform, and
g) Ancillary Buildings to Support Smart Water Services.

These components will enable real-time data collection, enhance water resource management, support early warning systems, and contribute to the long-term sustainability and resilience of the Nairobi River Regeneration Programme

2.6. Project Construction Materials and Machinery

2.6.1. Building construction materials

The construction will incorporate a range of high-quality materials selected for their durability and suitability to the project requirements. Reinforced Cement Concrete (RCC) will be used for all primary structural components, including footings, columns, beams, and slabs, ensuring a strong and stable framework. The foundation walls will be built using Random Rubble Masonry (RRM), while hard stones will be employed for stone filling to enhance base stability. For concrete works, a carefully proportioned mix of cement, sand, and graded crushed rock will be used to achieve the desired strength and finish. Door frames will be fabricated from Wood Plastic Composite (WPC), chosen for its resistance to moisture and decay, whereas window frames will be constructed from Fiber Reinforced Plastic (FRP), known for its lightweight and corrosion-resistant properties. Window shutters will utilize Unplasticized Polyvinyl Chloride (UPVC), offering low maintenance and excellent insulation. Flooring will feature high-quality tiles for a durable and aesthetic surface.

Mild steel will be used for railings, providing both safety and a sleek appearance, while the roof structure will be supported by a steel tubular truss system. The roof itself will be clad in Pre-Painted Galvalume Steel (PPGL) sheets,

offering excellent weather resistance and a long service life. For plumbing and sanitary installations, the materials will include Chlorinated Polyvinyl Chloride (CPVC) pipes and High-Density Polyethylene (HDPE) pipes, both selected for their durability and corrosion resistance. Sanitary fixtures will comprise Indian-style vitreous squatting pans as well as European-style pedestal water closets, providing options suited to diverse user preferences.

To ensure sustainability and environmental protection, all earth-based construction materials, including aggregate, sand, and stone will be responsibly sourced from local, authorized suppliers. This approach guarantees compliance with quality standards, promotes sustainable resource use, and supports the local economy. Furthermore, all material must be sourced from the approved National Environment Management Authority (NEMA) to ensure adherence to environmental regulations.

2.6.2. Construction Machinery

The Nairobi River Regeneration Programme will require a range of construction machinery and equipment tailored to the scope of works such as river dredging, bank protection, infrastructure upgrades, and ecological restoration as outlined in the below.

Table 2: Project Construction Equipment's

Category	Machinery/Equipment	Purpose/Use
Earthworks &Excavation	Excavators (tracked & wheeled)	Dredging, slope shaping, and excavation
	Bulldozers	Grading, clearing, and levelling
	Backhoe Loaders	Trenching, digging, backfilling
	Skid Steer Loaders	Small-scale or confined space excavation
	Dump Trucks / Tipper Trucks	Hauling excavated materials and debris
River Dredging & Slope Works	Amphibious Excavators	Dredging in marshy or submerged areas
	Hydraulic Dredgers	Removing riverbed sediments
	Crane Trucks	Lifting gabions, weir components, bridge parts
	Concrete Mixers (mobile & stationary)	Mixing and placing concrete for structural works
Material Handling & Transport	Wheel Loaders	Moving soil, gravel, aggregates
	Lowbed Trailers	Transporting heavy construction equipment
	Water Bowsers	Dust control and compaction
Road & Park Infrastructure	Asphalt Pavers	Laying asphalt on roads and walkways
	Road Rollers / Compactors	Soil and surface compaction
	Motor Graders	Shaping roads and walkways
Wetland & Landscaping Works	Hydro seeders	Vegetation restoration and erosion control
	Augers / Post Drivers	Installing fencing, lighting, and signage poles
	Tractor-Mounted Sprayers	Irrigation and plant maintenance

2.6.3. Construction Waste

Typical construction waste will include surplus construction materials, empty cement bags, packaging materials, and other by-products generated during the construction phase of the Nairobi River Regeneration Programme. All construction waste shall be managed in strict compliance with the Environmental Management and Coordination (Waste Management) Regulations, 2024. This will involve appropriate segregation, storage, collection, and disposal procedures to ensure that materials are handled responsibly. The objective is to minimize environmental pollution, protect natural resources, and safeguard public health and safety. Where feasible, recyclable materials shall be recovered and reused in line with sustainable construction practices.

- **Dredging Wastes**

Dredging activities will generate waste primarily composed of sediments, which may contain pollutants posing potential environmental risks. To mitigate these impacts, all dredged materials shall undergo appropriate treatment and dewatering processes to reduce contaminants to acceptable levels before final disposal. Treated sediments will be disposed of at licensed waste handling landfills in full compliance with national environmental regulations, including the Environmental Management and Coordination Act (EMCA) and relevant NEMA guidelines.

Where feasible and environmentally appropriate, alternative disposal methods, such as backfilling old or exhausted quarries, may be considered, subject to approval and guidance from the Nairobi City County Government (NCCG) and relevant regulatory authorities. These measures aim to minimize ecological disturbance and ensure sustainable sediment management throughout the dredging process.

2.7. Operation Wastes

During the operational phase of the Nairobi River Regeneration Project, the primary types of waste expected include:

- Effluent Discharge: Mainly from sanitation facilities within recreational parks, public amenities, and nearby service centers., and
- Solid Waste (Litter): Generated from daily use of recreational parks, pedestrian walkways, and other public areas by visitors.

2.8. Land Requirement and Ownership

The proposed Nairobi River Regeneration Project will be implemented along the Nairobi River wayleave and designated riparian corridor. Based on current assessments, it is anticipated that no land acquisition or compensation will be required, as the project alignment predominantly follows public land. However, the implementing agency will adhere to the Riparian Pegging Report issued by the Water Resources Authority (WRA) and will make every effort to avoid or minimize any potential impacts on private property, informal settlements, or sources of livelihood.

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1. Introduction

This Chapter outlines the legislative and policy frameworks relevant to the Nairobi River Regeneration Project, including those that will form the basis for assessing the application. It also identifies site-specific planning policy designations applicable to the project area. Given that legislation and policy are subject to change and ongoing development, all relevant statutes and policies will be continuously reviewed throughout the implementation phase of the project.

3.2. The Constitution of Kenya, 2010

The Constitution of Kenya, adopted in August 2010, serves as the primary legal foundation for environmental and social impact assessments in the country. It provides a comprehensive framework to guide current and future development, shaping both national and sectoral legislation. Article 42 affirms that every individual has the right to a clean and healthy environment. This right includes the protection of the environment for the benefit of present and future generations, through legislative and other appropriate measures.

Articles 10, 42, and 69 collectively emphasize public participation as a key principle of governance. They safeguard the right to a healthy environment and mandate the state to promote inclusive involvement in environmental management, conservation, and protection. Specifically, Article 10 underscores the importance of citizen participation, sustainable development, and the protection of marginalized lands. It also acknowledges the adverse effects of centralized governance and empowers communities particularly those in marginalized rangelands to have a voice in the management and development of their resources. ***Relevance: The proposed development is intended to enhance environmental quality by fostering a clean and safe environment for all***.

3.3. The Kenya Vision 2030

Kenya Vision 2030 is the country's development Programme from 2008 to 2030. It was launched on 10 June 2008 and its aim is to help transform Kenya into a newly industrialized, middle-income country with an aimed annual growth of 10 % by 2030. Developed through an all-inclusive and participatory stakeholder consultative process, involving Kenyans from all parts of the country, the Vision is based on three "pillars": Economic, Social, and Political. It calls for promoting environmental conservation and pollution and waste management, through the application of the right economic incentives in development initiatives. ***Relevance: The proposed project is in line with the Vision 2030 by contributing to sustainable development***.

3.4. National Environment Policy, 2014

his Policy seeks to achieve a better quality of life for present and future generations by promoting the sustainable management and use of the environment and natural resources. To achieve this goal, the Policy outlines several key objectives. First, it aims to establish a comprehensive framework for integrated planning and sustainable management of Kenya's environmental and natural assets. It also seeks to strengthen the legal and institutional structures responsible for coordinating and overseeing environmental and resource-related matters, ensuring a more effective and cohesive approach.

Sustainable use and conservation of Kenya's unique terrestrial and aquatic ecosystems are central to the Policy, recognizing their vital role in supporting economic growth and improving livelihoods across the country. To support these efforts, the Policy promotes investment in research and capacity development, as well as the adoption of innovative environmental management tools. These tools include incentives and disincentives, total economic valuation, sustainability indicators, Strategic Environmental Assessments (SEAs), Environmental Impact Assessments (EIAs), and environmental audits. ***Relevance; The undertaking of this Environmental Impact Assessment reflects the project's adherence to the requirements set out in this policy***.

3.5. National Climate Change Action Plan (NCCAP, 2023–2027)

The NCCAP (2023–2027) is the third action plan under Kenya's climate policy framework and supports the implementation of the Climate Change Act, 2023. It outlines the priority climate actions Kenya will pursue over a five-year period to meet its Nationally Determined Contributions (NDCs) under the Paris Agreement. Key Pillars include:

- Climate adaptation and resilience building;
- Climate change mitigation through reduced greenhouse gas emissions;
- Mainstreaming climate change into national and county planning;
- Climate finance mobilization;
- Enhanced stakeholder engagement and capacity building

The NCCRS and NCCAP serve as guiding frameworks that promote sustainable, climate-resilient development. The Nairobi River Regeneration Project, through its integrated design (housing, sanitation, green spaces, and ecosystem restoration), operationalizes many of these national priorities by enhancing urban climate resilience and reducing urban emissions and environmental risks.

3.6. National Urban Development Policy (NUDP) – 2016

The National Urban Development Policy (NUDP) is a key policy document developed to guide sustainable urbanization and orderly urban development in Kenya. It acknowledges the rapid rate of urban growth and the challenges that come with it, including informal settlements, inadequate infrastructure, environmental degradation, and poor urban planning. The NUDP provides a comprehensive framework for coordinating urban development across national and county levels. Its goal is to ensure that urban areas are efficient, sustainable, inclusive, and resilient. Objectives of the policy include:

- promote effective governance and management of urban areas
- Build efficient financial management systems in urban areas;
- Create systems for vibrant economic growth and development in urban areas;
- Mainstream spatial planning to drive sustainable urban development;
- Improve access to land of the right quality for urban development;
- Promote urban environmental planning and management as well as climate change adaptation in urban areas;
- Promote the development of requisite infrastructure and services in urban areas;
- Support the development of affordable housing of acceptable quality in urban areas;
- Mainstream urban safety, security and disaster risk management in urban planning and development.

Relevance: *The Nairobi River Regeneration Project directly aligns with the key thematic areas and goals of the NUDP. restoration and protection of* ***Ondiri Swamp*** *(river source) and riparian zones enhance urban ecosystem health, aligning with the policy's emphasis on sustainable resource use.*

3.7. National Water Policy 2021

The National Water Policy, 2021 was developed by the Ministry of Water, Sanitation, and Irrigation to guide sustainable management and development of Kenya's water resources. The policy aligns with Article 43(1)(d) of the Kenyan Constitution, which guarantees every person the right to clean and safe water in adequate quantities. This policy builds upon previous frameworks, including the Water Act, 2016, and seeks to harmonize Kenya's water governance with emerging challenges such as climate change, urbanization, pollution, and infrastructure gaps. The objective of the policy includes amongst

a) To strengthen sustainable water resource management in the country.
b) To accelerate delivery of water supply services through progressive realization of the human right to water towards universal access,
c) To promote development of water harvesting and storage infrastructure,
d) To accelerate delivery of sewerage and non-sewerage sanitation services through progressive realization of the human right to reasonable standards of sanitation towards universal access.
e) To put in place and implement a harmonized and constitutionally compliant regulatory framework for devolution of water functions and management of intergovernmental relations including areas of concurrent authority between the two levels of government.; and
f) Promote resilience to climate change and water-related risks

Relevance: *The Nairobi River Regeneration Project is strongly aligned with the principles and priorities of the National Water Policy (2021), particularly in the following areas.*

- The project includes the rehabilitation of Nairobi River, its tributaries, and the protection of Ondiri Swamp, the source of the Nairobi River and the construction of a new sewer trunk line and expansion of the Kariobangi Sewage Treatment Plant enhances wastewater management, directly contributing to water quality improvement in line with policy goals.

3.8. National Land Policy 2009

The National Land Policy, 2009 was adopted to provide a framework for the sustainable management and use of land resources in Kenya. Prior to its enactment, Kenya faced numerous challenges such as land tenure insecurity, informal settlements, encroachment on riparian and public land, and land-related conflicts. The policy addresses historical injustices, guides land use planning, and promotes equitable access to land for all Kenyans. It underpins the Constitution of Kenya, 2010, especially Chapter 5 (Land and Environment), and informs subsequent laws including the Land Act 2012, Land Registration Act, 2012, and Community Land Act, 2016.

The overall objective of the National Land Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically, the policy shall offer a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide:

1) All citizens with the opportunity to access and beneficially occupy and use land;
2) Economically viable, socially equitable and environmentally sustainable allocation and use of land;
3) Efficient, effective and economical operation of land markets;
4) Efficient and effective utilization of land and land-based resources; and
5) Efficient and transparent land dispute resolution mechanisms.

Relevance: *The National Land Policy will play a critical guiding role in the implementation of the Nairobi River Regeneration Project. Its provisions will influence planning, land acquisition, settlement regularization, and environmental protection.*

3.9. Kenya Forest Policy 2014

The Kenya Forest Policy, 2014 provides a framework for sustainable development, conservation, and management of forest resources in Kenya. It was developed to align forest sector management with the Constitution of Kenya (2010), the Forest Conservation and Management Act, 2016, and Kenya's broader environmental and development goals, including Vision 2030 and the National Climate Change Action Plan. The policy emphasizes the ecological, social, cultural, and economic importance of forests, and it recognizes forests as vital natural capital that supports water catchments, biodiversity, carbon storage, and community livelihoods. The objectives of this Policy are to: -

a) Increase and maintain tree and forest cover of at least ten percent of the land area of Kenya,
b) Establish an enabling legislative and institutional framework for development of the forest sector,
c) Support forestry research, education, training, information generation and dissemination, and technology transfer for sustainable development,
d) Promote public, private and community participation and partnership in forest sector development.
e) Promote investment in commercial tree growing, forest industry and trade,
f) Enhance management of forest resources for conservation of soil, water biodiversity and environmental stability

Relevance: *The Nairobi River Regeneration project includes the restoration of riparian vegetation and stabilization of riverbanks using indigenous plant species. This proposal, therefore, aligns with the policy's emphasis on protecting riparian ecosystems and enhancing ecological integrity.*

Ondiri Swamp, the source of the Nairobi River, is a significant wetland and catchment area. Its conservation under the project fulfills the policy's mandate to preserve forested water catchment areas and prevent degradation from encroachment or pollution.

3.10. Bottom-up Agenda

The Fourth Medium Term Plan 2023-2027 runs on the theme: "Bottom-Up Economic Transformation Agenda for Inclusive Growth", which focuses on achieving the Bottom-Up Economic Transformation Agenda (BETA) and builds on the achievements and Lessons learnt from the implementation of the preceding MTPs of the Kenya Vision 2030. The objectives of the MTP IV will be achieved through targeted investments in five core pillars, namely: Agriculture; Micro, Small, and Medium Enterprise (MSME) Economy; Housing and Settlement; Healthcare; and Digital Superhighway and Creative Economy.

Relevance: The Nairobi River Regeneration Programme is a flagship intervention that embodies the Bottom-Up Economic Transformation Agenda by promoting environmental sustainability, social equity, economic opportunity, and improved quality of life particularly for underserved urban populations.

3.11. Legal and Regulatory Framework

3.11.1. Environmental Management and Coordination Act Cap 387

The Environmental Management and Co-ordination Act (EMCA) is an Act of Parliament that establishes a legal and institutional framework for effective environmental management in Kenya. It serves as an umbrella law aimed at enhancing the coordination of various sectoral statutes related to the environment. As the principal environmental legislation in the country, EMCA affirms that every individual has the right to a clean and healthy environment. If this right is being, or is likely to be, violated, individuals have the right to seek legal redress.

To uphold this right, Part (VI) of the Act (Section 58) mandates that proponents of projects listed in the Second Schedule conduct Environmental Impact Assessment (EIA) and submit the EIA report to the National Environment Management Authority (NEMA) in the prescribed format, including the required information and fee. Additionally, Section 68 of the Act requires operators of existing projects to conduct environmental audits to assess their compliance with the commitments made in the EIA. Both the EIA and environmental audit reports must be submitted to NEMA for review and appropriate action.

3.11.2. Relevant Regulation under EMCA Cap 387

Regulation	Relevance
EMCA (Impact Assessment and Audit) Regulations, 2003	Requires that the EIA/EA be conducted by a registered lead or firm of experts in accordance with the terms of reference developed during the scoping exercise. The regulation categorizes the proposed projects as High risk and thus a Full study report must be prepared submitted to NEMA for licensing. *This ESIA was conducted by a NEMA registered EIA lead expert.*
EMCA (Waste Management) Regulations, 2024 (Legal Notice No. 178 of 2024)	The regulation operates under the Environmental Management and Coordination Act to provide a framework for the management of waste and abatement of pollution guaranteed under Article 42 of the Constitution and statutory guarantees of ensuring clean, safe and sustainable environment for all people. The regulations apply to the handling, storage, transportation, segregation and destruction of waste by providing for guidance, procedures and standards for environmental governance to ensure compliance in the waste management sector. **Relevance:** *The Ministry will develop and implement the Waste Management Plan in compliance with the provisions of this regulation.*
EMCA (Noise and Excessive Vibration Pollution) (Control) Regulations, 2024	This regulation prohibits any person from causing unreasonable, unnecessary, or unusual noise which annoys, disturbs, injures, or endangers the comfort, repose, health or safety of others and the environment. Part 11 section 6 (1) provides that no person shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations. It gives standards for maximum permissible noise levels for construction sites, mines, and quarries. It also gives maximum permissible noise levels for silent zones, places of worship, residential (indoor/outdoor), mixed residential; and

Regulation	Relevance
	commercial. **Relevance:** *Project work should be planned in a way that limits excessive noise and vibration, especially near sensitive receptors like schools and health facilities.*
EMCA (Water Quality) Regulations, 2024 (Legal Notice No. 177 of 2024	The regulations provide for the prevention of water pollution and protection of sources of water and apply to drinking water, water used for industrial purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. They establish standards for wastewater management to ensure clean and healthy water resources and provision of standards for water for different uses. Section 5. A waste generator shall collect, segregate and dispose the waste in the manner provided in regulation 6 of these Regulations. **Relevance:** *he government shall engage qualified site operators who will conduct periodic site visits and ensure that all environmental and social parameters are effectively monitored in accordance with the Environmental Management Plan (EMP) outlined in this report.*
EMCA (Air Quality) Regulations, 2024 (Legal Notice No. 180 of 2024	The Regulations provide for prevention, control and abatement of air pollution to ensure clean and healthy air. They apply to internal combustion engines, premises, places, processes, operations or works to which the provisions of the EMCA and the Regulations made apply. The regulation is a significant improvement of the 2014 Regulations and introduces various improvements including emission testing from mobile sources. **Relevance:** *The project implementers shall ensure full compliance with the applicable Air Quality Regulations by conducting regular maintenance of machinery and equipment, as well as routine monitoring and measurement of atmospheric emissions to ensure adherence to permissible limits.*

3.11.3. Water (Amendment) Act (No. 13 of 2024)

The Water (Amendment) Act, 2024 is a critical piece of legislation enacted to enhance the regulation, management, protection, and sustainable development of Kenya's water resources and sewerage services. This Act reinforces the framework for water governance and aligns water sector management with principles of environmental conservation, public health, and sustainable development. A central feature of the Act is the establishment of the Water Resources Authority (WRA), a statutory body mandated to regulate the use and management of water resources across the country. The Authority is responsible for issuing water permits, monitoring water use compliance, protecting catchment areas, and enforcing pollution control measures. The Act explicitly prohibits a range of activities that may harm water resources. These include:

- Obstruction, interference with, or diversion of any watercourse or water resource without lawful authority;
- Disposal or discharge of any form of waste including rubbish, effluent, trade waste, or any offensive matter into or near a water resource in a manner that causes or is likely to cause pollution;
- Unauthorized use of water resources or construction of infrastructure is likely to alter natural water flows without necessary approvals from WRA.

Relevance: Given that the proposed Nairobi River Regeneration Programme involves activities such as installation of a new sewer trunk line, expansion of wastewater treatment infrastructure, landscaping, and riverbank restoration, the Water (Amendment) Act 2024 is highly pertinent. Key aspects of relevance include:

- *No unauthorized discharges of construction-related waste, chemicals, or runoff enter the Nairobi River or its tributaries*;
- *Securing the necessary permits and approvals from WRA before undertaking any works that affect the river's flow or involve abstraction or diversion;*
- *Implementing best practices in erosion control, stormwater management, and sediment containment to prevent downstream pollution;*

- *Designing and operating sewer and wastewater infrastructure in a manner that aligns with water quality standards and catchment protection goals.*

3.11.4. Water Resources Regulations Legal Notice 170 of 2021

These Regulations shall apply to the regulation, management, use, and development of all water resources. They cover both perennial and seasonal water resources, including those within the territorial sea. The rules empower the Water Resources Authority (WRA) to impose management controls on land use falling under riparian land. The proposed project shall adhere to the provision of this regulation.

3.11.5. Sustainable Waste Management Act, 2024

This is an Act of Parliament to establish the legal and institutional framework for the sustainable management of waste; ensure the realization of the constitutional provision on the right to a clean and healthy environment under article 42 of the Constitution and for connected purposes. The objects of this Act shall be to:

a) Promote sustainable waste management;
b) Improve the health of all Kenyans by ensuring a clean and healthy environment;
c) Reduce air, land, fresh water and marine pollution;
d) Promote and ensure the effective delivery of waste services.

Section 12. Waste classification and segregation (1) All public and private sector entities shall segregate non-hazardous waste into organic and non-organic fractions. (2) The segregated waste shall be placed in properly labeled and colour coded receptacles, bins, containers and bags Sub section (4) Hazardous waste will be handled and managed as prescribed by the Environmental Management and Co-ordination Act (Cap. 387) and any other relevant written law. ***Relevance:*** *Waste management plans (WMPs) shall be prepared in accordance with this Act to guide waste management throughout the Project lifecycle.*

3.11.6. The Physical and Land Use Planning Act, 2019

Part IV of the Act outlines the objectives and regulatory framework for development control within the jurisdiction of county governments. Section 55(1) establishes the primary objectives of development control, which include ensuring orderly physical and land use development, promoting optimal land utilization, and facilitating the proper execution and implementation of approved physical and land use development plans. Furthermore, development control seeks to safeguard the environment, promote public safety and health, encourage public participation in decision-making processes, ensure the orderly planning and execution of building activities (including design, construction, operation, and maintenance), and uphold national security considerations.

Under **Section 56**, the Act grants county governments the authority subject to the Urban Areas and Cities Act, 2011, and the County Governments Act, 2012 to manage development within their areas of jurisdiction. This includes the power to prohibit or regulate land and building use to ensure proper and orderly development, control land subdivision, review and approve development applications, and oversee the implementation of approved physical and land use plans.

Section 57 provides that no individual or entity may undertake any form of development within a county without first obtaining the requisite development permission from the respective County Executive Committee (CEC) Member. Failure to secure such permission constitutes an offence under the Act. Upon conviction, the offender is liable to a fine not exceeding five hundred thousand Kenyan shillings, or to imprisonment for a term not exceeding two months, or both. **Relevance:** *The government, along with the respective implementing line ministries, bears the responsibility of adhering to established planning regulations by securing all necessary approvals as stipulated under the Physical and Land Use Planning Act. This ensures compliance with legal and procedural requirements governing land use, development control, and spatial planning within the project area.*

3.11.6.1. The Physical and Land Use Planning (Local Physical and Land Use Development Plan) Regulations, 2021

The Physical and Land Use Planning (Local Physical and Land Use Development Plan) Regulations, 2021, established under the Physical and Land Use Planning Act, 2019, provide the statutory framework for the preparation, approval, and implementation of local physical and land use development plans at county and urban levels. These regulations are highly relevant to the Nairobi River Regeneration Project in the following respects.

- The project must be aligned with existing or proposed local physical and land use development plans, particularly those developed by Nairobi City County and Kiambu County, which intersect the Nairobi River corridor.

The proponent will seek all the approvals in as required by the regulations.

3.11.7. Occupational Health and Safety Act, 2007

The Occupational Safety and Health Act (OSHA), 2007, is a key legislative framework designed to secure the safety, health, and welfare of individuals at workplace. The Act mandates that all workplaces be maintained in conditions that do not pose risk or harm to the health and safety of workers. In particular, Section 101 of the Act stipulates that worker exposed to wet, injurious, or offensive substances must be provided with appropriate and effective protective clothing and equipment to minimize risk and ensure their well-being.

Furthermore, the Act requires the appointment of a competent person from the management team to take responsibility for overseeing occupational safety and health within the workplace. This designated officer is charged with ensuring compliance with safety standards, implementing workplace health and safety programs, and responding to incidents that may compromise worker safety.

- The Act also covers a wide range of occupational safety dimensions, including:
- Development and implementation of workplace safety and health policies;
- Enforcement of occupational hygiene standards;
- Provision of adequate welfare facilities such as clean water, sanitation, and rest areas; and
- Monitoring and mitigation of workplace hazards, including physical, chemical, and biological risks.

Relevance: *This legislation is particularly relevant to the proposed project due to the nature of activities anticipated during the construction phase, which will involve a significant workforce and the use of heavy machinery, tools, and hazardous materials. Worker's safety protocols shall be established and enforced.*

3.11.8. Public Health Act Cap 242

The Public Health Act (Cap 242) serves as a foundational legal framework governing public health in Kenya. It is particularly focused on preventing and controlling activities that pose risks to human health, including those that result in unsanitary conditions, environmental pollution, and the spread of communicable diseases. The Act defines an environmental nuisance as any condition that causes danger, discomfort, or annoyance to the local population, or is otherwise injurious or hazardous to human health.
Relevance: *To protect both on-site workers and the surrounding communities, the implementing Agencies will develop a Sanitation and Hygiene Management Plans to ensure that health-related risks are minimized, thereby enhancing community well-being and contributing to the overall sustainability of the project.*

3.11.9. Climate Change (Amendment) Act, 2023

The Climate Change (Amendment) Act, 2023, builds upon the Climate Change Act, 2016, to strengthen Kenya's legal and institutional framework for addressing the adverse effects of climate change and promoting climate-resilient development. This Amendment Act aligns national climate actions with updated international obligations, particularly under the Paris Agreement, and enhances the roles and responsibilities of both national and county governments in climate governance.

Relevance: The Nairobi River Regeneration Programme involves interventions such as sewer infrastructure expansion, riverbank stabilization, and restoration of natural ecosystems, which intersect with key climate change issues, including *Increased vulnerability to flooding, waterborne diseases, and urban heat islands due to land use change and*

degraded ecosystems. The proposed development shall incorporate climate mitigation strategies and adaptive capacity in particular for vulnerable urban communities living along the Nairobi River corridor.

3.11.10. Land Act, 2012

In Kenya, land is legally classified into three categories: public land, private land, and community land, as established under the Constitution of Kenya, 2010 and the Land Act, 2012. Individuals or entities may acquire legal ownership and a certificate of title to land through various mechanisms, including:

- Allocation by the national or county government
- Adjudication processes in previously unregistered areas
- Compulsory acquisition for public purposes
- Transfers through sale or donation
- Transmission through inheritance or succession
- Leases exceeding twenty-one years

The law guarantees equal recognition, protection, and enforcement of land rights across all tenure systems, whether freehold or leasehold. This framework ensures that land rights are secure, equitable, and enforceable regardless of the nature or duration of tenure.

Access to land and use on the other hand plays a role in environmental management and sustainability. In recognition of this, the land commission has the obligation under the Act in section 19 to conserve land based natural resources. The commission is supposed to identify ecologically sensitive areas that has endangered or endemic species of flora and fauna, demarcate to prevent environmental degradation or climate change (section 11).

The National Land Commission (NLC) is empowered under Part VIII of the Land Act, 2012 to acquire land on behalf of the national or county governments for public purposes or in the public interest, including infrastructure development, environmental conservation, or other state functions. In instances of such compulsory acquisition, the Act guarantees that just and prompt compensation shall be paid to all persons holding recognized interests or rights in the affected land. The Act further outlines a clear, consultative, and legally binding procedure that must be followed prior to the issuance of compensation, including:

- Issuance of a notice of intention to acquire
- Public inquiries to determine rightful claimants
- Valuation of the land and any improvements
- Submission and verification of claims
- Agreement or determination of compensation payable

This process ensures that the rights of affected persons are safeguarded, and that any acquisition is conducted in a transparent, fair, and lawful manner in accordance with the principles of due process and equitable treatment. If need be, the commission has the power to create public right of way under section 143 and any institution or person has a right to execute any work, installation or structure on such way leave.

Relevance: The proposed project site along the entire stretch and the river source (Ondiri Swamp) falls within a riparian reserve, which is designated as an ecologically sensitive area under Kenyan environmental and land use regulations, including the Environmental Management and Coordination Act (EMCA), Cap 387 and guidelines issued by the Water Resources Authority (WRA).

3.11.11. Forest Conservation and Management Act, 2016

The Forest Conservation and Management Act, 2016 was enacted to provide for the development, sustainable management, and conservation of forest resources in Kenya. It repealed the Forests Act, 2005, and aligns forest governance with the Constitution of Kenya, 2010, particularly the principles of public participation, environmental sustainability, and devolution.

Relevance: The Nairobi River regeneration project includes important ecological and public land areas, many of which are covered under forest or wetland classifications. The Act is directly relevant in the following ways: *Protection of Riparian Zones*: The Act treats riparian and riverine vegetation as critical ecosystems that must be protected and

rehabilitated. The Act provides a robust legal framework for the protection and restoration of forested and riparian areas. The implementation and rehabilitation of the **Nairobi River**, especially those involving land use, removal, afforestation, and conservation of the river's ecological integrity are applicable.

3.11.12. County Governments Act, 2012

The County Governments Act, 2012 is a foundational law that operationalizes the devolution provisions of Kenya's Constitution (2010). The Act outlines the roles, powers, and functions of county governments in governance, planning, service delivery, and development control within their respective jurisdictions. The Act mandates each county to prepare a County Integrated Development Plan (CIDP), which guides all development activities, including infrastructure, housing, and environmental conservation.

Under Part XI, the county governments have the authority to regulate land use, approve development applications, and monitor compliance with environmental and physical planning laws. The Act supports sustainable development and empowers counties to enforce policies that promote ecological sustainability, conservation of natural resources, and climate adaptation within urban environments. **Relevance:** *Through adherence to the County Governments Act, the proposed project not only remains legally compliant but also promotes collaborative governance, transparency, and long-term sustainability in urban river regeneration and housing development.*

3.11.13. The Employment Amendment Act of 2022

This Act establishes the minimum terms and conditions of employment. The Act sets forth the relationship between an employer and a worker. It defines the benefits, duties and obligations of the employer and the worker, which includes contract of service, prohibition against forced labour, discrimination in employment, sexual harassment, payment of wages, leave, termination, and living amenities.

The Act requires written contracts for jobs longer than three months (Section 9–10), outlining terms like wages, working hours, and duties. Wages must be paid in legal tender and on time, with no unauthorized deductions (Sections 17–20). Employees are entitled to equal pay for equal work (Section 5(5)). (Section 27) and provides for 21 days of annual leave (Section 28), 90 days maternity and 2 weeks paternity leave (Section 29).

Termination must be fair and follow due process (Sections 35–46), with notice or pay in lieu. Redundancy requires proper notice and severance pay (Section 40). Child labor is restricted, with strict limits on work by persons under 18 (Sections 56–61). Disputes are handled by the Employment and Labour Relations Court (Sections 87–90), and employers must keep records for at least five years (Section 74). Penalties apply for violations of the Act. **Relevance:** During the construction phase of the project, the contractor will engage a combination of full-time and casual workers to support various project activities. In line with national labor laws and international labor standards, the contractor shall be required to strictly observe the prevailing basic minimum conditions of employment, as provided under the Employment Act, 2022 to prevent Child labour.

3.11.14. The Work Injury Benefits Act of (WIBA), 2007

The Work Injury Benefits Act, 2007 is legislation enacted to provide compensation to employees who suffer injuries, diseases, or death arising out of and during the course of employment. It applies to all employees in Kenya, whether employed on a permanent, casual, or contract basis, except members of the armed forces. **(Section 7)** Employers are required to obtain and maintain an insurance policy covering all their employees against work-related injuries and diseases. Failure to do so is an offence. Sections 10–13; An employer must report any workplace injury or accident to the Director of Occupational Safety and Health Services (DOSHS) within seven days. In the event of death, notification must be immediate. Sections 6, 16–24; Compensation is payable when an employee is injured, disabled, or dies due to work. Types of compensation include:

- Medical expenses
- Temporary or permanent disability benefits
- Compensation to dependents in the event of death

Disability compensation depends on the degree of incapacity. For permanent total disability, the employee is entitled to 80% of monthly earnings for up to 96 months, subject to limits. **Relevance:** The Contractor will ensure all employees are cover under life insurance cover and full compliance with the provisions of this Act.

3.11.15. The Children (Amendment) Bill 2020

The Children (Amendment) Bill, 2020, which seeks to amend the Children Act, 2001, strengthens the protection, care, and welfare of children in line with the Constitution of Kenya (2010), the United Nations Convention on the Rights of the Child (UNCRC), and the African Charter on the Rights and Welfare of the Child. The Bill reinforces mechanisms for safeguarding children from abuse, neglect, hazardous environments, and exploitation including child labor. This is especially relevant in areas along the Nairobi River corridor where children may be exposed to risks related to:

- Informal settlements,
- Waste dumping sites,
- Construction zones, and
- Waterborne diseases or open sewers.

The Bill recognizes every child's right to a clean, healthy, and safe environment, aligning with the objectives of the Nairobi River Regeneration Project. **Relevance:** In the context of the Nairobi River Regeneration Project, the Children (Amendment) Bill, 2020 becomes particularly relevant in scenarios where a worker or contractor's employee is implicated in incidents of Sexual Harassment (SH), Sexual Exploitation and Abuse (SEA), or consensual relationships that result in the birth of a child during the course of project implementation.

3.12. Social Risks Legislations

Table 3: Relevant Social Risks Legislations

Legislation	**Relevance**
The Sexual Offences Act 2006	The Sexual Offences Act, 2006 provides a comprehensive legal framework for the prevention, prosecution, and punishment of all forms of sexual offences in Kenya. It criminalizes a wide range of sexual violations, including rape, defilement, sexual harassment, exploitation, and indecent acts. Under the Act, employers, including contractors and implementing agencies, have a duty to: • Prevent and respond to any form of sexual offence occurring within the project environment • Implement Codes of Conduct for all workers prohibiting SH/SEA • Establish confidential and accessible Grievance Redress Mechanisms (GRMs) for reporting sexual offences The Act is particularly relevant during the construction and implementation phases of the project, where interactions between project workers and local community members especially vulnerable groups such as women, girls, and children may expose individuals to the risk of Sexual Harassment (SH), Sexual Exploitation and Abuse (SEA), and Gender-Based Violence (GBV).
HIV/AIDS Prevention and Control Act (Act No.14 of 2006, Revised in 2012)	The HIV and AIDS Prevention and Control Act (HAPCA), Act No. 14 of 2006, is a key piece of legislation in Kenya aimed at addressing the HIV/AIDS epidemic. It was revised in 2012 to enhance its provisions and align them with evolving public health needs and human rights standards. The Act mandates the government to promote public awareness about HIV/AIDS through comprehensive educational campaigns. These campaigns are to be conducted in schools, workplaces, prisons, and communities, focusing on scientifically proven approaches and encouraging HIV testing. ***Relevance*:** Contractor will make provision for Voluntary Counselling and Testing (VCT) services for employees and locals, as well as conduct training on HIV/AIDS awareness programmes throughout project lifecycle

3.13. Relevant Institutional Framework

Several government and regulatory institutions are mandated to oversee various components of environmental management, land use planning, water and sanitation services, housing, and public infrastructure all of which are central to the Nairobi River Regeneration Project. Outlined below represent institutions and their relevance but not limited to.

Institution	Mandate and Relevance
National Environment Management Authority (NEMA)	The National Environment Management Authority (NEMA) is a statutory agency established under the Environmental Management and Coordination Act (EMCA), Cap 387, as the principal instrument of the government in the implementation and coordination of all matters relating to the environment. The NEMA core mandate includes: • Formulating and implementing environmental policies and guidelines. • Supervising and coordinating environmental impact assessments and audits. • Enforcing environmental laws and standards. • Monitoring the state of the environment and issuing Environmental Impact Assessment (EIA) licenses. • Coordinating environmental protection activities at the national and county levels. NEMA plays a regulatory and oversight role in the Nairobi River Regeneration Programme, particularly in ensuring that all project activities are compliant with environmental laws and are sustainably implemented.
Water Resources Authority (WRA)	The Water Resources Authority (WRA) is a statutory body established under the Water Act, 2016, and sustained under the Water (Amendment) Act, 2024. It is responsible for the regulation, management, protection, and conservation of water resources in Kenya. WRA operates under the Ministry of Water, Sanitation, and Irrigation and functions as the key agency for: • Issuance of water abstraction permits. • Monitoring and assessment of water resources. • Enforcement of water resource regulations. • Protection of catchment areas and riparian reserves. • Controlling pollution of water bodies. The Water Resources Authority (WRA) is an essential stakeholder in the Nairobi River Regeneration Project. The agency will ensure that all water-related interventions are technically sound, legally complaint, and environmentally sustainable, and that the river system is restored for long-term use and resilience.
National Construction Authority (NCA)	The National Construction Authority (NCA) is a regulatory body established under the National Construction Authority Act No. 41 of 2011. Its primary mandate is to oversee the construction industry in Kenya by ensuring compliance with quality and safety standards and promoting sustainable construction practices. **Relevance:** Given the scale and complexity of the regeneration programme, which includes housing development, sewer infrastructure, landscaping, and pedestrian bridges, the NCA has a pivotal role in ensuring quality construction standards and promoting safety on construction sites.

Institution	Mandate and Relevance
Ministry of Lands, Public Works, Housing and Urban Development	The Ministry of Lands, Public Works, Housing and Urban Development is a national government ministry responsible for the formulation and implementation of policies, laws, and programs related to administration and management, Physical planning and land use regulation, Provision of affordable and decent housing, public works including civil engineering infrastructure and Urban planning and development. The Ministry of Lands, Public Works, Housing and Urban Development will play a critical role in the Nairobi River Regeneration Project. It will provide leadership in land use planning, infrastructure development, and delivery of affordable housing. Its coordination role will ensure that the project is integrated, legally compliant, socially inclusive, and aligned with Kenya's urban transformation goals.
Ministry of Defence (MOD)	The Ministry of Defence, through a special directive from the Executive and in coordination with the Nairobi River Commission, has been entrusted with a strategic implementation role in the Nairobi River Regeneration Programme. This mandate is part of the government's broader initiative to leverage institutional discipline, technical capacity, and rapid deployment mechanisms for public infrastructure development and environmental restoration projects. The MoD's involvement underscores the importance the government places on achieving quick, coordinated, and sustainable results in urban regeneration efforts. Under this directive, the Ministry works in conjunction with other line ministries and agencies to execute physical interventions along the Nairobi River Corridor.
Kenya Urban Roads Authority (KURA)	Established under the Kenya Roads Act, 2007, the Kenya Urban Roads Authority (KURA) is a state corporation under the Ministry of Roads and Transport. Its core mandate is to: • Develop, maintain, and manage all public roads in urban areas and cities except national roads under the Kenya National Highways Authority (KeNHA). • Oversee urban transport planning, including non-motorized transport (NMT) infrastructure. • Promote road safety, traffic management systems, and efficient urban mobility. • Approve and supervise road infrastructure projects within urban jurisdictions The Kenya Urban Roads Authority (KURA) will play an instrumental role in actualizing the transport and mobility goals of the Nairobi River Regeneration Project. Its contributions will ensure that new and upgraded infrastructure (Crossing bridges) is inclusive, sustainable, safe, and climate-resilient, thereby improving access, connectivity, and the overall quality of urban life along the Nairobi River corridor.

Institution	Mandate and Relevance
Kenya Forest Service (KFS)	The Kenya Forest Service (KFS) is a state corporation established under the Forest Conservation and Management Act, 2016, operating under the Ministry of Environment, Climate Change and Forestry. Its core mandate includes: • Conservation, protection, and sustainable management of all forests in Kenya (including both gazetted and community forests). • Promotion of forest development and the increase of forest and tree cover. • Rehabilitation of degraded forest ecosystems, including riparian and urban green spaces. The Kenya Forest Service will play a critical ecological and technical role in the Nairobi River Regeneration Project, particularly in riparian conservation and ecosystem restoration. KFS will provide guidance and technical support for the reforestation and rehabilitation of riparian zones along the Nairobi River and its tributaries.
Ministry of Environment, Climate Change and Forestry	The Ministry of Environment, Climate Change and Forestry is the lead government agency responsible for: • Formulating, implementing, and monitoring environmental, climate change, and forestry policies. • Coordinating and supervising all matters related to environmental protection, conservation, and sustainable management of natural resources. • Overseeing national efforts related to climate change adaptation and mitigation in line with international obligations. • Promoting afforestation, reforestation, and forest conservation through relevant state agencies and community partnerships. • Coordinating multi-sectoral environmental programs, including those addressing air quality, waste management, biodiversity, and water resource conservation The Ministry of Environment, Climate Change and Forestry provides overarching policy leadership, technical guidance, and inter-institutional coordination in the Nairobi River Regeneration Project. Its will play a leading role in ensuring that the project achieves its ecological restoration, climate resilience, and sustainability goals in line with national environmental priorities and global commitments.
Nairobi City Water and Sewerage Company (NCWSC)	The Nairobi City Water and Sewerage Company (NCWSC) is a key entity in Kenya's water sector, established to provide water and sewerage services within Nairobi County. Operating under the Water Act of 2016, NCWSC is a wholly owned subsidiary of the Nairobi City County Government. While it manages water and sewerage services, the Athi Water Works Development Agency (AWWDA) holds ownership of the infrastructure, including dams and treatment plants.
Nairobi City County Government (NCCG)	The Nairobi City County is a creation of the Constitution of Kenya, 2010 and serves as the legal and institutional successor to the defunct City Council of Nairobi. It operates under the framework of the Cities and Urban Areas Act, the County Governments Act, and other relevant legislation governing devolved governance. As the principal devolved unit of administration within Nairobi, the County is mandated to provide a wide range of services to residents within its jurisdiction. These responsibilities include functions previously carried out by the former City Council as well as services that have since been devolved from the national government.

Institution	Mandate and Relevance
	Nairobi City County is a key stakeholder in ensuring the successful rehabilitation and long-term sustainability of the Nairobi River Basin.
Athi Water Works Development Agency (AWWDA)	Athi Water Works Development Agency (AWWDA) is one of the nine (9) Water Works Development Agencies (AWWDA) established under the Ministry of Water, Sanitation & Irrigation. It was established under the Water Act 2016 vide Legal Notice No. 28 of 26th April 2019. The Agency is responsible for the development, maintenance and management of water and sewerage infrastructure in the counties of Nairobi, Kiambu and Murang'a Counties covering 5,800.4Km^2 with a total population of 9,320,287 people. Currently, the Agency has a bulk water production capacity of 664,337m^3/day and a wastewater treatment capacity of 210,500 m^3/day. Certain sub-components of the project fall under the direct responsibility of the Agency, particularly the development of new sewer trunks and associated wastewater infrastructure under the Athi Water Works Development Agency (AWWDA).
Nairobi Rivers Commission (NRC)	The Nairobi Rivers Commission (NRC) was established vide the Kenya Gazette Notice no. 13907 of 25th October 2024 and aligning its functions under the Executive Office of the Deputy President. The Commission emerged as a response to the pressing need to address the deteriorating state of the rivers within the Nairobi Basin, which were heavily polluted and degraded through time due to various factors, including urbanization, industrial activities, and inadequate waste management practices. Recognizing the critical importance of reclaiming these rivers as vital ecosystems and resources for the city, NRC was established to spearhead coordinated efforts towards their restoration and revitalization.
Kenya National Highways Authority (KeNHA)	The Kenya National Highways Authority (KeNHA) is a statutory body established under the Kenya Roads Act of 2007 and inaugurated in September 2008. KeNHA is responsible for the development, rehabilitation, management and maintenance of all National Trunk Roads comprising of Class S, A, and B roads As road construction and expansion often require alignment through urban river corridors, KeNHA's involvement is crucial in ensuring that road infrastructure development is integrated with river restoration efforts.
Kenya Power and Lighting Company (KPLC)	The Kenya Power & Lighting Plc is the nation's primary energy solutions provider, dedicated to delivering quality and reliable electricity services that contribute to societal well-being and sustainable socio-economic development. With a mission to power people for better lives through innovative and sustainable practices, we play a crucial role in Kenya's growth and progress. As part of the urban renewal and landscape improvement efforts under the Nairobi River Regeneration programme, existing overhead power lines along the riverbanks may require rerouting or upgrading. KPLC will support: • Conversion to underground cabling for aesthetics and safety • Decommissioning or relocation of unsafe or non-compliant power lines.

Institution	Mandate and Relevance
National Government Administration NGAO	The National Government Administration Officers (NGAO), comprising Regional Commissioners (RC), County Commissioner (CC)s, Deputy County Commissioners (DPC), Assistant County Commissioners (ACC), Chiefs, and Assistant Chiefs, will play a pivotal role in the successful planning, coordination, and implementation of the Nairobi River Regeneration Project. NGAO structures will serve as the primary link between the national government and local communities along the river corridor as well as ensuring the safety and security of project personnel and equipment.
Kiambu County Government	The Kiambu County Government holds a strategic role in the Nairobi River Regeneration Project, particularly given that the river's headwaters originate within its jurisdiction most notably in the Ondiri Swamp area, which is a key ecological source of the Nairobi River. Under the Constitution of Kenya (2010), environmental conservation is a devolved function. The County Government, through its Department of Environment and Natural Resources, will be responsible for protecting ecologically sensitive zones such as Ondiri Swamp and upstream riparian buffers. The County government will collaborate with national agencies to implement wetland restoration, afforestation, erosion control, and pollution mitigation initiatives at the river's source as well as regulating land use through spatial and integrated development plans.
Department of Social Protection	The Department of Social Protection, under the Ministry of Labour and Social Protection, will play a critical role in ensuring that the social dimensions of the Nairobi River Regeneration Project are addressed in an inclusive, equitable, and rights-based manner. Its involvement will be essential in safeguarding the welfare of vulnerable and marginalized groups affected by or benefitting from the proposed project. **Relevance**: In areas affected by livelihood disruption (Economic activities), or environmental degradation, the Department will ensure that vulnerable populations are not disproportionately affected and are included in benefit-sharing mechanisms of the proposed development.

4. BASELINE ENVIRONMENTAL DESCRIPTION

4.1. Introduction

Review and description of the existing biophysical environment is an important component of the study which provides the baseline existing information of environment prior to the commencement of the proposed project, as well as providing a general overview of more detailed study and primary data collection to support the ESIA process. Important components of the existing environment consist of **climate and weather, topographic, water resources, air quality, geology, and soil**. Again, understanding of this mentioned physical information will provide the data and information to the regulatory body (NEMA) to monitor and compare the physical parameters change to the baseline before the project is initiated.

Besides, the other existing environments such as terrestrial flora and fauna, public utilities, as well as non-physical components of existing environment such as socio-economic profile, public service, occupational health, and safety would also be important to be investigated and presented as part of the ESIA Study. A brief description of the most relevant existing environment, including the existing data, are presented in the following sub-sections.

4.2. Physical Features

Nairobi City County lies at the edge of Athi Kapiti Plains and the lower slopes of Kikuyu and the Aberdare's Escarpment, with an altitude of about 1,800m a.s.l. The topography of Nairobi, slopes from West to East as depicted in the Figure below and is influenced by the traversing water courses (rivers and streams) originating from the lower Southern slopes of the Aberdare's and Kikuyu Springs, including the Ngong Hills that tend to follow the same trend towards the Indian Ocean via the Athi River Basin. Ondiri swamp is located in Kiambu County, which is divided into four broad topographical zones namely Upper Highlands, Lower Highlands, Upper Midland and Lower Midland zones. Lying on the foothills of the Aberdare's to the North and Kikuyu Ridges to the West, Limuru is characterized by medium slopes and shallow valleys with an altitude ranging from about 1,500 to 2,000m a.s.l.

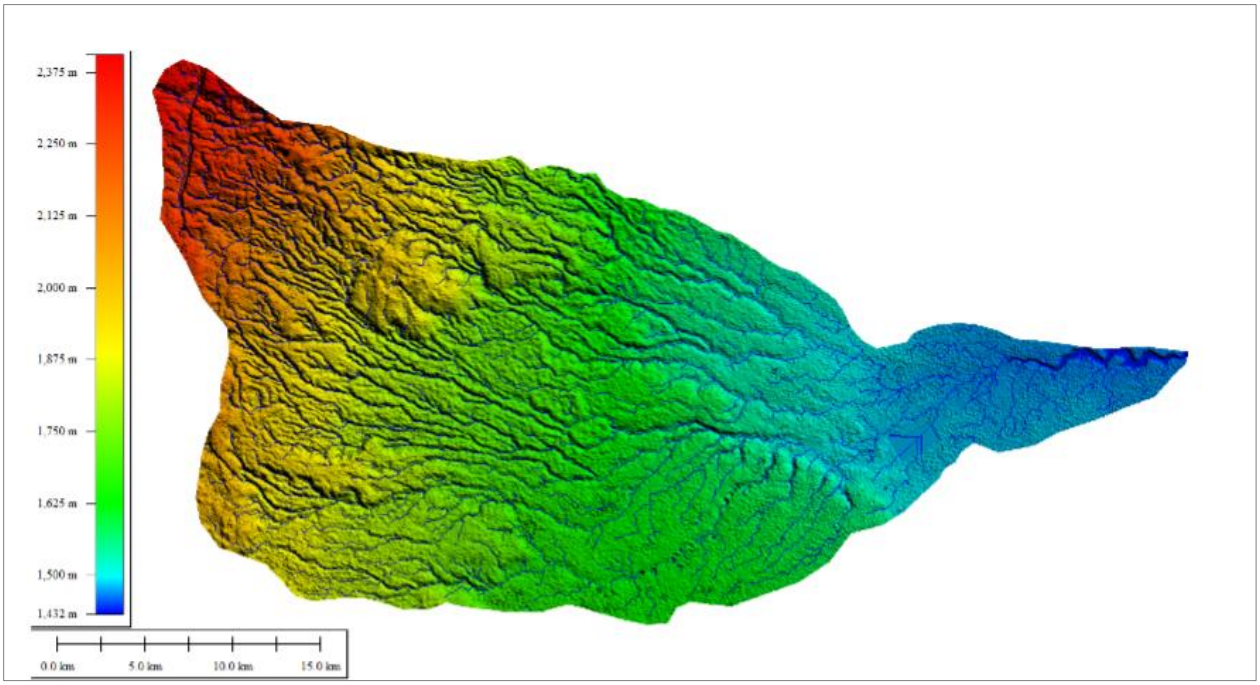

Figure 13: Topographical Map of the Project Area (Source: Nairobi University Situation analysis of the Nairobi River Basin Report)

4.2.1. Climatic Conditions

At 1,795 meters above sea level, Nairobi experiences a moderate climate. Under the Koppen climate classification, Nairobi has a subtropical highland climate. The altitude makes for some cold evenings, especially in the June/July season when the temperature can drop to 10°C (50°F). The sunniest and warmest parts of the year are from December to March, when temperatures average the mid-twenties during the day. The mean maximum temperature for this period is 24°C (75°F). There are two rainy seasons, but rainfall can be moderate. The long rains form the first season and fall in the months of March to May, and the short rains forming the second rainy season, fall between October and December. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with light drizzles. The mean annual rainfall ranges between 850- 1050mm. As Nairobi is located close to the Equator, the differences between the seasons are minimal.

Kiambu County, encompassing towns such as Kiambu, Limuru, Kikuyu, and Karuri, experiences a bi-modal rainfall pattern significantly influenced by the Aberdare's Forest. The long rains occur from mid-March to May, followed by a cool season with drizzles and frost from June to August, and short rains between October and November. Annual rainfall varies with altitude, ranging from 600 mm in low-lying areas to 2,000 mm in higher elevations, averaging approximately 1,200 mm. The mean annual temperature is 26°C, with temperatures fluctuating between 7°C in the highlands and 34°C in the lower midland zones.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	18.9 °C (66.1) °F	19.7 °C (67.5) °F	19.7 °C (67.5) °F	18.6 °C (65.6) °F	17.8 °C (64.1) °F	17 °C (62.6) °F	16.4 °C (61.4) °F	16.6 °C (61.8) °F	17.7 °C (63.9) °F	18.5 °C (65.3) °F	17.6 °C (63.7) °F	17.9 °C (64.3) °F
Min. Temperature °C (°F)	13.8 °C (56.8) °F	14.3 °C (57.7) °F	14.9 °C (58.9) °F	15.1 °C (59.2) °F	14.2 °C (57.6) °F	12.8 °C (55.1) °F	11.8 °C (53.2) °F	12.1 °C (53.8) °F	12.7 °C (54.8) °F	14 °C (57.2) °F	14.1 °C (57.5) °F	13.8 °C (56.8) °F
Max. Temperature °C (°F)	24.8 °C (76.7) °F	25.8 °C (78.5) °F	25.5 °C (78) °F	23.5 °C (74.4) °F	22.3 °C (72.1) °F	21.3 °C (70.4) °F	21 °C (69.7) °F	21.3 °C (70.4) °F	23.2 °C (73.8) °F	23.9 °C (75) °F	22.3 °C (72.2) °F	23.1 °C (73.5) °F
Precipitation / Rainfall mm (in)	37 (1)	34 (1)	62 (2)	125 (4)	102 (4)	48 (1)	20 (0)	28 (1)	20 (0)	49 (1)	94 (3)	55 (2)
Humidity(%)	62%	56%	61%	74%	75%	71%	68%	67%	61%	63%	77%	73%
Rainy days (d)	5	4	9	16	13	7	3	4	3	8	14	9
avg. Sun hours (hours)	9.5	9.6	8.5	6.6	5.7	4.6	4.2	4.3	6.5	7.2	6.4	8.1

Figure 14: Data: 1991 - 2021 Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

4.2.1.1. Air Quality

As part of this Environmental and Social Impact Assessment (ESIA), direct air quality measurements were conducted along the project corridor. These were complemented by field observations and stakeholder consultations, which identified several significant sources of air pollution within and surrounding the project area. The predominant emission sources are linked to urban activities, particularly within informal and peri-urban settlements that dominate much of the Nairobi River corridor.

One of the most notable contributors to ambient air pollution is the open burning of solid waste, which is widely practiced due to inadequate waste collection and disposal infrastructure. The materials frequently burned include:

- Dry plant matter (e.g., yard waste, leaves, and crop residues)
- Paper and cardboard
- Plastics and polythene materials
- Worn fabrics and textile waste

These open burning activities may result in the release of a wide range of airborne pollutants, including:

- Particulate Matter (PM_{10} and $PM_{2.5}$), which poses significant health risks by penetrating deep into the respiratory tract
- Carbon monoxide (CO), a product of incomplete combustion
- Volatile Organic Compounds (VOCs), many of which are hazardous to health and contribute to the formation of ground-level ozone
- Polycyclic Aromatic Hydrocarbons (PAHs) and dioxins, which are known carcinogens released during the burning of synthetic materials such as plastics and treated fabrics.

The cumulative effect of these emissions leads to localized air quality degradation, especially during early mornings and late evening when burning activities tend to peak and atmospheric dispersion is limited.

4.2.2. Geology and Soil

The rocks in the Nairobi area mainly comprise of a succession of lavas and Pyroclastics of the Cainozoic age and overlying the foundation of folded Precambrian schist"s and gneisses of the Mozambique belt. The crystalline rocks are rarely exposed but occasionally fragments and found as agglomerates derived from the former Ngong volcano. The soils of the Nairobi area are products of weathering mainly volcanic rocks. Weathering has produced red soils that reach more than 15m in thickness. The Nairobi River catchment basin occurs in an area of three geological formations: the upper catchment overlies the Upper Athi volcanics which are porous and permeable, the Lower Athi volcanics that are weathered down to clayey materials and the Kirichwa valley tuffs. At the lower catchment the main top formation are the deeply weathered Nairobi phonolites (*Krhoda and Kwamboka, 2016*).

The soil in Nairobi is primarily the result of weathering and erosion of the underlying volcanic rocks, influenced by relatively high temperatures, rainfall, and poor drainage. Due to the impeded drainage in the plains, the soils are predominantly black to dark grey clays (Grumosolic), including both calcareous and non-calcareous variants of black cotton soils. To prevent soil loss through erosion, immediate rehabilitation of disturbed areas is recommended. The project will not cause any significant physical changes to the environment, as the topography, slope, and stability of the soil will be preserved.

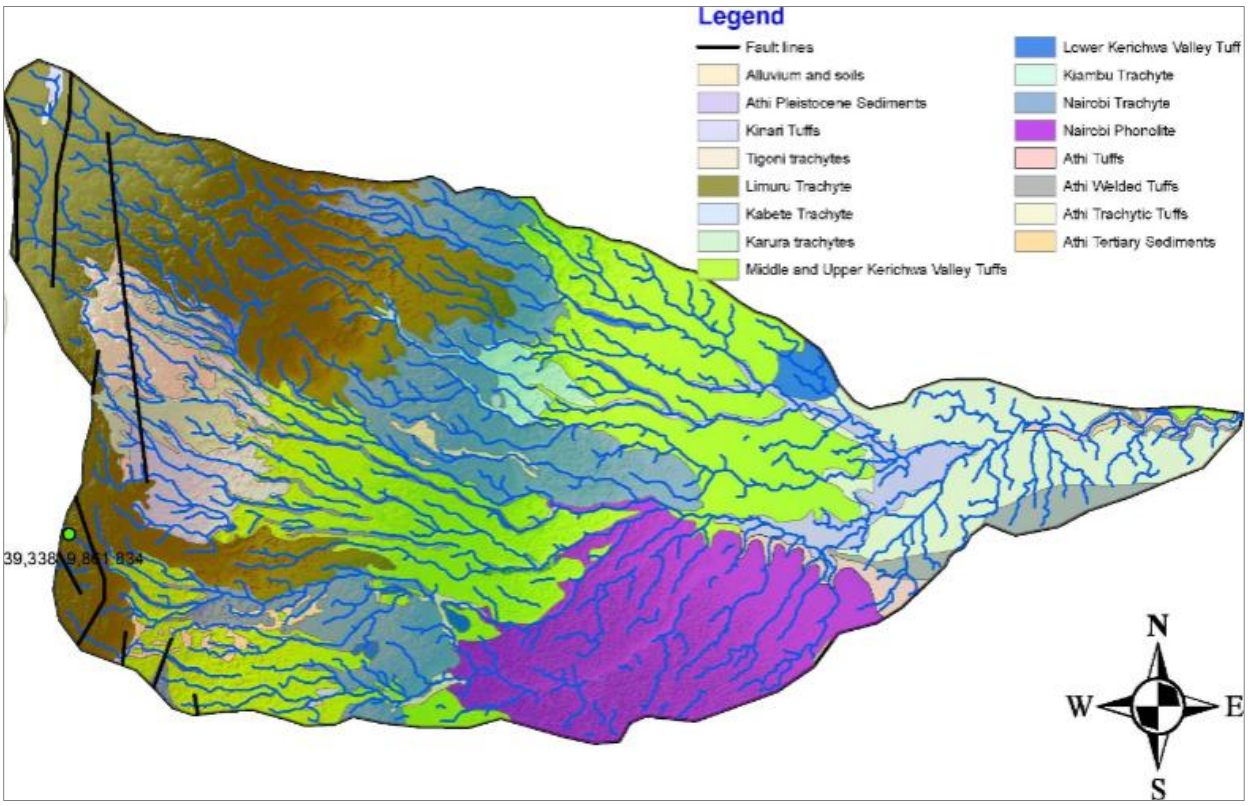

Figure 15: Geological map of the project area (Source: Nairobi University Situation analysis of the Nairobi River Basin Report).

4.3. Bio-physical

Nairobi Rivers Basin is located within the Athi River Catchment which is heavily affected by severe river pollution from defective sewers, domestic and industrial waste, and agricultural runoff. The rivers, including Nairobi, Mathare, and Ngong/Motoine, are heavily polluted, with water discoloration, high levels of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and turbidity. Odors and solid waste further indicate the pollution, which negatively impacts river flow and public health.

4.3.1. Drainage System

Nairobi's main drainage system follows the regional slope of volcanic rocks towards the east, while subsidiary drainage into the Rift Valley is confined to the western part of the city. The lava plains to the east of the Ruiru-Nairobi-Ngong line are characterized by alternating layers of lava flows, lakebeds, stream deposits, tuffs, and volcanic ash. These plains, which include the Athi Plains and the northern section of the Kapiti Plain, extend westward, rising from 1,493 meters at the Athi River to 1,829 meters in the faulted region near Ngong. The landscape is marked by steep-walled gullies and canyon-like gorges, such as those found along the Mbagathi Valley. Further east, this valley slightly widens, where softer materials are actively eroded.

Water draining eastward from the hills accumulates on the low-lying ground between Parklands in the north and Nairobi South Estate, creating a perched water table above the Nairobi phonolite rock. The Kerichwa Valley Tuffs function like a sponge, and their contact with the underlying impermeable phonolite rock forms a natural aquifer. As a result, several water channels containing groundwater are present beneath Nairobi, making it a critical water source for the city. In addition to its natural parks and grasslands, Nairobi has lost much of its wetlands to urban expansion and human settlements. Despite this, several fragments of natural wetlands still persist in the basins of Rivers Mathare, Nairobi, and Motoine. The most significant remaining swamps are Ondiri Swamp in Kikuyu and Kuna Estate, representing some of the few remaining wetland areas in the city. These wetlands continue to provide critical ecological functions, such as water filtration, flood control, and habitat for diverse wildlife.

- **Ngong-Motoine River System**

The Ngong/Motoine River System: The Motoine tributary originates from Dagoretti Forest, flows through Jamhuri Park, and merges with the Ngong tributary within the Kibera slums. After this confluence, the river is known as the Ngong/Motoine River, which flows into Nairobi Dam, passes through the Nairobi West suburbs as Ngong River, crosses Mombasa Road, and traverses the Industrial Area. It then continues to join Nairobi River after Njiru Shopping Centre. Beyond this point, the river becomes part of the Mathare and Nairobi tributary system, commonly referred to as Nairobi River.

- **Nairobi River Tributary**

The main sources of the Nairobi River tributary are the Ondiri/Kikuyu swamps and springs on the Kikuyu escarpment passing through Kangemi, Lavington, Chiromo after confluence with Kirichwa, Globe Round about, Kamukunji, Eastleigh, Kariobangi and Dandora.

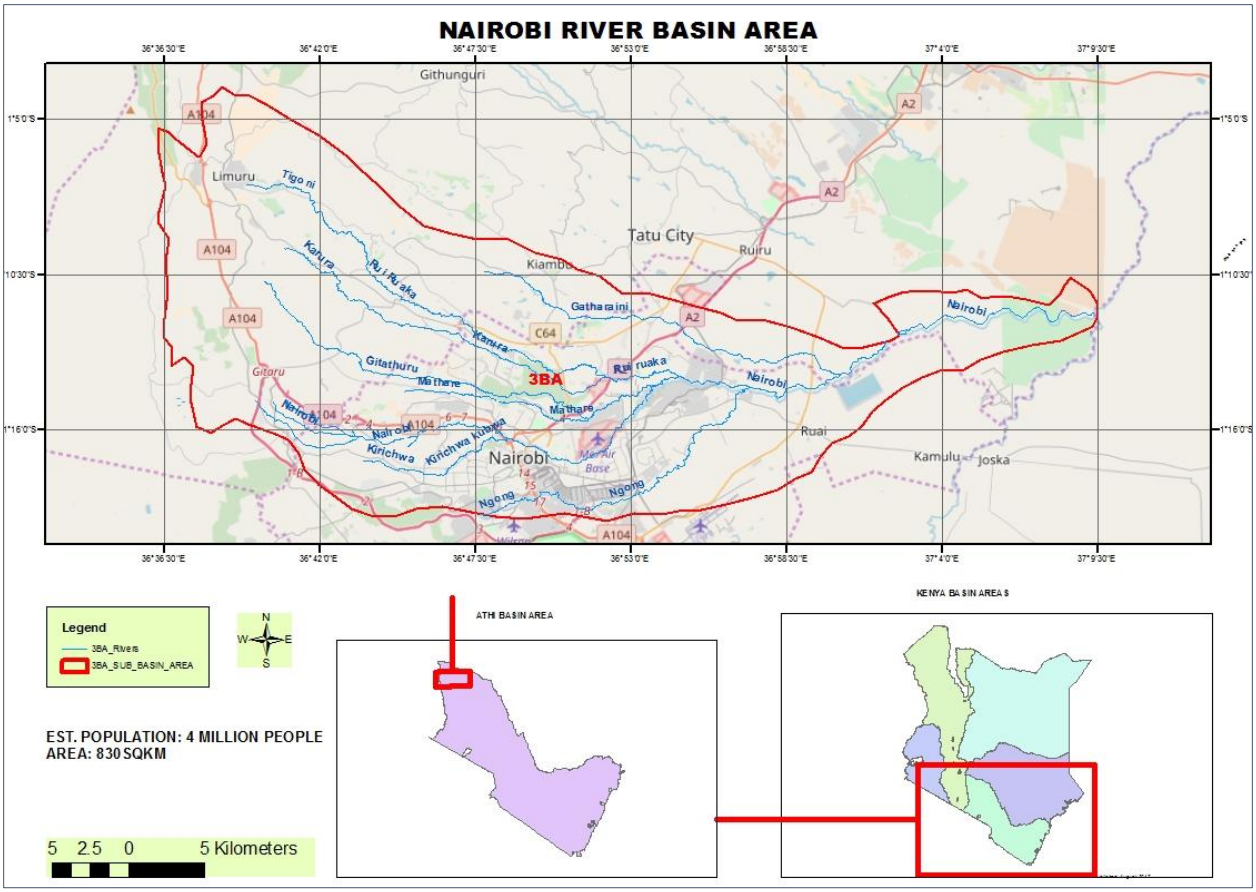

Figure 16: Map showing Ngong River, Nairobi River and Mathare River which are tributaries of the Nairobi River system (Source: JICA Report 2019)

4.3.2. Pollution Load Analysis

The Nairobi, Ngong, Motoine, and Mathare rivers, along with several smaller tributaries, all originate from the Ngong Hills and Dagoretti to the west of Nairobi City. These rivers flow through densely populated areas, including individual households, executive estates, slums, factories, and "Jua Kali" sheds. Consequently, the Nairobi, Ngong, Motoine, and Mathare rivers have become heavily polluted, leading to a severe decline in water quality and a significant loss of biodiversity. This pollution has affected both the aquatic ecosystems and the communities that rely on the rivers for water and other resources. As highlighted in the analysis, the contamination is largely due to untreated sewage, industrial waste, and runoff from urban areas. The once-thriving ecosystems have been replaced by degraded environments, with native species disappearing and the rivers becoming less viable for both wildlife and human use.

a) Water Quality Trends

To assess water quality, a set of conventional parameters is regularly monitored. In this report, five key indicators of electrical conductivity (EC), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and total suspended solids (TSS) are used to evaluate the overall condition of the water. Electrical conductivity reflects the concentration of ions in the water, and to some extent, salinity. It is directly related to TDS, which represents the amount of dissolved substances in the water. BOD measures the amount of oxygen required by microorganisms to break down organic matter, providing an estimate of biodegradable content. COD, in contrast, measures the oxygen demand for both biological and chemical oxidation of organic matter. As a result, COD values are typically higher than BOD but are closely correlated.

TSS indicates the concentration of solid particles that can be removed by filtration. These suspended solids often contribute to siltation in water bodies and infrastructure. The figure below illustrates the general trend of conductivity levels in rivers over the past five years (2018–2023). Overall, the annual average conductivity has remained relatively stable, with only minor fluctuations. In response to these challenges, the proposed Nairobi River Regeneration Program seeks to address the pollution and restore the rivers' ecological health. The program includes

various subproject components designed to improve water quality, enhance waste management, rehabilitate riparian habitats, and promote sustainable urban practices.

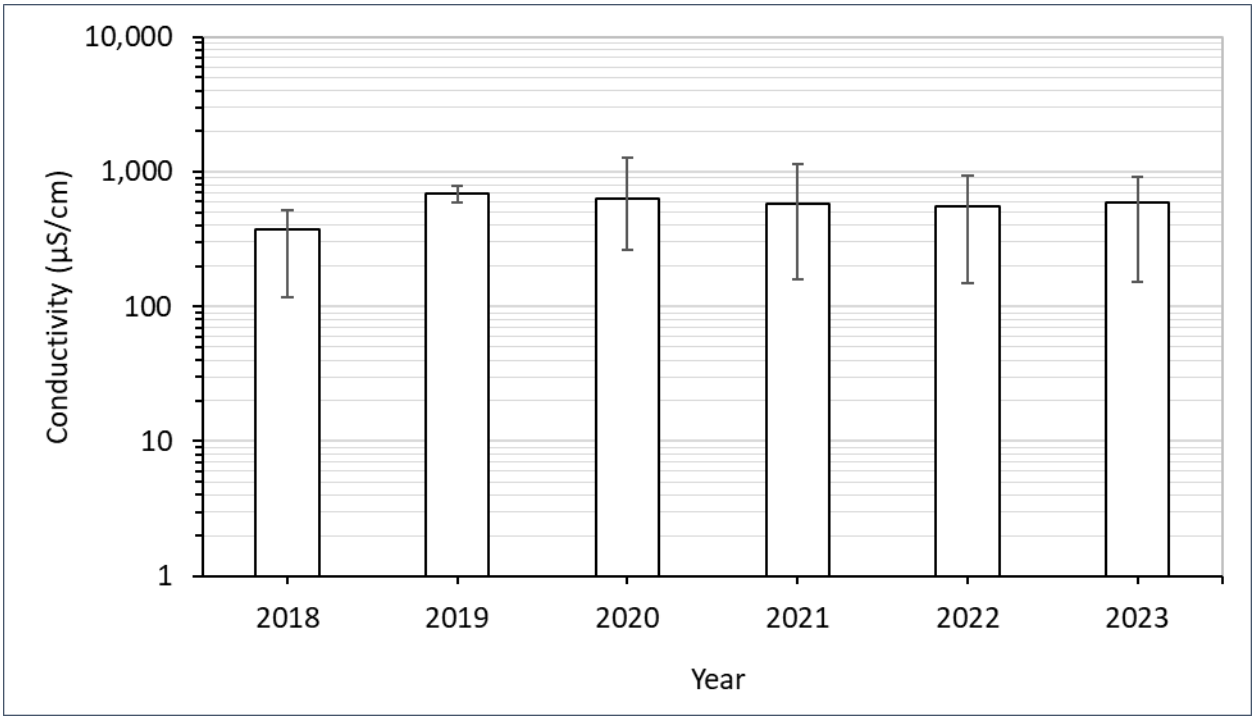

Figure 17: Average conductivity in R. Athi and its tributaries. The error bars indicate the minimum and maximum conductivity (Water Resource Authority Report 2022)

b) Distribution of Water Quality Parameters Across Rivers

The general distribution of BOD, COD, TDS, and TSS across selected rivers indicates varying levels of pollution. Overall, the Ngong, Mathare, and Nairobi Rivers are the most heavily impacted. This is not surprising, as these rivers flow through densely populated areas of Nairobi City and are significantly influenced by nearby informal settlements, which often lack adequate sanitation infrastructure. Additionally, a large proportion of both formal and informal industrial activities are concentrated within these sub-catchments, further contributing to the pollution levels in these rivers as outlined in the Figure.

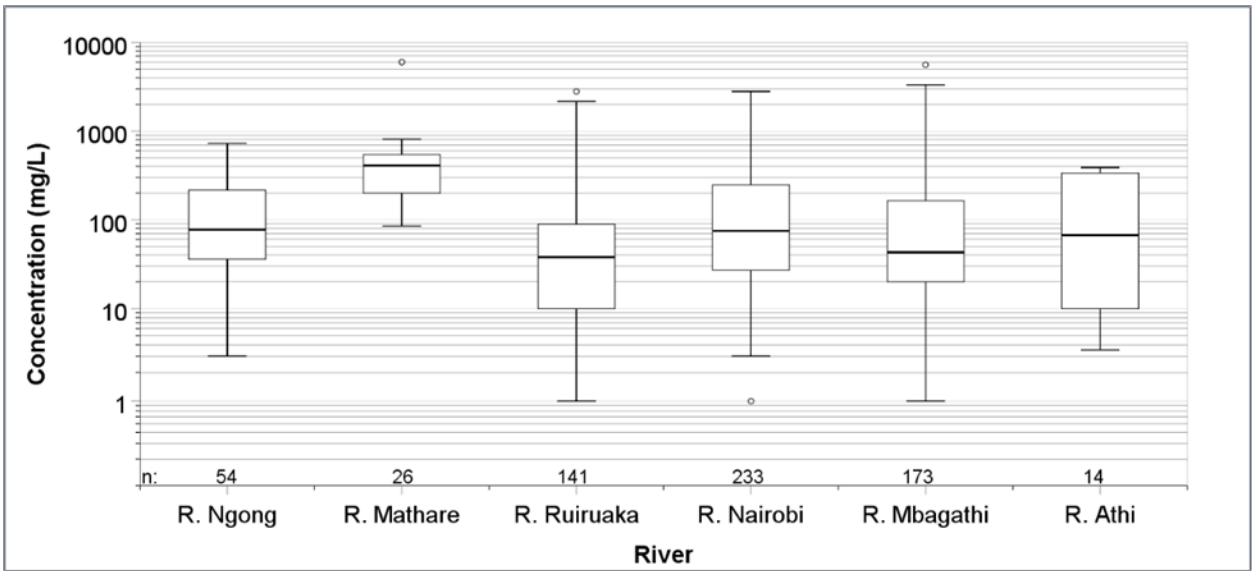

Figure 18: General Distribution of BOD, COD, TDS and TSS the Rivers Between 2018 to 2023 (Source: Water Resource Authority Report 2022)

c) Spatial Water Quality Trend

To illustrate the spatial trends in water quality along river profiles, data for the year 2022 have been analyzed. The results for BOD, COD, TDS, and TSS are presented in Figure below. For the Ngong River, a general increase in the concentration of all measured parameters is observed along its course from the relatively pristine upstream sections near the outskirts of Ngong Forest to the downstream site at Kangundo Road. This trend is particularly evident as the river flows through several informal settlements, including Kibera, Mukuru, Riverside, and Soweto. These areas are characterized by high population density and limited sanitation infrastructure, which contribute significantly to the degradation of water quality.

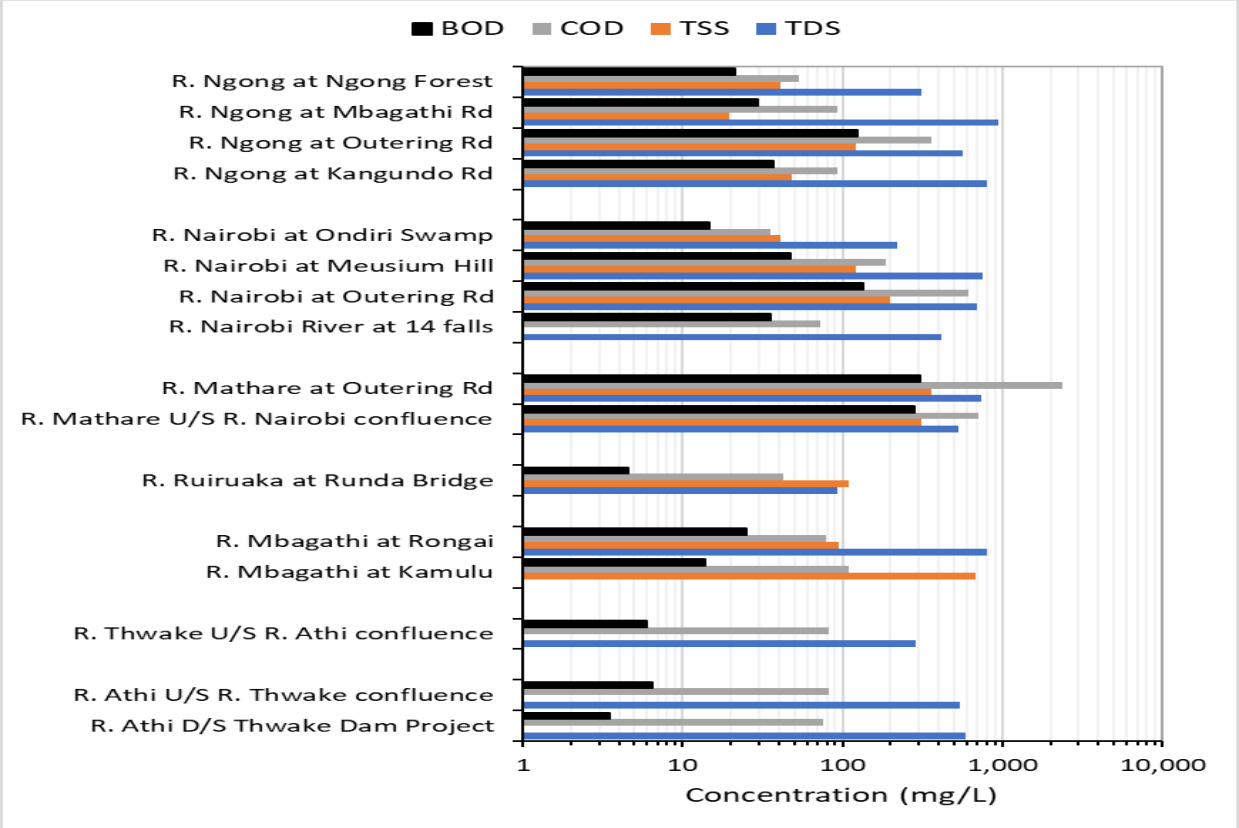

Figure 19: Average concentration of BOD, COD, TSS and TDS along the profile of R. Athi and its tributaries during the 2022 period (Source: Water Resource Authority Report 2022)

An analysis of 2022 water quality data along the Ngong, Nairobi, Mathare, and Athi Rivers reveals distinct spatial trends in key pollution indicators (BOD, COD, TDS, TSS, and electrical conductivity). Rivers Ngong and Nairobi show increasing concentrations of pollutants as they flow through densely populated informal settlements. A notable drop in BOD and COD is observed at Thika 14 Falls, attributed to natural self-purification and dilution from cleaner tributaries such as the Ruiru River. In the Mathare River, no consistent trend is observed, though BOD and TSS remain relatively stable. Downstream from Thika-14 Falls to Athi River at Thwake Dam, organic pollution levels decrease significantly, likely due to reduced pollutant input and minimal urban impact. Electrical conductivity mirrors the distribution patterns of the other parameters across all river profiles.

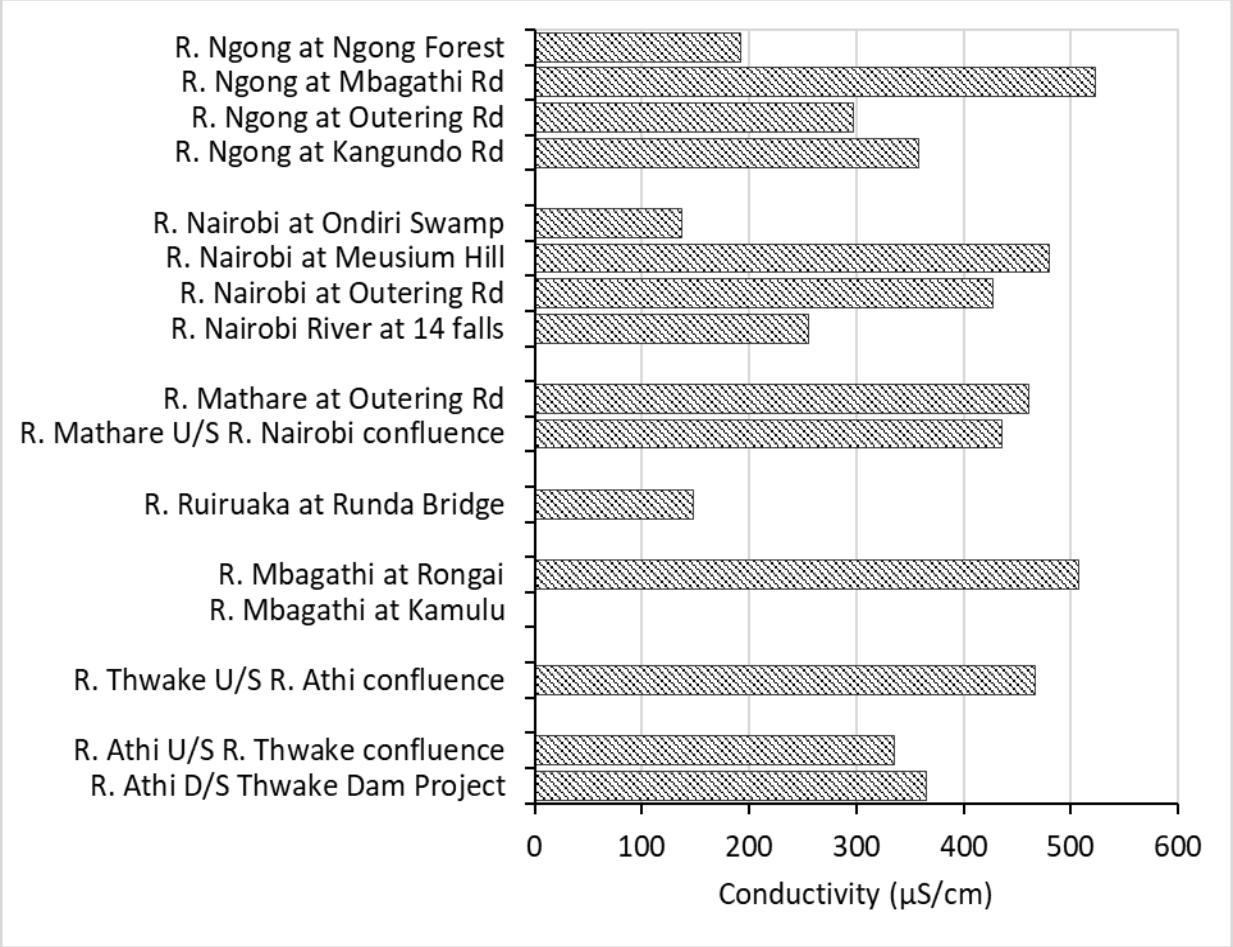

Figure 20: Average conductivity along the profile of R. Athi and its tributaries during 2022 period (Source: Water Resource Authority Report 2022)

Between 2018 and 2023, overall water quality in the basin has remained relatively stable, with only minor fluctuations. Rivers flowing through Nairobi, especially those passing through informal settlements, show higher pollution levels due to inadequate sanitation infrastructure and frequent sewer overflows. Spatially, water quality tends to deteriorate downstream as rivers pass through densely populated areas. However, after Thika 14-Falls, a significant improvement in water quality is observed. By the time the river reaches Thwake Dam, the organic pollution levels are low enough to be treated using conventional drinking water methods. Despite this, ongoing and regular monitoring remains essential to track changes and inform effective water management decisions.

4.4. Biological Environment (Biodiversity)

The study area is based on the drainage basin of the Nairobi River, its tributaries, the (*Mathare, Ngong-Motoine*) Rivers and associated reservoirs and wetlands. This covers most of Nairobi City and the watershed. The study area effectively extends from the upper watershed, at the western end of the source rivers on the Ngong-Dagoretti Kikuyu escarpment, to the confluence of the three tributaries and include all streams and their sub-catchments.

Nairobi City County and its surrounding suburbs cover an area of 658 km², with 117 km² of this area designated as forested parks and grasslands. The city is situated within the catchment area of the River Athi, the Athi-Kapiti Plains, and the forested slopes of the Aberdare Mountain Range. Nairobi's city parks feature a variety of natural landscapes, including open grasslands and deciduous forests. Notable examples include the Karura Forest, Arboretum, City Park, Dagoretti, and Ngong Forests, all of which contribute to the city's rich biodiversity and provide valuable green spaces for residents and visitors alike.

4.4.1. Flora

The eastern part of Nairobi County is primarily characterized by savanna grasslands, dominated by short grass and scattered drought-resistant trees. The surrounding undeveloped areas consist largely of bushy grasslands, where grass dominates with occasional shrubs. The shrub canopy cover is typically less than 2%. These grasslands occasionally feature widely scattered or grouped trees and shrubs, but the overall canopy cover remains below 2%. The area is also home to medium-sized indigenous trees, predominantly acacia species, such as *Acacia Abyssinica*, as well as ferns, shrubs, and grasslands. Along the main rivers Ngong/Motoine, Mathare, and Nairobi River, papyrus reeds and long green grasses are prevalent. These rivers experience high levels of eutrophication, leading to conspicuous algal blooms and the growth of leafy green grasses, such as *Chloris gayana* and *Themeda thriandra*, which provide pasture for large numbers of livestock in the region.

The western parts of Nairobi County form the catchments for the Ngong, Mathare, and Nairobi rivers. These rivers are predominantly lined with exotic tree species, including eucalyptus (*Eucalyptus grandis*), grevillea, whistling pines, cypress, sesbania, and lucena species. In areas such as Kileleshwa, Chiromo and Muguga, isolated indigenous trees are also present, including *Kikuyensis* species, Mugumo (fig), bamboo, *Croton megalocarpus*, *Acacia xanthopholea*, and yellow oleander, among others. The project will not have an impact on any natural forests, as the trunk sewers do not pass through any protected areas apart from Michuki park. Furthermore, any effects on the biological environment will be minimized, as the trunk sewers will be constructed within the riparian zones of the rivers, thereby eliminating the risk of wetland destruction or interference with the river course.

4.4.2. Riverine and Wetland Vegetation

Along the riverbanks, the vegetation is dominated by herbaceous plants, often interspersed with short grasses and fringing reeds in the lower reaches. Further upstream, the river's closed reaches support dense overhangs that form canopies, composed of both exotic and indigenous riparian trees. These tree canopies serve as a source of terrestrial invertebrates that fall into the streams, contributing to the ecosystem. The dominant forest type around the catchment area of the reservoir is dry semi-deciduous forest (*Trump, 1967*). Key species in this area include *Croton megalocarpus*, *Brachylaena huillensis*, *Calodendrum capense*, *Teclea spp.*, *Strychnos henningsii*, and *Diospyros abyssinica*. In areas such as Lavington, Riverside, and Arboretum areas, the river valley has been narrowed significantly. In these areas bamboo (*Bambusa vulgaris*) has become the dominant species in the riverine vegetation. After the confluence of Kirichwa Kubwa and Kirichwa Ndogo near Museum Hill, an agroforest exists that contains several species of indigenous plants (*UoN ASCO, 2005*).

Plate 3: Riverine vegetation (Fieldwork)

The natural vegetation in the Nairobi City County has been significantly altered since 1899, when a base railway camp was established in what was once a mosaic of open grasslands, montane closed forests, moist woodlands, and swampy areas. Today, it is challenging to visually determine what the native vegetation originally looked like in many parts of Nairobi. The city's streets are lined with trees, and gardens are primarily planted with introduced exotic ornamental trees and shrubs. Despite this, small and increasingly shrinking pockets of indigenous vegetation remain undisturbed in areas such as Mathare-Karura, the Arboretum, City Park, Dagoretti, and the Ngong Forests, among others. These areas still host a variety of woodland, forest, and grassland species.

4.4.3. Phytoplankton Community

According to studies by Njuguna (1978), diatoms and the blue green algae dominate the phytoplankton in the Nairobi Rivers. They include the filamentous and coccoid cyanophytes; *Lyngbya conorta, Anabaenopsis tanganyikae, Oscillatiria spp., Microcystis spp., Microcystis aeruginosa, and baccillariophyta e.g. Melosira sp. Chlorophytes include the Pediastrum duplex, Closterium sp., Ankistrodesmus sp., and Cosmarium sp*. Differences in the composition, distribution and abundance of the phytoplankton assemblages in the upper, mid and lower reaches are related to factors such as river discharge, nutrient levels and flushing rates in the main tributaries.

4.4.4. Fauna

The waters of the Nairobi, Motoine/Ngong, and Mathare Rivers have been heavily polluted, making them unfit for domestic, commercial, or industrial use. Additionally, the rivers can no longer support a diverse range of aquatic life due to the high levels of contamination. At present, these rivers have limited biological diversity and primarily function as open sewers, carrying waste from human settlements upstream and from the central business district (CBD). However, undisturbed areas such as Nairobi National Park, Arboretum, Ngong and Karura forests continue to support a diverse abundance of wildlife, providing a vital sanctuary amidst the urban environment.

4.4.5. Bird Community

The Nairobi River Basin and its catchment lie along a major flyway for thousands of migratory birds, including both intra-African and Palaearctic migrants. Many bird species use Nairobi as a stopover point during their northward migration to Europe or their southward journey to southern Africa. However, the steady loss of natural habitats in the city has led to a noticeable decline in the number of birds wintering in Nairobi. The clearing of forests, grasslands, and wetlands within the Nairobi River system for agriculture and human settlements has had a detrimental impact on both resident breeding birds and migratory species.

The birds occurring in the Nairobi River system occupy a wide range of trophic levels. They comprise primary consumers, such as grazers (ducks and geese), seed eaters (sparrows, weaverbirds and finches) and fruit eaters (Black and white casqued hornbills and Hartlaub's turaco). They also contain secondary consumers (insectivores such as Black Cuckoo shrikes and Greenbuls as well as carnivores such as Crowned Eagles and Sparrow Hawks). There are also tertiary consumers (vultures, kites and marabou storks as well as other carrion feeders). Marabou storks (*Leptoptilos crumeniferus*) are commonly found around city dams and dumping sites.

4.4.6. Land Use in Nairobi City

Nairobi City functions as Kenya's principal hub for population concentration and socio-economic activity, serving as the national center for transportation, communication, industrial operations, and political administration. The urban spatial structure reflects socio-economic stratification: the western and northern upland regions are characterized by low-density, high-income residential developments. Adjacent to the central business district (CBD), the northern sectors are predominantly occupied by middle-income residential communities. Conversely, the southern and eastern zones, particularly those adjoining the industrial core, accommodate high-density, low-income settlements.

It is expected that a large area of Nairobi County City and its satellite towns will be fully urbanized by 2042, with evidence of little agriculture. Land use will be predominantly for residential development – catering for low, middle and high-income households. Informal settlements will still be found in Nairobi and its satellite towns, unless deliberate efforts are made to tackle the serious housing shortage for the low and middle-income households, to include increasing unemployment and low per capita income in Kenya. The spatial distribution of the various land uses in Nairobi and the Selected Satellite towns is outlined below. Kikuyu town where Ondiri swamp is located has no approved integrated development plan for the period 2018 – 2040. As such, the expansion of commercial centres in Kikuyu, Gitaru, King'eero, Wangige, and Uthiru, etc. will continue to be unplanned. Agricultural land will be sub-divided into smaller units and the same will be turned into housing, commercial and industrial development. Land use in the Nairobi River basin has changed due to the expansion of agriculture and urbanization since the early 1900s.

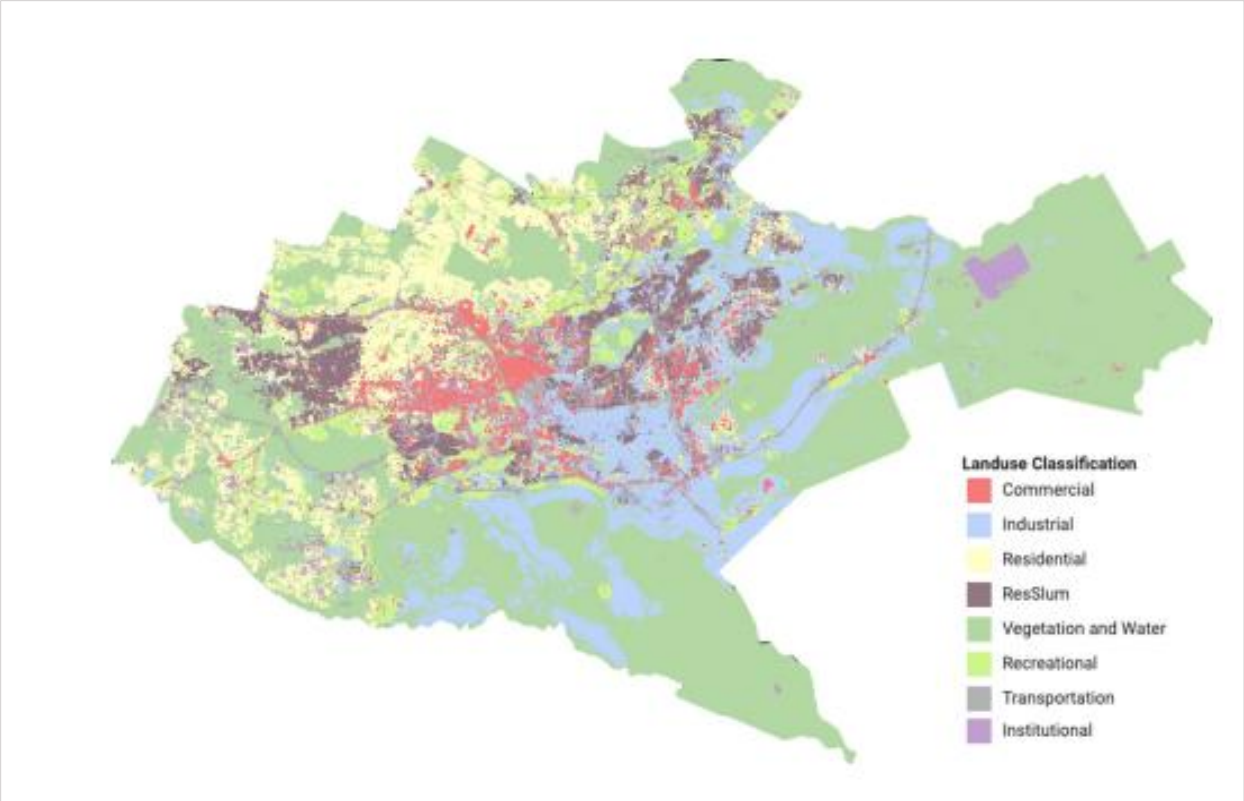

Figure 21: Nairobi Land Use Map (JICA Report 2019)

4.5. Socio-Economic Baseline Condition

4.5.1. Population Size and Density

As of the 2019 Housing and Population Census, Nairobi had a population of 4,397,073, with females slightly outnumbering males (2,204,376 compared to 2,192,452), and a recorded intersex population of 245. The city's population is estimated to have grown to 4,671,906 by 2022, with an additional one million people commuting into the city. Nairobi hosts nearly 10% of Kenya's national population, despite its limited land area, making it the most densely populated region in the country. The city spans a total area of 703.9 square kilometers, with a population density of approximately 6,237 people per square kilometer in 2019 census. The projected density is expected to increase further to 7,163 people per square kilometer by 2027. This is significantly higher than the national population density, which stands at 82 people per square kilometer. Nairobi is home to approximately 1,506,888 households, with an average household size of 2.9. The city is cosmopolitan and the primary languages being Swahili and English.

Table 4: Nairobi Population per Sub County 2019 and Projected Growth

Sub-County	Population					
	Male	Female	Total 2019	2022	2032	2042
Dagoretti	217,651	216,526	434,177	480,404	673,088	943,055
Embakasi	492,476	496,270	988,746	1,094,018	1,532,814	2,147,607
Kamukunji	136,670	131,599	268,269	296,832	415,887	582,694
Kasarani	381,234	399,285	780,519	863,621	1,210,008	1,695,327
Kibra	94,199	91,569	185,768	205,547	287,989	403,498
Lang'ata	96,698	100,774	197,472	218,497	306,133	428,919
Makadara	96,369	93,157	189,526	209,705	293,815	411,660
Mathare	106,522	100,028	206,550	228,541	320,206	448,637
Njiru	307,642	318,809	626,451	693,149	971,163	1,360,684
Starehe	109,173	101,238	210,411	232,813	326,192	457,023
Westlands	153,818	155,021	308,839	341,721	478,781	670,814
Total	**2,192,452**	**2,204,376**	**4,397,073**	**4,865,229**	**6,816,611**	**9,550,668**

Therefore, the proposed project preliminary design has conservatively adopted an annual population growth rate of 3.43% for projecting demographic trends across the three defined planning horizons. The projected populations have been disaggregated into the following key user categories: domestic, institutional, commercial, and livestock. A summary of the population projections for each category is provided on the above table. A design period of 20 years has been adopted as guided by the Ministry of Water and Irrigation Sewerage and Sanitation Services Manual (2005). On the other hand, Kikuyu town population projection to 2040, which falls in the Nairobi Northern Metro Region, will also experience an estimated population growth rate of 6.3% per annum.

Table 5: Kikuyu Town - Population Size and Density Projection 2010-2040

Year	2010	2015	2020	2025	2030	2035	2040
Population	123,176	167,262	222,126	308,417	418,802	514,455	631,954
Density (Persons/km²)	1,186	1,610	2,186	2,968	4,031	4,951	6,082

4.5.2. Population Density Along River Corridor

The proposed project alignment traverses multiple settlements and communities, beginning at the upstream section of the Nairobi River in the Ondiri Swamp located in Kikuyu Sub-County and extending downstream to Dandora Falls in Nairobi County. This corridor cuts across a diverse range of rural, peri-urban, and urban environments, each with its own unique socio-economic characteristics.

No.	Village/Area Name	Sub-County	2019-KPHC	Notable Features / Remarks
1	Ondiri Swamp (Sigona)	Kikuyu	16,741	Source of Nairobi River
2	Korogocho	Ruaraka	36,900	
3	Lucky Summer		50,865	
4	Kileleshwa	Dagoretti North	32,513	
5	Ruai	Kasarani	72,134	The Dandora waste treatment plant
6	Eastleigh North	Kamukunji	10,954	
7	Kangemi/Gatina	Westland	116,710	Upstream section
8	Nairobi Central	Starehe	53,110	
9	Dandora Falls (Phase I and II)	Embakasi North	59,802	Lower reach of Nairobi River

4.5.3. Water and Sanitation

Nairobi faces water and sanitation problems common to many cities of the developing world which grow too fast. The water supply is simply unable to meet fast-growing demand. Over the decades, Nairobi's rapidly growing population, coupled with the effects of climate change, have put the city's water infrastructure under increasing pressure. Nairobi currently has a total installed water production capacity of 525,000m³/day. However, the supply is insufficient to meet the current demand estimated at 669,888 m³/day with non-Revenue water estimated at 40%. During the current drought period, water production is 418,000m³/day. The water supply is from four sources as outlined:

a) Thika Dam/Ngethu Water Treatment Plant – 440,000m³/day (83.7%),
b) Sasumua Dam – 61,000 m³/day (11.6%),
c) Ruiru dam/Kabete Water Treatment Plant – 20,600 m³/day (3.9%),
d) Kikuyu Springs – 4,000m³/day (0.8%)

Nairobi County does not have a major water tower of its own and relies on neighboring counties such as Kiambu, Murang'a, and Nyandarua, located about 50 km away in the Tana Basin, for its water supply. However, this supply is unreliable during drought periods and is further endangered by siltation of reservoirs due to deforestation in the catchment areas. The situation is exacerbated by a poorly managed water distribution system, resulting in nearly 38% water loss due to leakage, illegal connections, and inefficient or wasteful use by some consumers.

Nairobi City Water & Sewerage Company Limited is the primary water service provider, with approximately 80% of the city having piped water connections. In areas that receive only intermittent supply, boreholes and wells are operated by large private consumers or individual residential owners. In these areas, water from wells is often shared with neighbors, or it is sold for distribution by tankers. Many private well owners are also connected to the main water supply network, which provides cheaper water, but use groundwater as a backup.

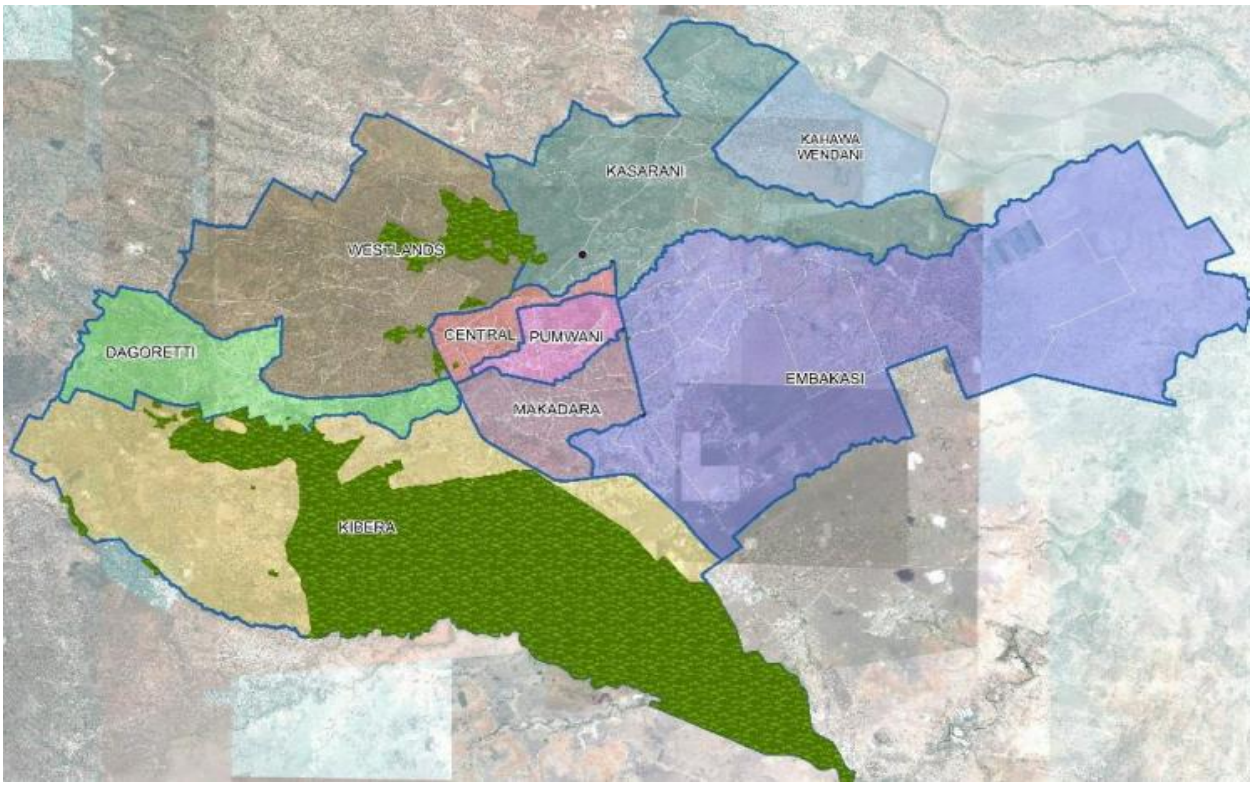

Figure 22: Administrative Sub Counties Supplied by NCWSC

4.5.4. Waste Management

Uncollected solid waste is one of Nairobi's most visible environmental challenges, with approximately 2,475 tons of waste generated daily. Many parts of the city, particularly in low- and middle-income areas, lack proper waste collection systems. Nairobi's current waste disposal system is plagued by several issues, including the failure to prioritize solid waste management, inadequate infrastructure, and the involvement of multiple actors whose activities are not adequately regulated. There is a pressing need to shift from traditional methods of waste disposal, such as dumping and burning, to more sustainable practices like recycling.

In terms of sanitation infrastructure, approximately 61.5% of the population utilize flush toilet systems, while 32.1% depend on pit latrines. The remaining 4.8% of the population lacks access to formal waste disposal methods. With regard to solid waste management, approximately 36.1% of households benefit from private waste collection services, while a comparable proportion relies on community-based collection initiatives operating within neighborhoods.

All collected waste is ultimately deposited at the Dandora landfill and other designated dumpsites. However, the Nairobi City and Metropolitan Region continues to face escalating levels of environmental pollution, primarily driven by inadequate wastewater and solid waste disposal systems, as illustrated in the plate below.

The Nairobi City Water and Sewerage Company (NCWSC) currently operates four municipal sewage treatment facilities:

a) Dandora Estate Wastewater Treatment Plant with an installed capacity of 160,000 m^3/day
b) Kariobangi Treatment Plant with a capacity of 32,000 m^3/day
c) Kahawa West Plant at 1,750 m^3/day
d) Karen Plant at 455 m^3/day

The combined installed capacity of 194,205m³/day is significantly below the anticipated wastewater generation projections for the year 2042, which are expected to exceed twice the current capacity. The current wastewater generation for Nairobi is estimated at 501,501m³/day with an ultimate generation of 1,046,948 m³/day in the year 2042 as outlined in the table below[5].

Table 6: Projected Wastewater Discharge

Population category	Generation Factor	Connection factor	Projected Water Demand (m^3/day) 2022	Wastewater discharge (m^3/day)		
				2022	2032	2042
Domestic	80%	75%	506,566	303,939	445,635	652,100
Students	85%	80%	49,323	33,540	46,671	64,944
Livestock	75%	75%	181	102	92	83
Commercial, Institutional and Industrial	80%	100%	204,901	163,920	241,702	329,821
			760,971	**501,501**	**734,100**	**1,046,948**

The proposed project aims to address several of the existing challenges by constructing new sewer trunk lines, expanding the capacity of the Kariobangi Sewer Treatment Works (KSTW), and implementing a comprehensive river regeneration program. These interventions are designed to reduce pollution, enhance wastewater management, and curb improper solid waste disposal along the river corridors.

Plate 4: Evidence of Inappropriate Waste Management (Korogocho area Source: Kombgreen solutions)

[5] Nairobi City County ICDP 2022-2027)

4.6. Kiambu County (Kikuyu Sub County) Baseline

4.6.1. Background Information

Kikuyu Sub-County is one of the twelve sub-counties within Kiambu County, covering a total area of approximately 172.9 square kilometers. The sub-county is administratively divided into five wards, namely: Karai, Nachu, Sigona, Kikuyu, and Kinoo. This area plays a significant role in the county's socio-economic and environmental landscape, hosting a mix of urban, peri-urban, and rural settlements, and serving as a key link between Nairobi City and the greater Kiambu region.

4.7. Physical Characteristics

4.7.1. Climate

The Ondiri Wetland and its environs experience a bi-modal rainfall pattern characterized by two distinct rainy seasons. The long rain typically occurs from mid-March to May, followed by a cold season stretching from June to August, which is often marked by light drizzles, low sunshine, and frequent frost, particularly in the early mornings. The short rainfall between mid-October and November contributes significantly to the area's hydrological recharge. The region receives an average annual rainfall of approximately 1,500 mm, supporting the wetland's unique biodiversity and ecosystem functions.

The mean annual temperature is about 26°C, with notable spatial variation. Temperatures range from as low as 20.4°C in the upper highlands to up to 34°C in the midland areas, particularly around Karai in Kikuyu Sub-County. Cooler conditions are generally experienced in July and August, while the hottest months are typically January and February (*Macharia et al., 2010*; CGK, 2018).

4.7.2. Topography

Ondiri Wetland is situated at the foot of the Kikuyu Escarpment and is surrounded by a gently undulating hilly landscape. The wetland lies at an elevation of approximately 2,000 meters above sea level (ASL), making it one of the highest elevation wetlands in Kenya. To the north of the wetland, Kikuyu Town is perched on a raised terrain, forming a prominent ridge that overlooks the swamp. The general topographical gradient of the area slopes eastward, descending from around 2,000 meters ASL at Ondiri to about 1,600 meters ASL as the terrain stretches toward Nairobi City.

This elevation difference contributes to the eastward drainage pattern of surface and subsurface water, feeding into the Nairobi River system. The high altitude and surrounding topography also influence the local microclimate, hydrology, and vegetation distribution within the wetland catchment area.

4.7.3. Geology and Soils

The geological formation of the Ondiri Wetland area plays a critical role in determining soil types, texture, and ultimately, the groundwater recharge potential of the wetland. The region is underlain by faulted, north–south-oriented Late Quaternary lava flows and pyroclastic deposits of trachytic composition, which were extruded during the tectonic events associated with the formation of the Kenyan Rift Valley.

The Ondiri area is composed predominantly of the youngest trachyte sequences, specifically the Limuru Trachytes, which have been radiometrically dated to approximately 1.72–1.55 ± 0.09 million years ago (*Barker et al., 1971*). This geological unit is part of the Eastern Border Zone of the Rift Valley, which is filled with Cainozoic volcanic rocks and sedimentary deposits. These formations underline the Upper Athi Basin and form productive aquifers, making the region important for groundwater storage and discharge. The dominant soil types in the region are well-drained podsols and andosols, developed from undifferentiated Tertiary volcanic rocks and basic igneous formations (*GoK, 2002*). These soils are typically extremely deep, with coloration ranging from grey or red to dark brown friable clays. In valley bottoms, the soils are often imperfectly drained, appearing as dark to black with a higher organic content.

Overall, the soil exhibits moderate fertility and are capable of supporting a wide range of agricultural activities, including both subsistence and commercial farming. The combination of favorable contribution characteristics and permeable geological layers contributes to efficient infiltration and aquifer recharge, which are crucial for sustaining the ecological integrity of the Ondiri Wetland.

4.7.4. Hydrology

Ondiri Wetland forms an integral part of the Lari–Ondiri Fault drainage system and serves as the primary source of the Nairobi River, which ultimately drains into the Athi River and eventually discharges into the Indian Ocean (*Onkaru WRUA, 2013*). To the east of the wetland lies Kikuyu Springs, hydrologically linked to Ondiri through a subterranean water passage, indicating the presence of a shared groundwater system.

The wetland is perennially sustained through a combination of surface and subsurface sources. It is recharged by three seasonal streams originating from the Muguga Forest Block on its northern side, in addition to direct rainfall, surface runoff from adjacent upland areas, and numerous springs located around its periphery (*Gichuki et al., 1998*). The perennial nature of Ondiri Wetland is also attributed to a suspected underground aquifer source, enhancing its hydrological resilience during dry periods. The main outflow from Ondiri Wetland is directed southeast via the Nyongara River, which is a significant tributary of the Nairobi River. As it flows downstream, the Nyongara River is joined by several smaller streams and traverses densely populated areas such as Thogoto, Dagoretti Market, Uthiru, and Kawangware, before merging with the Nairobi River at Waithaka.

These downstream settlements are predominantly inhabited by low-income communities, many of whom depend on natural water sources for domestic use and small-scale farming. As such, the conservation and protection of Ondiri Wetland not only supports ecosystem services and urban water security but also has direct socio-economic benefits for vulnerable populations living along the Nairobi River corridor.

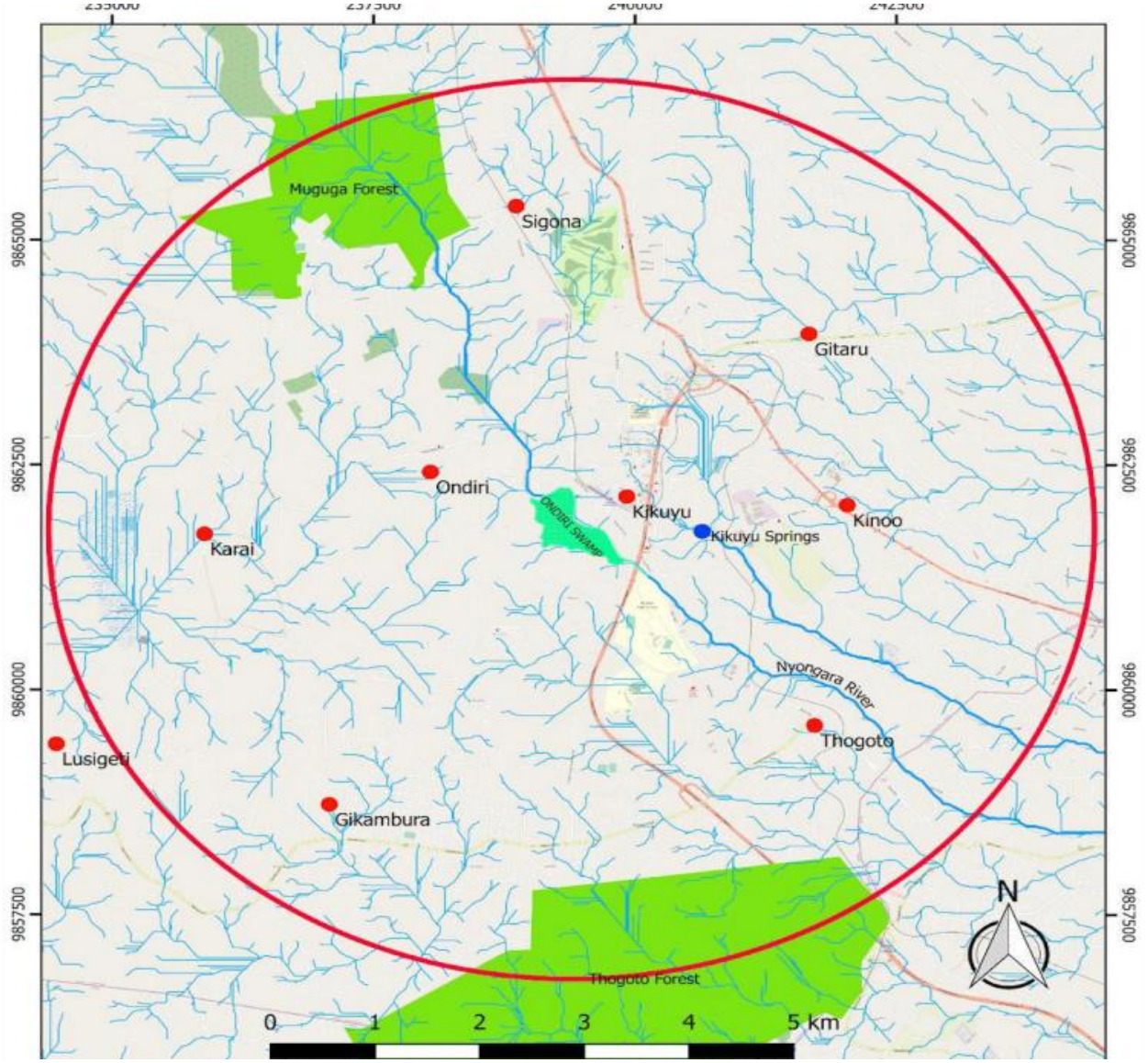

Figure 23: Hydrological Map of Ondiri Wetland (Source: NEMA Ondiri Wetland Integrated Management Plan)

4.7.5. Ondiri Swamp Vegetation

The main plant species found in the Ondiri Swamp wetland include *Typha* and *Cyperus* species, with planted Napier grass surrounding the area. Other notable plants include water lilies (*Nymphaea caerulea*), which are well-established indicators of clear, oligotrophic waters (*Dumont, 1981*). A total of 68 plant species, both aquatic and semi-aquatic, have been documented within Ondiri Wetland. Dominant vegetation includes species such as *Typha domingensis*, *Vossia cuspidata*, *Cyperus brevifolius*, and wetland grasses like *Leersia hexandra*, *Eragrostis exasperata*, and *Eriochloa meyerana*. These species thrive on a dense layer of partially decomposed organic matter, forming a peat mat approximately 0.5 meters thick, which floats atop the swamp's water surface.

The wetland catchment area is characterized by open woodland cover ranging between 40% and 65%, composed mainly of indigenous tree species. Notable native species include *Warburgia ugandensis*, *Prunus africana*, *Podocarpus milanjianus*, *Acacia melanoxylon*, *Acacia mearnsii*, *Ocotea usambarensis*, *Croton megalocarpus*, *Brachylaena huillensis*, *Calodendrum capense*, *Teclea nobilis*, *Strychnos henningsii*, and *Diospyros abyssinica* (Macharia et al., 2010). Additionally, the area hosts a number of exotic tree species, which have been introduced primarily for agroforestry and commercial purposes. These include *Grevillea robusta*, various *Eucalyptus* species, *Jacaranda mimosifolia*, and *Cupressus lusitanica* (*Macharia & Thenya, 2007b*). Several diatom species, a group of microalgae, have also been recorded in the wetland ecosystem. Diatoms are known for their rapid response to eutrophication and are therefore useful as bioindicators of nutrient enrichment, particularly elevated concentrations of phosphates and nitrogen compounds (*Ogondo et al., 2010*). Their presence offers valuable insights into the water quality and ecological health of the wetland.

Plate 5: Ondiri Swamp and Eucalyptus Species Surround the Swamp (Source: Nation Media Group 2023)

4.7.6. Faunal Diversity of Ondiri Wetland

Ondiri Wetland supports a rich diversity of wildlife, with an estimated 94 bird species, both resident and migratory, recorded in the area. Notable avifauna include the Cattle Egret, Sacred Ibis, Hadada Ibis, various species of Kingfishers, Hamerkop, Jackson's Widowbird, African Marsh Harrier, and the Grey Crowned Crane, which is classified as endangered (*Muhati, 2002; Wathiru & Ng'weno, 2019*). The Marabou Stork, though rare, has also been observed as an occasional visitor to the wetland. Ondiri Wetland plays a critical ecological role as a breeding and feeding ground for these bird species, particularly during migration and nesting seasons. The wetland's diverse habitats comprising open water, tall grass, and peat also support a variety of insects, crustaceans, and amphibians, forming a robust food web that sustains bird populations throughout the year.

The dense grasslands surrounding the wetland provide cover and habitat for small carnivores such as mongooses and wildcats, contributing further to the ecological complexity of the area (*Gichuki et al., 1998*). According to a recent rapid baseline survey conducted by the National Museums of Kenya (NMK) under the leadership of Mr. L. Njoroge, additional species continue to be identified, indicating the wetland's high conservation value and the need for sustained ecological monitoring.

Plate 6: Bird Species at Ondiri Swamp (Friends of Odiri Wetland)

4.7.7. Macro-invertebrates

Available records indicate the presence of 27 macro-invertebrate taxa in Ondiri Swamp, the majority of which are pollution-tolerant species, suggesting a degree of environmental degradation within the ecosystem. The dominant groups include beetles (14 taxa), true flies (Diptera, 6 taxa), and dragonflies (4 taxa). Other recorded taxa include single representatives from the spider, crayfish, and mayfly groups. The composition of these macroinvertebrate communities, particularly the prevalence of pollution-tolerant species serves as a bioindicator of water quality decline, potentially due to anthropogenic pressures such as urban runoff, nutrient loading, and habitat disturbance. Continuous biomonitoring of macroinvertebrates is therefore essential for assessing ecological health, identifying pollution sources, and guiding appropriate wetland management interventions.

4.8. Socio-Economic

4.8.1. Agriculture

Ondiri Swamp is a highly productive ecosystem that plays a crucial role in supporting the livelihoods of surrounding communities, even beyond its immediate borders. The wetland provides fertile soil and reliable water resources that sustain intensive agricultural activities in the adjacent areas (*Macharia et al., 2010*). Approximately 70% of households in the region engage in agriculture, largely dependent on water drawn from the swamp for irrigation (*Macharia & Thenya, 2007b*). Farming practices in the area include a mix of overhead irrigation systems and the use of greenhouses, accommodating both small-scale and commercial-scale operations. The main crops cultivated include cabbages, tomatoes, spinach, kale, and carrots, contributing significantly to local food security and income generation.

Agricultural activities surrounding Ondiri Wetland are highly intensive, largely driven by the growing demand for fresh produce from the nearby urban centers of Nairobi and Kikuyu. The fertile soil and year-round availability of water make the area ideal for high-output farming, contributing to both local and regional food supply chains. In addition to crop production, the wetland also serves as a vital source of livestock fodder, particularly during dry seasons, when alternative grazing areas are limited.

Plate 7: Economic Activities (Greenhouse abutting the Ondiri Wetland)

4.8.2. Demographic

According to the 2019 Kenya Population and Housing Census (KPHC), Kikuyu Sub-County had a total population of 187,122, comprising 90,919 males, 96,198 females, and 5 intersex individuals. Based on national projections, the population was estimated to rise to 201,384 in 2022 and is expected to reach approximately 220,961 by 2027. In terms of population density, the sub-county recorded 1,082 persons per square kilometer in 2019. This density was projected to increase to 1,165 persons/km² in 2022 and is anticipated to reach 1,278 persons/km² by 2027, reflecting continued urbanization and population growth pressure in the region.

Table 7: Population per wards in Kikuyu Municipality

Wards	2009	2019
Karai	20,420	23,661
Sigona	26,823	52,259
Nachu/Lusigetti	18,655	22,917
Kikuyu Township	32,422	39,585
Kinoo	27,082	48,700
Total	125,402	187,122

(Source: KNBS Kenya Population & Housing Census 2019)

4.8.3. Land Use

The predominant land use in Kikuyu Sub-County is agriculture, primarily practiced on individual farms. Key institutions supporting agricultural activities in the region include the Kenya Agricultural and Livestock Research Organization (KALRO), the Kenya Forestry Research Institute (KEFRI), and the Kenya Forest Service (KFS), all of which contribute to research, extension services, and resource management. In areas such as Gikambura, dairy farming is a significant economic activity, largely conducted through zero-grazing systems, alongside subsistence crop farming. Other areas, including Gitiba and Karai Muslim, are characterized by small-scale vegetable farming, supporting household food security and local markets. Additionally, residential development is rapidly expanding,

particularly in Kikuyu Town and Gikambura, where the construction of buildings for settlement is becoming increasingly common due to urban sprawl and growing population demands.

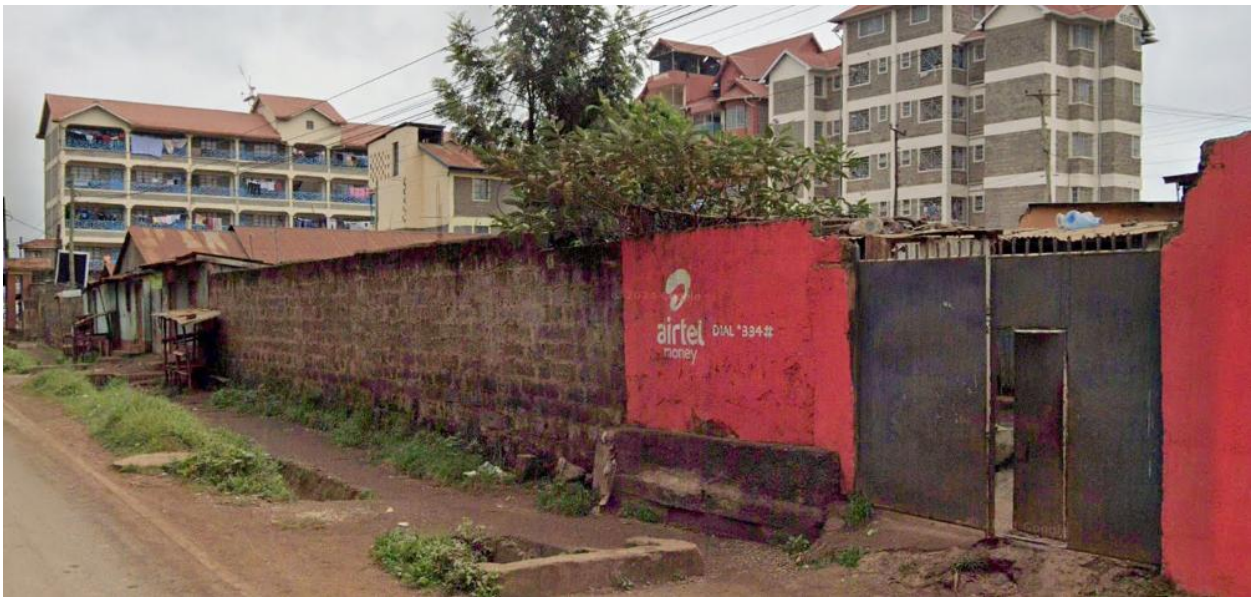

Plate 8: Residential Activities Around Ondiri Swamp

4.9. Physical Infrastructure and Access

4.9.1. Roads and Public Transport

Kikuyu Municipality has a moderate coverage of classified roads, comprising bitumen, gravel, and earth surfaces. The key transport corridor is the Nairobi–Nakuru highway, which traverses the constituency and features five underpasses located at Uthiru/Kinoo, Regen, Gitaru, Zambezi, and Kiambaa. These underpasses fall under the jurisdiction of the Kenya National Highways Authority (KeNHA). The recent completion of the Southern Bypass, which cuts across Kikuyu Town, is expected to significantly enhance commercial activities by improving regional connectivity and reducing traffic congestion. Additionally, the Nairobi–Kisumu railway line, which also passes through Kikuyu Town, provides further logistical support and trade facilitation. Despite these key infrastructure assets, the majority of roads in the constituency remain murram and earth-surfaced, many of which are in poor condition. These roads become difficult to navigate during the rain. Roads around Ondiri swamp, however, are fairly in good condition.

4.9.2. Water and Sewer Facilities

The main sources of water in Kikuyu Municipality include boreholes and surface water bodies, notably River Ondiri, River Gitaru, and Kiambagathi River. The area serves as a net groundwater recharge zone, contributing significantly to regional hydrology. It is estimated that groundwater supplies approximately 13,855 cubic meters per day, meeting a portion of the area's water demand. Natural discharge occurs along the eastern and southern fringes of the municipality, primarily through base flow in rivers originating from the area, including Kikuyu Springs and Ondiri Swamp (*Master Plan for Developing New Water Sources for Nairobi and Satellite Report*).

Water services are primarily provided by the Kikuyu Water and Sanitation Company and the Singuna Water Company, alongside various community-based self-help providers. However, all these entities have since been consolidated under the Kiambu Water and Sewerage Company (KIWASCO) to improve efficiency and service delivery. As of the latest records, 103,983 residents are served by the former Kikuyu Water Company, with a total of 9,945 connections, although only 6,330 are currently active. The current total production capacity of all water sources stands at 4,202 cubic meters per day, which falls significantly short of the projected water demand of 55,526 cubic meters per day by the year 2035. This growing water deficit highlights the urgent need for investment in new water sources and infrastructure expansion to support the municipality's growing population and economic activities.

4.9.3. Kikuyu Spring Biodiversity

Kikuyu Spring is a notable freshwater source located within Kikuyu Town, approximately 1 kilometre southeast of Ondiri Swamp, the recognized headwater of the Nairobi River. The two water bodies are hydrologically and ecologically related, forming part of the upper Nairobi River catchment area. Despite their proximity, they are physically separated by the Southern Bypass, a major infrastructure corridor that runs east-west across the region. The spring is georeferenced at GPS coordinates **-1.249285° latitude, 36.668564° longitude**.

Plate 9: Kikuyu Spring (Source: https://www.nairobiwater.co.ke/kikuyu-springs/)

Hydrological Context

Kikuyu Spring, though smaller in scale compared to Ondiri Swamp, serves as a perennial water source contributing to localized surface and subsurface hydrological flows. It supports urban domestic use, small-scale irrigation, and localized ecological functions, particularly for riparian vegetation and urban biodiversity. Ondiri Swamp, on the other hand, is a peatland wetland system and the principal recharge zone for the Nairobi River. While the Southern Bypass acts as a physical barrier, it does not entirely sever the subsurface hydrological interactions between the spring and the swamp. There is potential for subsurface connectivity through shallow aquifers, particularly during peak rainfall seasons when the water table is elevated.

Biodiversity

Given their geographic proximity (approximately 1 km apart) and shared physiographic setting, both Ondiri Swamp and Kikuyu Spring fall within the same ecological zone and are subject to similar climatic, geomorphological, and hydrological conditions. As a result, the faunal and floral assemblages within these two wetland systems exhibit a high degree of similarity in terms of composition, structure, and ecological function. Vegetation communities in both systems are composed of:

- Hydrophytes and helophytes such as *Cyperus spp.*, *Typha domingensis*, *Phragmites australis*, and *Papyrus spp.*
- Peripheral grassland and shrubland mosaics, including *Cynodon dactylon*, *Sporobolus spp.*, and *Solanum incanum*
- Isolated patches of indigenous trees and riparian woodland remnants, dominated by *Croton megalocarpus*, *Ficus thonningii*, and *Dombeya torrida* as exhibited in the Plate 9 above.

Faunal Assemblages

The shared ecological conditions support a similar array of fauna, including:

- Amphibians such as *Xenopus laevis* (African clawed frog) and *Hyperolius spp.*
- Avifauna, with wetland-dependent species like *Hadada ibis*, *Sacred ibis*, *Black-headed heron*, *Hammerkop*, and *Common moorhen.*

5. IMPACT ASSESSMENT METHODOLOGY

5.1. Brief Overview

The impacts are assessed based on the impact's magnitude as well as the receiver's sensitivity, culminating in an impact significance which identifies the most important impacts that require management. Based on National Environment Management Authority (NEMA) EIA guidelines and international guidelines, the outlined criterion was considered when examining potentially significant impacts of the proposed project.

Table 8: Impact Criterion

Criteria	Summary
Nature of Impacts	Direct or indirect, and positive or negative depending on the activity.
Duration	Impacts may be short, medium, or long-term; they can be temporary (reversible) or permanent (irreversible) and occur frequently or occasionally.
Extent	Varies by impact; may affect a small, localized area or a wide geographical region, and influence a limited or large population, habitat, or species.
Intensity	Ranges from minimal to severe; impacts may be replaceable or irreplaceable depending on the environmental or social resource affected.
Probability	Impacts may have a high, medium, or low likelihood of occurring.
Mitigation Potential	Significant adverse impacts can often be avoided, minimized, mitigated, or offset through appropriate planning and management measures.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in the Table below. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this Environmental Impact Assessment (EIA) Report.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e., there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 9: Impact Assessment Parameter Ratings

Rating	Intensity		Extent	Duration/ Reversibility	Probability
	Negative Impacts	Positive Impact			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and/ or social order	Noticeable, on-going natural and / or social benefits which have improved overall conditions of the baseline.	International The effect will occur across international borders.	Permanent The impact is irreversible, even with management, and will remain after the life of the project.	Definite There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability
6	Irreplaceable damage to highly valued items or natural or social significance or breakdown of natural and/or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond Project Life The impact will remain for some time after the life of the project and is potentially irreversible even with management or mitigation.	Almost Certain/ Highly Probable It is most likely that the impact will occur. < 80% probability
5	Very serious widespread natural and/or social baseline changes.	On-going and widespread benefits to local communities and	County/Region Will affect the entire County or region.	Project Life (>15 years) The impact will cease after the operational life span	Likely The impact may occur. < 65% probability

Rating	Intensity		Extent	Duration/ Reversibility	Probability
	Negative Impacts	Positive Impact			
	Irreparable damage to highly valued items	natural features of the landscape.		of the project and can be reversed with sufficient management and remediation.	
4	On-going serious natural and / or social issues. Significant changes to structures/ items of natural or social significance	Average to intense natural and / or social benefits to some elements of the baseline.	Sub County/Municipal Area Will affect the whole municipal area.	Long Term 6-10 years and the impact can be reversed with management or mitigation.	Probable has occurred here or elsewhere and could therefore occur. < 50% probability
3	On-going natural and /or social issues. Discernible changes to natural or social Baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Extending only as far as the development site area.	Medium Term 1-5 years and the impact can be reversed with minimal management.	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. < 25% probability
2	Minor natural and /or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experienced by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings	Short Term Less than 1 year and is Reversible.	Rare / Improbable Conceivable, but only in extreme circumstances. The possibility of the impact materializing is very low as a result of design, historic experience, or implementation of adequate mitigation measures. < 10% probability
1	Minimal natural and / or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline	Very Limited Limited to specific isolated parts of the site	Immediate Less than 1 month and is completely reversible without management	Highly Unlikely / None Expected never to happen. < 1% probability

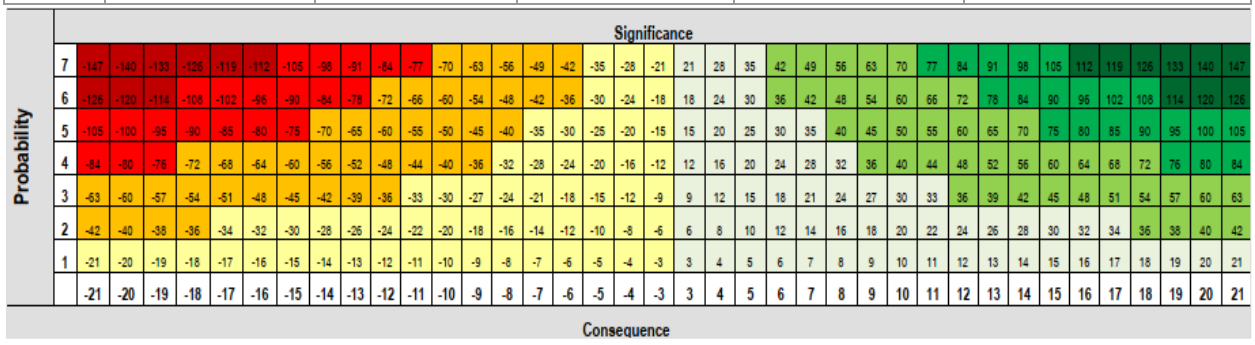

Figure 24: Probability/Consequence Matrix)

Note Key Colour Coding

	Very High Negative Impact
	High Negative Impact

	Moderate Negative Impact
	Low Negative Impact
	Negligible Positive Impact
	Moderate Positive Impact
	High Positive Impact
	Major Positive Impact

5.2. Assigning Risk

Risk or impact classification involves a systematic assessment of the magnitude, nature, and sensitivity of the receiving environmental and social receptors. This process is essential to determine the significance of each identified potential impact. The classification of risk is typically guided by a risk classification matrix, which evaluates both the likelihood and consequence of an impact occurring. Based on this evaluation, potential impacts are categorized into one of four distinct levels of significance:

- **High** – Impacts that are severe, widespread, irreversible, or affect highly sensitive receptors. These typically require immediate mitigation and potentially significant changes to project design or operations.
- **Substantial** – Impacts that are serious but manageable with proper mitigation measures. These may be localized but still affect important receptors or functions.
- **Moderate** – Impacts that are limited in scope and severity, often reversible and manageable through standard mitigation practices.
- **Low** – Minor impacts with negligible or no lasting effects. These are typically addressed through routine environmental or social management procedures.

This classification informs the prioritization of mitigation strategies and supports decision-making throughout the project lifecycle.

Table 10: Significance Rating Description

Score	Description	Rating
109-147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change.	Major (Positive)
73-108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by the community as constituting a major and usually a long-term positive change to the (natural and / or social) environment.	Moderate (Positive)
36-72	An important positive impact. The impact is insufficient by itself to justify the implementation of the project. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment.	Minor (Positive)
3-35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment.	Negligible (Positive)
-3 -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in	Negligible (Negative)

Score	Description	Rating
	negative medium to short term effects on the natural and/or social environment.	
-36 -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and/or social environment.	Minor (Negative)
-73 -108	A serious negative impact which may prevent the implementation of the project. These impacts would be considered by society/community as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects.	Moderate (Negative)
-109 -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (Negative)

Note: Positive project impacts are not rated but merely stated. It is considered sufficient for the purpose of the Impact Assessment to indicate that the Project is expected to result in a positive impact, without characterizing the exact degree of positive change likely to occur. However, positive impacts shall be presented quantitatively, where possible.

5.3. Mitigation Measures

Once the significance of a given impact has been characterized using the above processes, the next step is to evaluate what mitigation measures are warranted. In keeping with the Mitigation Hierarchy, the priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once reasonably practicable mitigations have been applied to reduce the impact magnitude). The approach to defining mitigation measures is based on a typical hierarchy of decisions and measures.

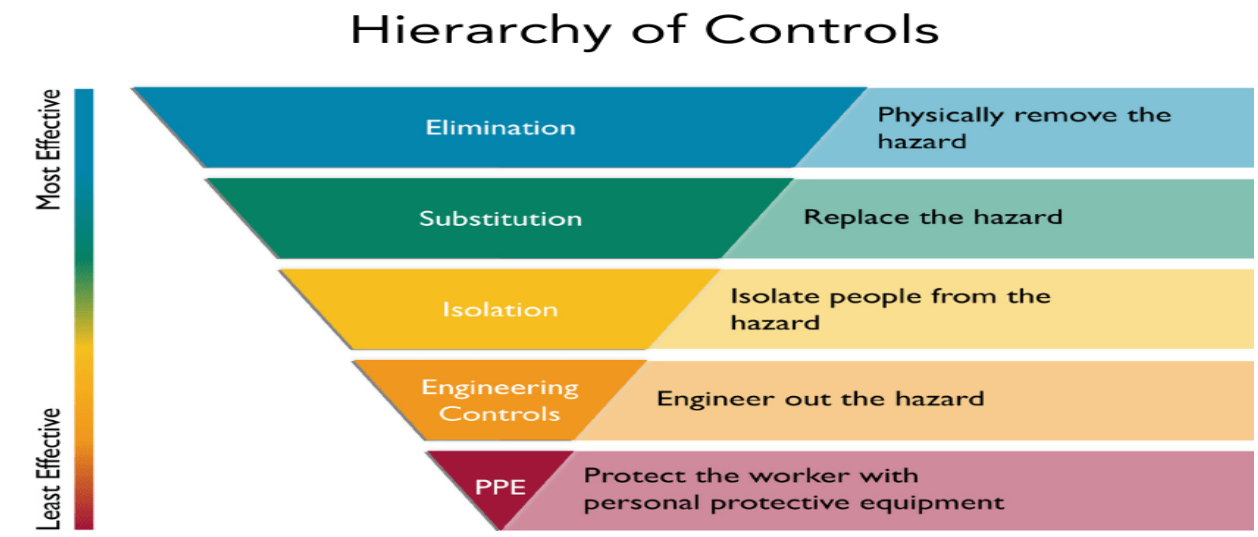

Figure 25: Mitigation Hierarchy (Source: https://safetymanagementgroup.com/)

Formula for Significance Scoring

Significance = Duration × Extent × Intensity × Probability

6. POTENTIAL ENVIRONMENTAL, SOCIAL IMPACTS AND MITIGATION MEASURES

6.1. Impact Assessment

Environmental and social impacts from infrastructure development is a function of the activities that take place during project preparation, construction and operation of the infrastructure, on the one hand, and the particular environmental and social attributes of the local setting on the other. The people, communities and ecosystems that may be affected by a project (receptors) are variable in terms of their proximity to the infrastructure; their sensitivity to influences such as noise, disturbance and emissions; and their ability to adapt to change. The activities involved in construction and operation of infrastructure also vary based on the nature of the project, and how long different activities are carried out in one place.

The impacts that arise from particular configurations of infrastructure development activities and landscape features may emerge in different forms and through various pathways. It is useful to consider the types of impacts that may come into play - some of which may be more immediately obvious than others when assessing the potential effects of a project on people and nature in the surrounding environment.

6.2. Anticipated Potential Impacts

The project components are designed to address the unique management and hydrological characteristics of Nairobi River. A combination of structural and non-structural measures will be implemented, including wetland protection and soil erosion control in the upper and mid-section; pollution load reduction through improved sewage and solid waste management in both the upper and middle sections; and flood control interventions in the middle and lower sections. Another key feature in the implementation of the Nairobi River project is the integration of smart technology to support effective monitoring and management. This includes the use of real-time data collection tools, such as sensors for water quality monitoring, and remote surveillance systems.

The proposed river regeneration initiative is expected to yield substantial social benefits by enhancing community well-being and improving the overall livability of both urban and rural environments. Key among these benefits is the provision of clean, safe, and inclusive green spaces, which are particularly valuable for underserved populations. This impact has already been demonstrated through community-led initiatives such as ***Komb Green Solutions*** in Korogocho, Nairobi, where youth efforts have transformed degraded river-bank into vibrant, accessible public spaces that promote environmental stewardship and social cohesion.

Plate 10: Section of the Park in Korogocho (Source: Komb Solution)

6.2.1. Labor Sourcing

Procurement of labor has two main potential impacts, which can be either **positive** or **negative**, depending on where most workers come from. Hiring mostly non-local workers is a missed opportunity for the project to bring benefits to the local community. The people who live in nearby areas will bear the brunt of any negative impacts that arise during the construction and operation phases, and employment opportunities will go some way in compensating for the inconveniences and discomforts experienced. In order to minimize and prevent construction implementation impacts and maximize the project's benefits to the local community, the primary contractor and all of its sub-contractors shall be contractually required to hire mostly or exclusively local residents for construction jobs. This should be stipulated in the bidding documents and contracts to minimize the risk associated with labor influx.

6.3. Construction Phase Impacts

Construction-related risks include: (a) noise and odor disturbances affecting nearby communities as a result of earthworks and dredging; (b) temporary noise and visual disturbances to local fauna during habitat improvement activities; and (c) traffic congestion or delays caused by construction vehicle movement. Potential project impacts can be categorized into general impacts common to most construction activities and more specific impacts, such as those associated with dredging operation.

6.3.1. Noise and Vibration

The major sources of noise pollution during construction are the movement of construction vehicles, and the haulage of construction materials to the construction site. Construction facilities and equipment will include loaders, bulldozers, and excavators, piling machines, concrete mixer, travelling hoists, vibrators, air wrenches and cargo trucks. Concrete mixing and material movements are the primary noise generating activities and will be uniformly distributed over the entire construction period. Construction activities are expected to produce noise levels in the range of 80-95 dB(A). The proposed sewer trunk will be installed in built-up areas and most sensitive receptors will be close to construction areas. The following measures will be implemented to comply with EMCA (Noise and Vibration) Regulation 2009 construction site noise limits and protect sensitive receptors.

Impact Significance

Construction noise is expected to have a low impact on local residents near the Nairobi River due to the temporary nature of the works, daytime scheduling, and natural buffers such as vegetation and distance from sensitive receptors. The noise exposure will be confined to the duration of construction activities, with no long-term or significant disruption anticipated.

Activity and Interaction (Noise and Vibration) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	It's likely that noise will be produced for the duration of the construction phase.	Moderate (Negative) - 96
Extent	Beyond site (3)	It is expected that during construction activities noise will extend as far as the development site area.	
Intensity	Serious (4)	It is expected that during construction noise and vibration will have a serious impact	
Probability	Highly probable (4)	It is highly probable that noise will impact on the surrounding receptors.	
Nature	Negative		

Mitigation Measures

- Inform residents prior to construction about the anticipated noise levels and duration,
- Conduct regular interviews with residents adjacent to construction sites to identify concerns. This will be used to adjust working hours of noisy machinery,
- Regularly monitor noise levels at sensitive areas as per EMCA (Noise and Vibration) Regulation 2009. If noise is exceeded by more than 3-dB, equipment and construction conditions shall be checked, and appropriate mitigation measures instituted to rectify the situation,

- The construction activities shall be restricted to daytime from 700hrs to 1700hrs. No night construction activities unless authorization are given by relevant Authorities,
- Prioritize machinery and vehicles with noise-reduction technology or certified noise emission ratings,
- Ensure all equipment and vehicles are well-maintained to avoid unnecessary noise from faulty parts or worn-out engines,
- Fit machines with silencers, mufflers, and acoustic enclosures where applicable,
- Stage high-noise operations activities to minimize cumulative noise levels,
- Install temporary noise barriers (e.g., hoarding, earth berms, soundproof curtains) near high-noise machinery and along construction boundaries close to sensitive areas,
- Provide and enforce the use of ISO certified PPEs (e.g., earplugs or earmuffs) for workers exposed to noise levels above **85 dB(A),** and
- Ensure adherence to legal thresholds (e.g., **60 dB(A)** in residential areas during the day) and document findings in environmental monitoring reports.

Post-Mitigation Measures			
Duration	Short term (2)	Noise will be produced for the duration of the construction phase.	**Minor (Negative) -36**
Extent	Beyond Site (3)	It is expected that during construction noise will extend beyond the development site area	
Intensity	Minor (2)	It is expected that during construction noise will have a minor impact.	
Probability	Unlikely (3)	Unlikely of noise causing disturbance with mitigation.	

6.3.2. Air Quality

Anticipated sources of air pollution from construction activities include both dust and exhaust emissions. Dust is expected to be generated from: (a) earthwork activities such as excavation, loading, hauling, and unloading; (b) the movement of vehicles and heavy machinery on unpaved access and haul roads; and (c) aggregate preparation, concrete mixing, and related transportation. Exhaust emissions will result from the use of vehicles and construction equipment. These emissions primarily contain sulfur dioxide (SO_2) and nitrogen dioxide (NO_2), especially from excavators, bulldozers, and transport vehicles. The predicted impact of fugitive dust generated from earthworks and uncovered stockpiles of earth materials is expected to extend up to 150 meters downwind from the source. Dredged sediments may generate odors that could affect surrounding sensitive receptors. The sediments often contain anoxic or anaerobic organic pollutants, which result from microbial metabolism. This process can lead to the formation of hydrogen sulfide (H_2S), ammonia (NH_3), and other odorous gases. When these sediments are disturbed during the dredging process, these gases can be released into the air. As a result, sensitive receptors such as residents and workers within 30 meters of the dredging site may experience the effects of these odors. Although the odor may be unpleasant, it is important to note that dredging is a temporary and localized activity.

Impact Significance

During the construction phase, dust generation from machinery is expected to be relatively low. However, higher levels of fugitive dust are anticipated from activities such as earthmoving, excavation, levelling, demolition, concreting, and transportation of materials. As a result, dust-related impacts are expected to be localized, with particles likely to settle within close proximity to the construction site.

Activity and Interaction (Dust and Emission) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Impact can be reversed with minimal management after construction	Moderate (Negative)-96
Extent	Beyond (3)	It is expected that during construction activities dust will extend as far as the development site area.	
Intensity	Serious (4)	It is expected that during construction fugitive dust will have a serious impact.	
Probability	Highly probable (4)	It is highly probable that fugitive dust and other emissions will impact on the surrounding receptors.	
Nature	Negative		

Mitigation Measures

- Regularly spray water on unpaved haul roads and access roads at least once daily to suppress dust. Erect hoardings around areas with high dust-generating activities to contain dispersion,
- Maintain construction vehicles and machinery in good working conditions through regular servicing, and switching off engines when not in use to minimize emissions,
- Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin,
- During periods of high wind, dust-generating operations shall be prohibited within 200 meters of residential areas,
- Cover stockpiles of loose materials with dust shrouds or tarpaulins to prevent wind-blown dust, and
- Provision of appropriate PPEs for construction workers
- Vehicles transporting pre-treated sediment to the temporary storage site will be fully covered with tarpaulin sheets to prevent spillage during transport. Additionally, the vehicles will not be overloaded, ensuring that they operate within their capacity limits,
- Odor levels will be regularly monitored in sensitive areas,
- Ensure that sediment at the temporary storage site is covered with a layer of mulch, followed by soil, and compacted with ventilation holes to minimize odor emissions, and
- The sediment pre-treatment sites will be located at least 200m downwind from residential areas and other sensitive receptors such as schools and Hospitals.

Post-Mitigation Measures			
Duration	Short term (2)	The impact of dust emissions is considered reversible and can be effectively managed	**Negligible (Negative) -24**
Extent	Limited (2)	Will only occur within and immediately around the Project site.	
Intensity	Minor (2)	Very little impact to the receptors	
Probability	Unlikely (3)	It is unlikely that dust emissions will have a significant effect on ambient air quality	

6.3.3. Generation of Solid Waste

Solid waste will be generated from both construction camps and construction activities. If not properly managed and disposed of, these wastes could negatively affect soil quality, water resources, and the health of both workers and nearby communities. The waste streams will include various types of materials, such as inert construction waste (e.g., soil, debris, concrete), municipal solid waste (e.g., food scraps and packaging from consumables), and hazardous waste (e.g., used fuel containers, oil filters, and oily rags).

Impact Significance

During the construction phase, various types of waste will be generated, including construction debris, packaging materials, excavated soil, cement bags, and general litter. While the quantity of waste generated is expected to be moderate, poor handling or uncontrolled disposal may result in localized environmental degradation, including soil and water contamination. The waste impact is expected to be short-term, localized, and reversible.

Activity and Interaction (Waste Generation) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	Only during construction phase short term	**Minor (Negative) -36**
Extent	Minor (2)	Impacts would be site specific and in the local environment.	
Intensity	Local (3)	On-going natural and /or social issues. Discernible changes to natural or social Baseline	
Probability	Unlikely (3)	The probability of change is uncertain	

Mitigation Measures

- Provide suitable waste storage containers at workers' construction sites. Install appropriately color-coded waste collection bins and ensure they are placed away from sensitive receptors.,

- Regularly transport the construction waste to an approved disposal facility through a registered NEMA waste handler,
- Prohibit the burning of construction waste and encourage the reuse and recycling of solid waste to the greatest extent practically possible,
- Ensure waste is sorted into categories (organic, recyclable, inert, hazardous) at generation points,
- Reuse excavated materials (where uncontaminated) for backfilling or landscaping. Recycle metal, plastic, and wood waste where feasible,
- Adhere to the Environmental Management and Coordination (Waste Management) Regulations, 2024, and
- The contractor to develop and implement the Construction Waste Management Plan (C-WMP).

Post-Mitigation Measures			
Duration	Short term (2)	During the construction period and the impact can be reversed with minimal management after construction	**Negligible (Negative) -24**
Extent	Limited (2)	Will only occur within and immediately around the Project site.	
Intensity	Minor (2)	Very little impact to the receptors	
Probability	Unlikely (3)	It is unlikely that waste materials will have an effect on the surrounding environment.	

6.3.4. Dredged Sediment

The rehabilitation of the Nairobi River will result in the generation of dredged sediments, which must be carefully managed to minimize environmental impacts. The dredged material, initially wet, will undergo a drying process using a belt dewatering machine. This process helps reduce the water content of the sediments, making them more suitable for further use. Once dried, the sediment will either be repurposed for backfilling various subcomponents of the project or, if unsuitable for reuse, will be disposed of in approved landfills. Analysis shall be undertaken to monitor and assess the quality of the dredged material to ensure it does not contain harmful contaminants before its use in backfilling or disposal.

Impact Significance

The dredging of sediments from the Nairobi River corridor is expected to generate significant quantities of spoil material, which may contain a mixture of organic matter, silt, sand, and potentially contaminants such as heavy metals, hydrocarbons, or other pollutants from past urban runoff and industrial discharges. The overall impact significance of dredged sediments is considered moderate to high, depending on the contamination level, but can be mitigated.

Activity and Interaction (Dredged Sediments) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Impact can be reversed with minimal management after construction	Moderate (Negative)-96
Extent	Beyond (3)	It is expected that during construction excavation it is expected to generate significant quantities of spoil material.	
Intensity	Serious (4)	It is expected that during construction sediments will have a serious impact.	
Probability	Highly probable (4)	It is highly probable that sediments and other materials will impact on the surrounding receptors.	
Nature	Negative		

Mitigation Measures

- The contractor will prepare a Construction Waste Management Plan as part of the C-ESMP in alignment with GIIP and national regulation requirements,
- Use geotextile tubes, dewatering basins, or settling ponds to separate water from dredged sediments before transportation to landfills or abandoned quarry sites,
- Stabilize contaminated sediments with lime, cement, or bentonite to prevent leaching, and
- Use engineered containment cells lined with HDPE geomembranes to isolate toxic material

Post-Mitigation Measures			
Duration	Short term (2)	During the construction period and the impact can be reversed with minimal management after construction	**Negligible (Negative) -24**
Extent	Limited (2)	Will only occur within and immediately around the Project site.	
Intensity	Minor (2)	Very little impact to the receptors	
Probability	Unlikely (3)	It is unlikely that waste materials will have an effect on the surrounding environment.	

6.3.5. Surface Water Quality

Dredging will increase the level of suspended solids (SS) and release nitrogen and phosphorus in the water by stirring up the bottom sediment, especially immediately around the dredging areas. High SS can lead to the physical, chemical and biological changes of the water body. This may cause temporary ecological degradation of aquatic environments. Following the completion of dredging activities, concentrations of suspended solids (SS) and heavy metals in the water are expected to gradually return to baseline levels. Construction phase impacts on aquatic habitats and biota will arise primarily from accidental pollution, and increased turbidity/sediment inputs, some of which can be adequately managed through good site practices (e.g. accidental spills), but some such as increased sedimentation/turbidity are inevitable and will be difficult to mitigate effectively. The following key mitigation strategies are proposed to protect aquatic habitats populations.

- Protect the riparian corridor through implementing measures to reduce erosion and sediment inputs into river courses through construction of gabions, embankments, and/or berms.

Sedimentation impacts during the construction phase period may have a moderate significance on downstream aquatic biodiversity but is expected to be enhanced once construction is completed.

Impact Significance

During the construction phase, activities such as earthworks, excavation, stockpiling, and the operation of machinery near watercourses may lead to increased sediment runoff, oil and fuel leaks, and the accidental discharge of construction materials into nearby surface water bodies, particularly the Nairobi River. The impact is potentially direct, negative, and of moderate to high intensity.

Activity and Interaction (Surface Water Quality) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Impact can be reversed with minimal management after construction	Moderate (Negative)-96
Extent	Beyond (3)	It is expected that during construction activities surface water quality will extend as far as the development site area (downstream).	
Intensity	Serious (4)	It is expected that during construction water pollution will have a serious impact.	
Probability	Highly probable (4)	It is highly probable that water pollution and other pollutants will impact the critical receptors.	
Nature	Negative		

Mitigation Measures

- Store fuels, oils, paints, and other hazardous materials in secure, covered areas with secondary containment to prevent accidental spills leaking into the river,
- Designate specific refueling areas with spill containment systems, away from the riverbanks and stormwater drains,
- Maintain on-site spill kits and train personnel in spill prevention, containment, and response procedures,
- Provide mobile toilets and handwashing stations for construction workers, to be regularly serviced by licensed waste handlers, and
- Clean up exposed waste near the river and construct leachate collection systems including HDPE pipes and concrete drainage channels.

Post-Mitigation Measures			
Duration	Short term (2)	The impact will occur only during the construction phase and can be reversed with minimal management post-construction,	**Negligible (Negative) -24**
Extent	Limited (2)	Potential water quality impacts are confined to the project site and immediate surroundings (e.g. nearby drainage channels or the Nairobi River).	
Intensity	Minor (2)	With proper erosion control and wastewater management, only minimal and localized effects on surface water receptors are expected	
Probability	Unlikely (3)	It is unlikely that construction activities will significantly affect surface water quality if mitigation measures are implemented.	

6.4. Impacts on Ecological Resources

Ecological and hydrological impacts resulting from construction and dredging activities may include disturbance to waterbird communities, degradation of aquatic habitats, and harm to aquatic invertebrates due to increased sedimentation. Elevated sediment levels can reduce water clarity, smother benthic habitats, and disrupt feeding and breeding patterns. Additionally, the construction of temporary cofferdams to divert river flow during embankment works may alter natural flow regimes, potentially affecting the ecological balance and water quality downstream. The proposed regeneration works will not result in the loss of any natural wetland habitats within the broader basin. On the contrary, the project is expected to contribute positively to the local environment. Forest and shrub vegetation cover will increase through targeted habitat revegetation activities, while the overall wetland area is anticipated to expand as a result of enhanced protection and conservation efforts at Ondiri Swamp, the main Nairobi River catchment.

Impact Significance

Vegetation disturbance is an unavoidable consequence of the site preparation and construction phases of the project. The duration of the impact is considered long-term, and the extent of the disturbance is assessed as beyond the immediate site. In terms of intensity, the impact is rated as high due to the potential loss of habitat, displacement of species, and degradation of ecosystem.

Activity and Interaction (Biodiversity Disturbance) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Long Term (4)	Vegetation clearance leads to long-term impacts, as natural regeneration takes time and may not fully restore original biodiversity	High (Negative)-192
Extent	Beyond (3)	Vegetation loss may extend beyond the project footprint due to edge effects, soil erosion, and habitat fragmentation.	
Intensity	Serious (4)	Removal of vegetation can result in serious ecological consequences, including loss of habitat, microclimate changes, and biodiversity decline.	
Probability	Highly probable (4)	Vegetation clearance is a direct and certain outcome of site preparation.	
Nature	Negative		

Mitigation Measures

- Carry out works of embankment protection section by section while implementing greening works at the same time in order to minimize soil erosion and restore habitats,
- Take special precautions during construction to protect local fauna which includes measures to safeguard habitats where small animals, reptiles, and common bird species reside particularly trees and vegetated areas along the riverbanks,
- Ensure construction sites are well demarcated prior to any works and, that workers are fully informed of "no-go" areas,
- Increase awareness of construction workers on the need to protect the environment, wildlife and vegetation around the construction sites. Training shall be conducted for all construction workers,

- In the event that any injured animals are found during construction, these will be immediately reported to the project team,
- Engage ecologists to relocate affected fauna where feasible,
- Avoid nighttime construction in sensitive habitats to reduce disturbance to nocturnal species,
- The contractors will sanitize equipment before moving between work zones to prevent the spread of invasive species along the corridor,
- Collaborate with local conservation groups, schools, and residents to support replanting and awareness programs.

Post-Mitigation Measures			
Duration	Medium Term (3)	With active replanting and rehabilitation using native species, vegetation cover can be restored over time	**Moderate (Negative) -54**
Extent	Limited (2)	Clearance will be confined to the project footprint and controlled to avoid unnecessary habitat loss	
Intensity	Moderate (3)	Ecological disruption is minimized through careful site planning, phased clearing, and vegetation buffers	
Probability	Possible (3)	With proper enforcement of mitigation measures, significant residual impacts are less likely	

6.5. Social-economic Impacts

The proposed Nairobi River regeneration project is expected to improve livelihoods by enhancing flood protection and creating a healthier urban environment. However, it may also result in certain undesirable social impacts, including land acquisition within riparian zones, occupational health and safety risks for workers, potential interruptions to public utilities, and community health and safety concerns during construction activities.

6.5.1. Labor, working Conditions and Labor Risks, including Risks of Child Labor and Forced Labor.

The proposed projects will entail employment of a significant number of labors especially during construction phase. The majority of laborers will be locally hired, with the exception of skilled workers who may not be found in the project areas. However, potential risks engaged both for the hired skilled and non-skilled workers, especially during construction period include health hazards, poor living conditions, accidental hazards risks, etc. Similarly, hiring labor from external areas may cause social risks on the local communities including gender-based violence, price hiking of daily used products/foods, etc. Substantial risks are associated in-terms of hiring child labor or forced labors.

6.5.2. Occupational Health and Safety

The construction industry involves numerous hazardous operations and materials. The intensive use of heavy machinery, tools, and materials exposes workers to physical risks, including noise, vibration, dust, and the handling of heavy equipment. Additionally, workers face hazards such as falling objects, slippery surfaces, fire risks, and chemical dangers like toxic fumes and vapors. To ensure the health and safety of construction personnel, the contractor will implement necessary precautions including a combination of hazard avoidance, and control measures.

Impact Significance

The intensity of the impact is considered serious, as unaddressed OSH risks may result in injuries, illnesses, or even fatalities. The probability of such risks occurring without proper controls is highly probable, especially in projects involving excavation, structural work, or material handling. Therefore, the pre-mitigation impact significance of OSHA risks is rated as Moderate Negative.

Activity and Interaction (OSHA Risks) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	OSH risks will exist during construction only and are not expected to continue into operation.	
Extent	Local (2)	Risks are confined to the project site and its immediate surroundings.	

Activity and Interaction (OSHA Risks) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Serious (4)	Construction involves significant risk of injury or health hazards without mitigation.	Moderate (Negative) -64
Probability	Highly probable (4)	It is very likely that OSH risks will materialize in the absence of controls.	
Nature	Negative		

Mitigation Measures

- Provide ISO Certified personal protection equipment (PPEs), such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations (OSHA 2007), for workers,
- The contractor will develop an Emergency Response Plan (ERP) to effectively manage emergencies, including those related to environmental and public health risks, such as hazardous material spills and other similar incidents,
- Ensure that safety, rescue, and industrial health protocols are prominently communicated to all individuals present on-site, whether regularly or occasionally through training and inductions,
- The contractor will provide comprehensive training for all construction workers on basic sanitation and healthcare practices, general health and safety protocols, and the specific hazards associated with their work,
- Obtain necessary licenses, permits, and approvals for construction and hazardous operations,
- The contractor will develop an OHS policy manual accessible to all workers and contractors and establish an OHS Management team responsible for:
    - Policy enforcement
    - Hazard identification
    - Incident response
    - Continuous improvement
- The contractor shall conduct a baseline Work Hazard Analysis and develop mitigation plans for each hazard,
- The contractor shall provide mandatory safety induction for all personnel including task-specific training (e.g., for dredging operators, welders, sewage handlers) and maintain records of all training and certifications,
- The contractor shall conduct pre-employment medical checks and periodic health screenings as well as the provision of first aid kits and trained first aiders on site,
- The contractor shall provide clean drinking water, sanitary facilities, and rest areas for workers,
- Install warning signs and barriers around hazardous areas and moving equipment,
- The project EHS personnel shall hold daily safety briefings and toolbox talks.

Post-Mitigation Measures			
Duration	Short Term (2)	Risks exist only during the construction phase and do not persist in project operation	**Negligible (Negative) -24**
Extent	Local (2)	Impacts are confined to the project site where construction activities occur	
Intensity	Minor (2)	With mitigation, the likelihood and severity of injuries or incidents are greatly reduced	
Probability	Unlikely (2)	Implementation of safety protocols and training makes serious incidents rare	

6.5.3. Community Health and Safety

Traffic congestion is likely to worsen as construction-related traffic increases in urban areas during peak hours. Temporary road and intersection closures may disrupt traffic flow, causing inconvenience to commuters, residents, businesses, and institutions. Additionally, some construction sites are located near residential and commercial areas, which could pose risks to public health and safety. The project may also contribute to road accidents due to the use of heavy machinery on existing roads and the temporary obstruction of pedestrian walkways.

Impact Significance

During construction, there is potential for negative community health impacts stemming from increased dust levels, noise, solid waste, potential water contamination, and disruption caused by increased traffic and human activity. The impact is considered High negative due to its medium-term duration, potential to spread beyond the project boundary.

Activity and Interaction (Community Health Risks) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Health impacts may continue during and shortly after construction due to dust, noise, or traffic	High (Negative) -144
Extent	Beyond (3)	Health effects may reach neighboring settlements and roadside vendors.	
Intensity	Serious (4)	Potential for respiratory illnesses, communicable diseases, accidents, and exposure to contaminants	
Probability	Highly probable (4)	Without mitigation, adverse health impacts are likely due to the proximity of the community to construction areas.	
Nature	Negative		

Mitigation Measures

- Clear signage will be installed at construction sites to warn the public of potential hazards such as moving vehicles, hazardous materials, and open excavations and to raise awareness about safety,
- All active construction sites will be secured, with appropriate fencing and high-visibility tapes to deter public access where necessary,
- Secure machinery after construction works and restrict access with trained security,
- The contractor to develop and communicate Emergency Preparedness and Response Plans through community Liaison office,
- The project team to establish a Grievance Redress Mechanism (GRM),
- Track incidents and complaints using a GRM monitoring log,
- Provide First Aid facilities and trained personnel near construction zones.

Post-Mitigation Measures			
Duration	Short Term (2)	Risks are reduced with mitigation and will mostly be limited to construction duration	**Negligible (Negative) -24**
Extent	Local (2)	Impacts are confined to the immediate project surroundings	
Intensity	Minor (2)	Mitigation reduces severity, though some minor health nuisances may still occur	
Probability	Unlikely (2)	With health & safety awareness, medical outreach, and environmental controls, impacts are less likely	

6.5.4. Utilities Provision Interruption

Construction activities may disrupt utilities such as water and communication cables (e.g., internet cables). Temporary suspension of services whether planned or accidental could impact businesses and daily life for residents along the entire river course. These disruptions can arise from excavation, trenching, or accidental contact with underground or overhead services. If not properly managed, utility disruptions can result in significant inconvenience to local residents, businesses, institutions, and service providers leading to interruptions in daily activities, economic losses, and reduced public confidence in the project.

Impact Significance

The impact of utility disruption is considered high and negative, given its serious consequences and high probability of occurrence.

Activity and Interaction (Utility Disruption) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (3)	Disruptions are likely to occur only during trenching, excavation, or rerouting phases	Moderate (Negative) -64
Extent	Local (2)	Disruptions will mostly affect users near the project site	
Intensity	Serious (4)	Interruption of water, electricity, or telecom can significantly affect local households, businesses, and services	
Probability	Highly probable (4)	Construction near existing utility lines poses a high risk of accidental breakage or service interruption	
Nature	Negative		

Mitigation Measures

- The contractor will conduct detailed mapping using ground-penetrating radar (GPR) and consult with utility service providers (e.g., Nairobi Water, Kenya Power, Safaricom),
- The contractor will notify service providers early and plan for temporary rerouting or supporting services during construction,
- The contractor will establish on-site emergency repair teams to handle accidental damage to utilities immediately,
- Stagger construction works to minimize simultaneous access blockages in the same locality,
- The contractor shall provide clearly marked detours, temporary footbridges, and vehicle bypasses,
- The contractor will ensure the temporary access paths are suitable for people with disabilities and emergency vehicles,

Engage with community leaders, business owners, and transport operators to understand key access needs and incorporate feedback into planning.

Post-Mitigation Measures			
Duration	Short Term (2)	With coordination and planning, utility disruption is minimal and quickly resolved	**Negligible (Negative) -24**
Extent	Local (2)	Impacts confined to the immediate areas undergoing active construction	
Intensity	Minor (2)	Affected users can be notified in advance or provided with alternatives	
Probability	Unlikely (2)	Careful utility mapping, permits, and supervision reduce risk	

6.5.5. Labour and Working Conditions

The Local Content Policy mandates that the contractor prioritizes the recruitment of construction workers from Nairobi and Kiambu Counties, with particular preference given to those from project-affected communities. It is expected that approximately 75% of the workforce will consist of unskilled labor. Furthermore, the policy stipulates that at least 15% of all employees, both skilled and unskilled, will be women, ensuring equal employment opportunities and promoting gender inclusivity in the workforce. The local employment objectives, targets and process will be communicated to local people by area administrators (*Chief's and Assistant Chief's*). The contractor's (China Energy Engineering Group) recruitment Policy shall comply with the labour laws of Kenya.

- **Non-Discrimination and Equal Opportunities**

The Project's Contractor HR policy, labor management principles, and procedures will include provisions to ensure strict adherence to the principles of equal opportunity and fair treatment. Discrimination will not be tolerated in any form, whether in employment, promotion, training, compensation, dismissal, or wages, based on race, religion, language, ethnic identity, sexual orientation, faith, civil, social or economic status, disability, political opinion, union membership, pregnancy, or military service.

- **Workers Grievance Mechanism**

The contractor will develop and implement a formal workers' Grievance Mechanism for all direct and subcontracted employees that will follow legal requirements of Kenya and align with good international practice. The grievance mechanism will allow workers to raise reasonable workplace concerns, including options for making anonymous grievances. The workers will be informed of the existence and functioning of the grievance mechanism at the time of hiring. The contractor (China Energy Engineering Group) will monitor the effectiveness of the employee grievance mechanism on regular basis.

- **Forced Labour and Child Labour**

The contractor (China Energy) HR policy and labor management principles will explicitly state that forced labor and child labor will not be tolerated under any circumstances. The policy will outline specific measures to ensure that both the contractor and its subcontractors comply with these principles, including regular monitoring, audits, and enforcement mechanisms to prevent violations. The project's contractor HR Policy and labour management principles will clearly state that there will be no forced labour and child labour.

6.5.6. Gender-based Violence Impacts

The project may contribute to the rise of gender-based violence and harassment (GBVH) cases, which may include sexual exploitation and abuse (SEA), sexual harassment (SH), and other forms of violence such as physical, sexual, emotional, and financial control. As outlined in the World Bank Good Practice Note on GBV (2019), GBVH can be exacerbated by resettlement and land redistribution processes and a large influx of male workers. Although the sensitivity of the receptive environment is high, the potential impact on GBVH is considered moderate in magnitude, since it may only be experienced during construction period.

Specific indicators to assess the nature of GBVH incidents and the demographics of victims will be added to the monitoring arrangements of the grievance mechanism, to ensure that GBVH cases are adequately monitored and that corrective measures can be put in place in a timely manner. To reduce the risk of women experiencing gender-based violence and harassment (GBVH) in the context of labor influx and construction activities, several mitigation measures will be implemented. These measures aim to (i) minimize the likelihood of GBVH occurring and (ii) reduce the severity of its impact, should it occur.

Mitigation Measures

- The contractor will establish workers' safety committee which will include at least one trained female worker representative,
- The contractor will develop and implement a workers' code of conduct, including GBVH policies, and mandatory training of all workers on sexual harassment and GBVH protocols.

6.5.7. Traffic Impacts

During construction of the proposed project, restriction of access such as temporary footpath closures or diversions may be necessary. This may temporarily increase access lengths and routes for pedestrians and others, with consequent adverse impacts on commuting journeys. There is also the potential for access limitations for businesses within the area of project influence. Impacts are most likely to occur at peak flow periods. The majority of road works would occur during the hours of 07:00-19:00 (Monday to Friday) and 07:00-13:00 (Saturday).

Impact Significance

It is considered that traffic would be managed to the extent that it would not have a significant impact. Traffic flows will be maintained in all but occasional circumstances, and these will be scheduled to occur when they have the least impact. The traffic impacts are considered moderate to high negative due to their potential to affect a wide area, delay commuters, disrupt public transport routes, and compromise road safety especially in densely populated urban settings.

Activity and Interaction (Traffic Impacts) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	Will occur only during construction	Major (Negative) -120
Extent	Local (3)	Extending only as far as the development site area.	
Intensity	Serious (4)	Ongoing serious occurrences	
Probability	Likely (5)	The impact may occur. < 65% probability	
Nature	Negative		

Mitigation Measures

- The contractor will prepare and implement a Traffic Management Plan (TMP) in consultation with the county government and traffic police,
- Installation of temporary directional signage, safety barricades, and traffic cones,
- Use variable message boards or fixed signs to alert drivers and pedestrians of construction zones,
- Restrict movement of heavy construction vehicles to off-peak hours (e.g., early morning, late evening),
- Where pedestrian bridges are under reconstruction, ensure temporary walkways or footbridges are installed,
- The contractor will engage traffic marshals and flagmen to control flow at busy intersections.
-

Post-Mitigation Measures			
Duration	Short Term (2)	Only during active construction works	**Moderate (Negative) -36**
Extent	Local (2)	Confined to the construction area and nearby roads	
Intensity	Moderate (3)	Delays and congestion remain but can be managed with control measures	
Probability	Likely (3)	Mitigation reduces the likelihood of severe disruption	

6.6. Operational Phase Impacts

The operation of Nairobi River regeneration component is not expected to generate major impacts. The mitigation measures for environmental impact during operation includes properly maintaining all river embankment vegetation, emergent aquatic plants and other vegetation; and inspecting all river embankments for stability issues. If signs of failure are discovered, a repair program will be implemented immediately. Periodic maintenance to remove garbage or excessive plant growth will be conducted.

6.6.1. Water Quality Impacts on Aquatic Ecosystem

The project's impact on water quality during the operational phase is assessed to be minimal, with no significant adverse effects expected. Specifically, a reduction in dissolved oxygen levels in the Nairobi River is not anticipated, as the project design incorporates measures to maintain water quality. Waste originating from upstream sources and tributaries is expected to accumulate in the waste collection weirs. The project will actively manage this waste, ensuring regular removal and appropriate disposal to prevent any long-term buildup or contamination. However, along the 27 km river corridor (Gatina to Lucky Summer), twelve (12) informal settlements exhibit limited access to adequate sanitation infrastructure, posing a risk to the project's environmental objectives. To address this, strategically located manual faecal sludge transfer stations will be established within these settlements. These facilities are essential for minimizing direct effluent discharge into the river and improving decentralized sanitation management.

In addition, standardized waste management protocols shall be implemented to systematically address waste accumulation, thereby mitigating potential adverse effects on water quality. In view of these control measures, it is anticipated that water quality impacts arising from project operations will not exceed those currently observed under baseline environmental conditions, instead water quality will improve. Consequently, the project's operational activities are not expected to result in significant alterations to aquatic ecosystems, as any variations in water quality are projected to remain within the natural variability. Furthermore, the operational phase of the project will

incorporate the deployment of advanced monitoring technologies to ensure continuous assessment and management of water quality parameters. These technologies will include but not be limited to:

a) Smart Water Management System, and
b) Automatic Water Quality Monitoring Stations.

Impact Significance

In the absence of mitigation, the operational activities present a **Major Negative** risk to water quality within the Nairobi River. The persistent nature of effluent discharge, combined with limited natural buffering capacity and the presence of informal settlements, underscores the importance of robust mitigation interventions to avoid long-term environmental degradation.

Activity and Interaction (Water Quality) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Long term (4)	The impact is expected to persist throughout the operational life of the project due to continuous waste generation, runoff, and potential effluent discharge, especially in the absence of adequate management systems.	Major (Negative) -120
Extent	Local (2)	Effects are likely to be restricted to the immediate downstream sections of the Nairobi River adjacent to project installations, particularly where drainage and effluent converge.	
Intensity	Serious (4)	In the absence of control measures, the project may contribute to a sustained decline in water quality through the release of untreated or poorly managed waste, leading to degradation of aquatic ecosystems	
Probability	Likely (5)	There is a high likelihood (>60%) that the adverse impact will materialize if no mitigation is applied, due to the proximity of project components to the river and the vulnerability of informal settlements lacking sanitation infrastructure	
Nature	Negative		

Mitigation Measures

- Ensure all domestic and commercial premises within the riparian zone are connected to the expanded trunk sewer system,
- Enforce the use of proper sanitation facilities and prohibit direct discharge into the river,
- Monitor commercial and industrial facilities for compliance with NEMA's Effluent Discharge Standards,
- Increase access to regular and reliable solid waste collection services in nearby settlements and market areas,
- Prohibit and penalize illegal dumping of waste into storm drains and waterways,
- Run targeted awareness campaigns on the dangers of water pollution and the importance of proper waste disposal,
- Establish river watch groups made up of residents, especially youth, to monitor pollution and report illegal discharge,
- Provision of designated manual waste disposal facilities or sanitation points within informal settlements located along the river corridor. These facilities will serve as controlled disposal sites, effectively deterring the direct release of raw sewage and greywater into the riverine ecosystem.

Post-Mitigation Measures			
Duration	Short Term (3)	Water quality impacts may persist throughout the operational life of the project but are expected to be minimal due to sustained mitigation efforts and environmental monitoring.	**Negligible (Negative) -24**
Extent	Local (2)	Potential impacts are expected to remain confined to specific zones adjacent to the river where project activities intersect with drainage networks or effluent pathways	

Post-Mitigation Measures			
Intensity	Low (2)	With the implementation of appropriate waste management systems, controlled discharge mechanisms, and periodic water quality assessments, the magnitude of any degradation is anticipated to be low.	
Probability	Unlikely to Likely (2)	The likelihood of adverse water quality impacts is reduced significantly through mitigation, although occasional localized events may still occur, especially under extreme weather or system failure	

6.6.2. Solid Wastes

During wastewater treatment, preliminary filtration processes will remove large solid objects such as plastics and debris. These materials, along with incidental solid waste generated during the operation of the sewage treatment facility, will be collected and transported to the Dandora Sanitation Landfill by designated municipal waste management vehicles. In addition, operational activities at community centers and riverfront social amenities are expected to produce various categories of domestic waste. These waste streams will be managed through an integrated solid waste management system, incorporating source segregation, scheduled collection, and disposal via authorized service providers, in accordance with applicable municipal and environmental regulations.

Impact Significance

Solid waste generation during the operation phase presents a Moderate Negative impact pre-mitigation, primarily due to the potential for unmanaged waste in active and informal areas. However, with effective waste management systems, the residual impact is expected to be Low and manageable, ensuring compliance with environmental standards and public health safeguards**.**

Activity and Interaction (Solid Waste) Pre-mitigation			
Dimension	Rating	Motivation	Significance
Duration	Long term (3)	Solid waste will be generated continuously throughout the operational lifespan of the project due to activities at sewage treatment facilities, community centers, and riverfront amenities.	Moderate (Negative) -54
Extent	Local (2)	Waste generation and its impacts will be localized to specific project sites and adjacent community activity zones.	
Intensity	Moderate (3)	While the volume of waste may be substantial, especially in high-use areas, it can be effectively managed through structured collection, segregation, and disposal systems.	
Probability	Likely (3)	Without proper oversight, there is a considerable likelihood of litter accumulation and improper disposal, particularly in informal settlements or high-traffic areas	
Nature	Negative		

Mitigation Measures

- Install labeled and covered bins at strategic intervals along walkways, parks, recreational spaces, and public gathering areas,
- Develop and enforce a strict waste collection schedule (daily/weekly depending on foot traffic),
- Run regular sensitization campaigns on proper waste disposal through signage, local media,
- Collaborate with community-based organizations (CBOs) to monitor waste hotspots and report illegal dumping,
- Register and integrate informal waste pickers into formal systems, and
- Regularly clear trapped waste to avoid clogging and flooding.

Post-Mitigation Measures			
Duration	Long Term (3)	Ongoing, but well-controlled through established waste management systems.	**Negligible (Negative) -24**
Extent	Local (2)	Still localized to the project area	
Intensity	Low (2)	Proper segregation, storage, and disposal will minimize health and environmental risks.	
Probability	Unlikely to Likely (2)	With routine waste collection and monitoring, the risk of unmanaged waste is significantly reduced.	

6.6.3. Noise Pollution

Noise will be generated by mechanical equipment, including wastewater lift pumps, return sludge pumps, and grid screen rotations. The estimated operating noise level for these pumps is 85-dB(A). To mitigate potential noise impacts, low-noise equipment will be used, and the buildings structures will be constructed with sufficient wall thickness and acoustic measures, such as barriers or sound-absorbing materials. Regular equipment maintenance will also be part of standard operating procedures. These measures are expected to reduce noise levels to 70 dB(A).

Impact Significance

The impacts during the operation phase are expected to be Moderate Negative pre-mitigation and Low and manageable post-mitigation. The technical operating procedures will ensure compliance with regulatory standards and preserve the quality of life for adjacent communities.

Activity and Interaction (Noise Pollution) Pre-mitigation			
Dimension	Rating	Motivation	Significance
Duration	Long term (3)	Noise will persist throughout the operational phase, particularly from equipment at treatment plants, vehicular movement, and community activities.	Moderate (Negative) -54
Extent	Local (2)	Noise is expected to affect areas directly surrounding operational sites and sensitive receptors nearby.	
Intensity	Moderate (3)	Expected noise levels may cause disturbances to surrounding communities, especially if no controls are in place.	
Probability	Likely (3)	High likelihood of occurrence due to continuous operations and lack of buffer zones or suppression measures.	
Nature	Negative		

Mitigation Measures

- Install acoustic enclosures, silencers, and vibration isolation mounts on generators, blowers, and pumps,
- Apply sound-dampening materials on interior walls, ceilings, and around noise-generating units,
- Locate high-noise equipment (e.g., aerators, mechanical screens) away from property boundaries and sensitive receptors such as homes,
- Restrict high-noise activities to daytime hours (e.g., 07:00 – 19:00) to avoid disturbing nearby communities during sensitive nighttime periods,
- Display signage in high-noise areas and provide Personal Protective Equipment (PPE) (e.g., earmuffs or plugs) for staff,
- Establish a grievance redress mechanism for community members to report noise-related disturbances,
- Conduct periodic ambient noise monitoring using calibrated sound level meters at facility boundaries and nearby receptors,
- Compare results against national guidelines (e.g., NEMA Noise and Excessive Vibration Pollution Control Regulations, 2009) and take corrective actions as needed, and
- Maintain records of noise levels and mitigation actions for regulatory reporting and auditing.

Post-Mitigation Measures			
Duration	Long Term (3)	Operational noise will remain present throughout the project lifespan but will be significantly attenuated with appropriate noise control interventions.	**Negligible (Negative) -24**
Extent	Local (2)	Noise effects will still be limited to the vicinity of facilities and active zones but reduced in reach through mitigation	
Intensity	Low (2)	With the installation of acoustic insulation, sound barriers, landscaping buffers, and regulated operation hours, noise levels are expected to fall within NEMA permissible limits.	
Probability	Unlikely to Likely (2)	The probability of community-level noise disturbance is substantially reduced with regular maintenance of equipment and operational scheduling during daytime hours only.	

6.6.4. Air Quality

Odor generated during sewage treatment (including sewage grating room, sedimentation tank, oxidation pond, secondary sedimentation tank) will impact upon the environment within and around the plant area. The concentration of odor is related to wastewater quality, and its dispersal is related to meteorological conditions. Odor is a composite of pollutants of which ammonia (NH_3) and hydrogen sulfide (H_2S) are the key parameters for measurement during operation.

Impact Significance

The pre-mitigation significance of air quality impacts during the operation phase is High Negative (-128). Without appropriate control measures, odour nuisance and localized air pollution may occur near the treatment plant and adjacent informal settlements. With effective implementation of the mitigation measures outlined, air quality impacts from the wastewater treatment plant operations are reduced to a low significance level and shall remain within regulatory thresholds (e.g., NEMA standards).

Activity and Interaction (Air Pollution) Pre-mitigation			
Dimension	Rating	Motivation	Significance
Duration	Long term (4)	Emissions will occur consistently throughout the operational life of the facility.	High (Negative) -128
Extent	Local (2)	Impacts are expected to remain near the treatment plant and immediate downwind areas.	
Intensity	Moderate (4)	Odors (e.g. H_2S, NH_3) and minor air pollutants may cause discomfort and complaints if not controlled.	
Probability	Likely (4)	Without mitigation, there is a high likelihood of periodic odour nuisance or air quality exceedances near sensitive receptors.	
Nature	Negative		

Mitigation Measures

- Seal sludge tanks, grit chambers, and primary sedimentation units using impermeable covers to contain gases,
- Install biofilters, chemical scrubbers, or activated carbon units at high-emission points to remove hydrogen sulfide (H_2S), ammonia (NH_3), and volatile organic compounds (VOCs),
- Ensure rapid dewatering and disposal of sludge to prevent anaerobic decay and foul odors,
- Apply water sprays or dust-binding agents on unpaved access roads and dry sludge areas,
- Pave frequently used roads and plant vegetative ground cover in non-operational areas to reduce windblown dust,
- Install continuous or periodic monitoring stations to assess, Hydrogen sulfide (H_2S), Ammonia (NH_3), Particulate matter (PM_{10}, $PM_{2.5}$) and general odour levels
- Provide appropriate Personal Protective Equipment (PPE) to all operational personnel handling wastewater and sludge treatment processes, including but not limited to:
    - Respirators or face masks (for odour and particulate exposure)
    - Protective gloves and waterproof boots

- Coveralls or overalls
- Eye protection (e.g., goggles)
- Hearing protection (in high-noise areas).

Post-Mitigation Measures			
Duration	Long Term (3)	Ongoing, but emissions will be managed and contained	**Negligible (Negative) -24**
Extent	Local (2)	Still localized due to plant activity	
Intensity	Low (2)	Odors and emissions greatly minimized by engineered controls	
Probability	Unlikely to Likely (2)	With consistent maintenance, exceedances are unlikely	

6.6.5. Occupational Health and Safety

The operational phase of the Nairobi River Restoration and Sanitation Project presents a range of occupational risks that may compromise worker safety and health if not adequately managed. These risks stem from the interaction with wastewater, mechanical systems, confined spaces, high-traffic areas, and chemical substances. The nature of the project spanning treatment works, decentralized sanitation units, and community amenities requires stringent compliance with the Occupational Safety and Health Act, 2007 (Kenya) and relevant international standards (e.g., IFC Performance Standard 2).

If unmanaged, these OSH risks can result in chronic health conditions, occupational injuries, reduced worker productivity, and regulatory non-compliance. Therefore, implementation of a comprehensive OHS Management System, regular training, and strict adherence to occupational exposure limits is essential for the sustainable and safe operation of the Nairobi River project facilities. Some of the risks and management is outlined in the Table below

Table 11: OHS Risk Register-Operation Phase

Hazard/Activity	**Potential Risk**	**Mitigation Measures**	**Responsibility**	**Monitoring Indicators**
Handling untreated wastewater and sludge	Exposure to pathogens and infections	PPE use, hygiene stations, medical screening, vaccination, awareness training	Facility Operator/ EHS Manager	Number of infections reported; PPE availability
Emissions of H_2S, CH_4, NH_3	Respiratory illness, eye/nose irritation, long-term health risks	Install gas detectors, ventilation, use of respirators, sealed sludge tanks	Plant Engineer/ Safety Officer	Gas monitoring logs; Air quality reports
Noise from equipment and vehicular movement	Hearing loss, fatigue, reduced productivity	Use of earmuffs, scheduled maintenance, rotation of workers	Maintenance Supervisor / OHS Officer	Noise level readings; PPE compliance reports
Wet/slippery walkways, poor lighting	Trips, slips, and falls	Install anti-slip surfaces, improve lighting, conduct regular maintenance	Site Supervisor/ Facility Manager	Incident reports; Safety audit outcomes
Operation of trucks and heavy machinery	Traffic accidents, physical injuries	Operator training, clear traffic routes, signage, use of hi-vis PPE	Fleet Manager/ Safety Officer	Number of traffic-related incidents; Training records
Confined space entry (manholes, tanks)	Asphyxiation, entrapment, toxic gas exposure	Confined space entry permits, gas monitoring, standby supervision, emergency rescue drills	Technical Supervisor / Safety Officer	Entry logs; Emergency drill frequency
Outdoor manual work in high temperatures	Heat exhaustion, fatigue	Shift rotation, provision of water, shade structures,	Project Manager/ Contractor	Temperature logs; Worker

Hazard/Activity	Potential Risk	Mitigation Measures	Responsibility	Monitoring Indicators
		climate-appropriate clothing		complaints; Shift records
Handling of cleaning chemicals	Skin irritation, chemical burns, inhalation risks	Labeling, secure storage, PPE use, chemical handling training	Facility Manager/ Procurement Officer	Incident logs; MSDS availability; PPE usage records

Impact Significance

In the absence of mitigation, occupational safety and health risks associated with the operation phase of the Nairobi River Restoration and Sanitation Project are considered to be of High negative significance. With proactive mitigation such as use of PPE, gas monitoring, OHS training, and emergency preparedness the occupational health and safety risks can be reduced from high to moderate significance, ensuring compliance with both Kenyan regulations and international EHS standards.

Activity and Interaction (OSH-Risks) Pre-mitigation			
Dimension	Rating	Motivation	Significance
Duration	Long term (4)	Risks will persist throughout the operation phase as long as facilities are active.	High (Negative) -128
Extent	Local (2)	Impacts are confined to the facility sites, transfer stations, and worker zones	
Intensity	Serious (4)	Potential for severe health effects, injuries, or fatalities if unmitigated	
Probability	Likely (4)	High probability of occurrence without robust safety systems and training.	
Nature	Negative		

Mitigation Measures

- Install fixed gas detection systems for Hydrogen Sulfide (H_2S), Ammonia (NH_3), and Methane (CH_4) in treatment units, pumping stations, and confined spaces,
- Provide adequate mechanical ventilation systems in enclosed or high-risk areas to dilute hazardous gases,
- Design safe access systems, including guardrails, anti-slip flooring, and enclosed ladders to prevent falls,
- Develop and implement a comprehensive OHS Management System aligned with the Occupational Safety and Health Act, 2007 and ISO 45001 standards,
- Conduct routine risk assessments and safety audits across all operational sites,
- Establish Standard Operating Procedures (SOPs) for high-risk tasks such as confined space entry, chemical handling, and machine operation,
- Maintain safety signage and demarcations throughout the facilities to indicate hazard zones, PPE requirements, and emergency exits,
- Provide mandatory training for all personnel on workplace hazards, emergency response, and safe work practices,
- Conduct regular safety drills (e.g., fire, chemical spill, rescue operations) to enhance preparedness and response capacity,
- Provide and enforce PPE usage through supervision and compliance monitoring,
- Establish a health monitoring program including:
    - Pre-employment and periodic medical exams
    - Vaccination programs (e.g., Hepatitis A & B, Tetanus)
- Maintain a fully equipped first aid station at each operational facility,
- Develop and communicate emergency response procedures including contacts for medical evacuation, and
- Maintain a safety file with all training records, incident logs, permits, and inspection reports

Post-Mitigation Measures			
Duration	Long Term (4)	Risks persist but are manageable with controls in place.	**Moderate (Negative) -48**
Extent	Local (2)	No change; confined to work zones.	
Intensity	Moderate (3)	Safety procedures reduce the severity of incidents and exposures	
Probability	Unlikely to Likely (2)	The likelihood of occurrence is significantly reduced through training and PPEs equipment	

6.7. Decommissioning Impacts

Decommissioning activities have the potential to generate environmental impacts comparable to those experienced during the construction phase. Key concerns include soil disturbance, erosion, sedimentation, and potential contamination of adjacent watercourses or other sensitive ecological features.

6.7.1. Noise and Vibration

Noise generation during the demobilization phase of the Nairobi River regeneration subcomponents will be inevitable, primarily due to the removal of fixtures, equipment, and temporary structures. This activity may result in increased noise levels, potentially causing nuisance to nearby sensitive receptors, such as residential areas, schools, and health facilities. Appropriate mitigation measures will need to be implemented to minimize disturbance.

Impact Significance

The impact rating is **High Negative** during the short-term demobilization period. However, with effective noise management measures, the severity, extent, and probability of impact can be reduced, though nature remains negative.

Activity and Interaction (Noise and Vibration) Pre-mitigation			
Dimension	Rating	Motivation	Significance
Duration	Short term (3)	Noise is expected to be produced for the entire duration of the decommissioning phase	High (Negative) -144
Extent	Beyond site (3)	Noise and vibration are likely to be perceived beyond the immediate project site	
Intensity	Serious (4)	Removal of structures and equipment is likely to generate high noise levels.	
Probability	Highly probable (4)	It is highly likely that construction activities will result in noise and vibration affecting the surrounding environment.	
Nature	Negative		

Mitigation Measures

- Restrict all demobilization and dismantling activities to daytime working hours only (e.g., 08:00 to 17:00) to avoid disturbing nearby residents during sensitive hours,
- Employ modern machinery and equipment fitted with noise suppression devices such as silencers and mufflers,
- Ensure all machinery and equipment are properly maintained to operate within manufacturer noise specifications,
- Erect temporary acoustic screens or barriers (e.g., metal sheets) around noise-generating equipment especially near schools, hospitals, residential areas, and other sensitive receptors,
- Apply low-impact demolition techniques such as manual dismantling where applicable,
- Locate high-noise equipment (e.g., aerators, mechanical screens) away from property boundaries and sensitive receptors such as homes,
- Display signage in high-noise areas and provide Personal Protective Equipment (PPE) (e.g., earmuffs or plugs) for staff,
- Establish a grievance redress mechanism for community members to report noise-related disturbances,
- Conduct periodic ambient noise monitoring using calibrated sound level meters at facility boundaries and nearby receptors,

- Compare results against national guidelines (e.g., NEMA Noise and Excessive Vibration Pollution Control Regulations, 2009) and take corrective actions as needed, and
- Maintain records of noise levels and mitigation actions for regulatory reporting and auditing.

Post-Mitigation Measures			
Duration	Short Term (3)	The temporal scale of impact remains unchanged	**Moderate (Negative) -54**
Extent	Local (2)	Mitigation measures are expected to contain the impact within or near the project site.	
Intensity	Moderate (3)	The severity of the noise impact is expected to be reduced with mitigation in place.	
Probability	Likely (3)	The likelihood of occurrence is reduced but not eliminated	

6.7.2. Air Quality

Air quality is anticipated to deteriorate during the demobilization phase due to demolition and dismantling activities. These activities are likely to generate significant amounts of dust and airborne particulates, potentially leading to respiratory discomfort and health concerns among nearby residents and sensitive receptors. If not adequately mitigated, the resulting fugitive emissions may contribute to localized air pollution and reduced ambient air quality.

Impact Significance

The anticipated deterioration of air quality due to dust and emissions during demobilization is rated as a **High Negative** Impact, requiring comprehensive mitigation measures to reduce its significance.

Activity and Interaction (Dust and Emission) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (3)	The impact is expected to last only for the duration of the demobilization phase and can be reversed with minimal environmental management once activities cease.	High (Negative)-144
Extent	Beyond (3)	Dust and emissions are likely to disperse beyond the immediate project site, potentially affecting surrounding residential areas and other sensitive receptors.	
Intensity	Serious (4)	The generation of fugitive dust and vehicle/machinery emissions is anticipated to significantly degrade local air quality, posing health risks to workers and nearby communities.	
Probability	Highly probable (4)	Given the nature of the demolition activities, it is highly probable that fugitive dust and emissions will be released into the environment	
Nature	Negative		

Mitigation Measures

- Regularly spray water on exposed surfaces, roads, and demolition areas to suppress dust, especially during dry and windy conditions,
- Use dust nets or screens around active demobilization zones, particularly near sensitive receptors (schools, homes, hospitals),
- Ensure all vehicles and machinery used during demobilization are well-maintained and regularly serviced to minimize emissions of carbon monoxide, nitrogen oxides, and particulates,
- Cover trucks transporting demolition of waste or loose material (e.g., soil, rubble) using tarpaulins or equivalent materials,
- Avoid overloading trucks and ensure debris is moistened before loading/unloading to reduce particulate matter emissions,
- Conduct periodic air quality monitoring using portable air quality sensors or passive samplers to detect dust (PM_{10}, $PM_{2.5}$) and gaseous emissions (e.g., NO_2, CO), and
- Provide appropriate PPE **(e.g., N95 dust masks)** to all workers on-site.

Post-Mitigation Measures			
Duration	Short Term (3)	The impact remains short-term and limited to the demobilization period.	**Moderate (Negative) -24**
Extent	Local (2)	Effective mitigation measures will restrict dust dispersion within the project site.	
Intensity	Moderate (2)	Dust suppression techniques are expected to reduce the intensity of the impact.	
Probability	Likely (2)	With proper implementation, the probability of significant emissions is lowered.	

6.7.3. Occupational Safety and Health (OSH) Risks

The demobilization of Nairobi River Regeneration subcomponents will be associated with substantial occupational safety and health (OSH) risks. Activities such as dismantling structures, removal of heavy machinery, and disposal of construction materials pose significant hazards to workers. If not adequately managed, these risks can result in serious injuries or fatalities. Potential hazards include falling objects, slips and falls, sharp objects, exposure to hazardous substances, and improper use of tools and equipment. It is therefore imperative that robust OSH management measures are implemented to ensure the safety and well-being of all personnel involved in the demobilization process.

Impact Significance

The overall impact significance of Occupational Safety and Health (OSH) risks during the demobilization phase of the Nairobi River Regeneration Project is Moderate and negative before mitigation. However, with the implementation of effective mitigation measures, the impact significance is lowered to low to moderate negative.

Activity and Interaction (OSHA Risks) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (3)	OSHA risks are expected to persist only during the short-term demobilization phase.	Moderate (Negative) -96
Extent	Local (2)	The effects are likely to be limited to the immediate site and adjacent work area.	
Intensity	Serious (4)	Potential incidents may cause severe injuries or fatalities if not managed.	
Probability	Highly probable (4)	Due to high-risk dismantling and movement activities, OSHA incidents are highly likely without mitigation.	
Nature	Negative		

Mitigation Measures

- The contractor shall prepare a detailed OSH Demobilization Plan outlining hazards, safety procedures, and emergency response protocols,
- Assign a competent OSH Officer to oversee compliance with health and safety regulations,
- Conduct daily safety briefings (toolbox talks) before beginning work,
- Provide all workers with appropriate PPE, including helmets, gloves, safety boots, high-visibility vests, ear protection, and dust masks,
- Secure work areas using warning signs, safety barriers, and restricted access zones,
- Implement safe dismantling procedures using proper tools and machinery,
- Conduct risk assessments before commencing high-risk activities like lifting, welding, or working at height,
- Provide comprehensive induction and task-specific training for all workers on OSH procedures and emergency response,
- Ensure all machinery and equipment used in dismantling is in good working condition and operated by trained personnel,

- Provide on-site first aid kits and trained first aiders,
- Ensure availability of clean drinking water, sanitation facilities, and shaded rest areas, and
- Establish a log for recording accidents, injuries, and near misses.

Post-Mitigation Measures			
Duration	Short Term (3)	The risk duration remains short-term, only lasting through the demobilization phase.	**Moderate (Negative) -24**
Extent	Local (2)	Risks will be confined to the site due to access control and safety zoning.	
Intensity	Moderate (2)	Implementation of safety protocols and PPE usage will significantly reduce the severity of incidents.	
Probability	Likely (2)	With proper mitigation measures in place (training, supervision, equipment handling), the probability of incidents is lowered.	

6.7.4. Soil Contamination

Dismantling activities associated with the Nairobi River regeneration project, particularly the Kariobangi Sewage Treatment Plant, sewer trunk lines, and other related urban sanitation and social amenities, present a significant risk of soil contamination. These risks will arise due to the potential exposure and disturbance of untreated or partially treated effluent, septic sludge, and legacy leakages during removal or decommissioning of aging infrastructure.

Impact Significance

During the decommissioning phase of the Nairobi River regeneration project, there exists a moderate to high risk of soil contamination, particularly if dismantling, demolition, and disposal activities are not managed in accordance with environmental best practices. Soil contamination may arise from accidental spills, and improper waste handling.

Activity and Interaction (Soil Contamination) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (3)	The contamination risk is expected to be limited to the short-lived demobilization period. Any spills or exposure are likely reversible with prompt remediation and soil management.	High (Negative)-144
Extent	Beyond (3)	Contaminants, especially from effluents and sludge, may leach or be transported via runoff, potentially affecting adjacent land parcels, drainage systems, and water bodies.	
Intensity	Serious (4)	Soil contamination may severely impair soil health, hinder natural regeneration, and pose health hazards to workers and the surrounding community. In extreme cases, contaminants may bioaccumulate or pollute downstream ecosystems.	
Probability	Highly probable (4)	The likelihood of contamination is high due to the handling of aged sewer infrastructure, sludge exposure, and movement of hazardous materials under demolition conditions.	
Nature	Negative		

Mitigation Measures

- The decommissioning contractor shall develop a site-specific WMP outlining how different types of solid waste (hazardous, recyclable, organic, construction debris) will be handled, stored, transported, and disposed,
- The decommissioning contractor will set up clearly labeled bins or collection points to separate waste into categories for appropriate disposal and management,
- Partner with licensed recycling firms for proper disposal of scrap metal, plastic, and e-waste,
- All non-recyclable and non-hazardous waste should be transported to licensed landfills or dumpsites approved by NEMA and Nairobi City County,
- The decommissioning contractor shall maintain records of types and volumes of waste generated, recycled, reused, or disposed,

- Conduct induction training for decommissioning workers on proper waste handling procedures and the importance of waste minimization,
- Remove all debris, packaging, and unused materials from site, and
- Restore and rehabilitate waste-handling areas with soil stabilization and vegetation where appropriate.

The residual impact falls within the "Moderate Negative" category. This indicates that although the risk cannot be entirely eliminated, it is within acceptable limits and can be effectively managed through rigorous implementation of the outlined above mitigation measures and monitoring protocols.

Post-Mitigation Measures			
Duration	Short Term (3)	Despite control measures, the impact remains limited to the project's demobilization phase and is reversible.	**Moderate (Negative) -24**
Extent	Local (2)	Risks are expected to be contained within the immediate site through physical barriers, zoning, and procedural controls.	
Intensity	Moderate (2)	Severity is significantly reduced by PPE use, staff supervision, and safe handling/disposal of contaminants.	
Probability	Likely (2)	With proper mitigation in place, the chance of uncontrolled contamination is notably reduced, though not eliminated.	

6.7.5. Disruption to Public Access or Utilities

Decommissioning activities, particularly dismantling of physical infrastructure and subsurface works along the Nairobi River corridor, are expected to pose a significant risk of disruption to public utility services. This disruption can result from direct physical damage, relocation, or temporary disconnection of existing utility infrastructure, most of which traverses or runs adjacent to the project site. Utilities likely to be affected:

- Electricity Distribution Lines (KPLC),
- Water Supply Pipelines (NCWSC and County Supplies),
- Sewerage and Drainage Infrastructure,
- Telecommunications and Fiber Optic Cables, and
- Stormwater and Roadside Drainage Systems

Impact Significance

The disruption of public utilities impact is rated as High Negative before mitigation, with a significance score of -144. This rating reflects the short-term but serious intensity, broad spatial extent, and high probability of occurrence. The residual impact after mitigation is therefore assessed as Moderate Negative**.**

Activity and Interaction (Disruption of Public Utilities) Pre-mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (3)	Disruptions are expected only during the actual decommissioning works and will cease once activities are completed.	High (Negative)-144
Extent	Beyond (3)	Disruptions may affect utility networks (e.g., electricity, sewer, water pipelines, internet cables) and public roads/pedestrian paths, impacting adjacent communities and businesses.	
Intensity	Serious (4)	Interruption of essential services or blocked access may severely inconvenience the public, affect economic activities, and pose safety risks.	
Probability	Highly probable (4)	There is a high likelihood of interference with utilities or access routes given the nature of demolition and dismantling works in densely serviced urban areas.	
Nature	Negative		

Mitigation Measures

- Conduct thorough utility surveys prior to decommissioning and coordinate with service providers (water, power, telecom) for safe removal or rerouting,
- Inform communities, businesses, and institutions well in advance about planned disruptions and provide timelines,
- Provide temporary solutions such as water tanks, mobile toilets, generators, or bypass roads where permanent services are disrupted, and
- Maintain a standby maintenance team to address accidental service interruptions promptly.
-

Post-Mitigation Measures			
Duration	Short Term (3)	Disruptions will still occur but are limited to specific controlled periods.	**Moderate (Negative) -24**
Extent	Local (2)	Affected areas will be confined through zoning and routing measures.	
Intensity	Moderate (2)	Impact severity will be significantly lowered through proactive public engagement and access management.	
Probability	Likely (2)	Risk is reduced through coordination, mapping, and communication, though minor disruptions may still occur.	

6.7.6. Encroachment on Riparian Zone

The dismantling and removal of physical barriers (infrastructures) previously installed to protect the river riparian zone may inadvertently increase the risk of encroachment by adjacent land users. In the absence of effective alternative protection measures such as signage, community sensitization, and routine enforcement, the cleared areas may become vulnerable to illegal development, dumping, or agricultural expansion, potentially undermining conservation efforts and threatening riparian ecosystem integrity.

Mitigation Measure

- Extend institutional monitoring (e.g., by NEMA, WRA, Nairobi River Commission) for at least 6–12 months after project demobilization,
- Replace temporary structures with permanent ecological buffers (e.g., native vegetation belts, gabions, or wetlands),
- Conduct awareness campaigns targeting residents near the river to educate them on the legal protection of the riparian zone,
- Ensure riparian boundaries are gazetted and integrated into county spatial plans,
- Use visible markers, fencing, or signage to clearly define protected riparian areas along the river,
- Utilize satellite imagery and GIS systems to monitor land use changes and detect illegal encroachment in real-time,
- Formalize handover to responsible agencies or community conservancies with clear maintenance and protection duties,
- Schedule periodic patrols by enforcement officers, especially in high-risk or previously encroached areas,
- Enforce EMCA, Physical and Land Use Planning Act, and County by-laws that prohibit construction or settlement in riparian zones.

7. ANALYSIS OF PROJECT ALTERNATIVE

Alternative analysis is a critical step in Environmental and Social Impact Assessment (ESIA), helping identify the most environmentally and socially sustainable option among several viable choices. The alternatives considered for the Nairobi River Regeneration Project include:

a) No Project Alternative (Do-Nothing Scenario),
b) Alternative Locations for Project Components, and
c) Alternative Technologies and Designs.

7.1. No Project Alternative (Do-Nothing Scenario)

The "No Project" alternative assumes no interventions are undertaken within the Nairobi River Basin. In this scenario, the current state of the river and surrounding areas remains unchanged. Existing environmental degradation, pollution, social inequities, and infrastructural challenges will persist without any substantial regeneration efforts. The "No Project" alternative is not a feasible option, as it fails to address the urgent environmental, social, and economic challenges facing the Nairobi River Basin. The continuation of current trends of river pollution, flooding, and informal settlement degradation would have serious long-term consequences for both human health and the environment.

The implementation of the Nairobi River Regeneration Project offers a comprehensive solution to these problems by promoting environmental sustainability, social inclusion, and economic revitalization. Therefore, the "No Project" scenario is not advisable, and it would be detrimental to the city's future growth and resilience.

7.2. Alternative Location Components

The Nairobi River Regeneration Project is a multi-component initiative designed to restore the ecological integrity of the Nairobi River and improve the urban environment through integrated infrastructure and community development. The project spans several zones along the river, from Ondiri Swamp (source) to Dandora Falls, and includes social amenities, sewer trunk lines, pedestrian and cycling infrastructure, landscaping, and water treatment expansions. When considering alternative locations for these project components, several environmental, technical, social, and economic factors must be evaluated to determine feasibility, cost-effectiveness, and long-term sustainability.

7.2.1. Alternative Sewer Trunk Route

The sewer alignments incorporated into the design have been adopted based on detailed topographical and reconnaissance surveys conducted by the design consultant. The proposed trunk and secondary sewer routes have been strategically aligned along the riparian reserves, public road reserves, and existing utility way leaves to minimize land acquisition requirements and potential disruptions to private properties. In line with sustainable planning principles and infrastructural integration, the sewer network prioritizes coverage in areas currently supplied with piped water as well as zones identified to have imminent potential for water service connectivity. This strategic targeting enhances the cost-effectiveness and operational synergy of the sewerage system.

Furthermore, the proposed sewer alignments will also extend to areas not originally covered under the Environmental Impact Assessment (EIA) license issued to the Athi Water Works Development Agency (AWWDA). This expansion is envisioned to accommodate the broader service coverage envisioned under the current project scope).

7.3. Alternative Sewer Works Design

The proposed trunk sewer design for the proposed Nairobi River Project is based on a comprehensive set of assumptions and technical standards that align with both national and international design guidelines. The contractor relied on data from the Kenya National Bureau of Statistics (KNBS), the Nairobi City Water and Sewerage Company (NCWSC) Sewer Design Manual, and international standards such as BS EN 752-2017 and BS EN 16933-2017 to develop a robust and future-proof sewer system.

Key design assumptions include a population density of 24,607 persons per square kilometer, a domestic water consumption rate of 165 liters per capita per day, and an infiltration allowance equivalent to 10% of dry weather flow (DWF). A peak flow multiplier of 0.8 was applied to the DWF, and a peak factor of 2.5 agreed upon with the project employer was used to reflect diurnal fluctuations and peak demand conditions. An annual population growth rate of 3.0% was also factored into the calculations to account for anticipated urban expansion. The hydraulic design employed the Manning equation, with a roughness coefficient (n) of 0.014 and a design slope of 5% (0.05 m/m). This configuration ensures sufficient flow velocities for self-cleansing, preventing sediment accumulation and ensuring long-term operational efficiency.

The total design flow was calculated by combining the peak domestic wastewater flow with the estimated infiltration rate, using the formula:

Q = DWF × Peak Factor + DWF × 10%

This approach provides a conservative design margin to accommodate unexpected inflows or operational anomalies.

Sections	Design Information
Nairobi River – Naivasha Road to Museum Hill	This section covers a length of approximately 10.7 km, with estimated peak flows ranging between 3,408.35 and 5,092.72 L/s. The original design featured box culverts ranging from 1.5m × 1.2 m to 1.8 m × 1.5 m, which have been replaced with precast circular pipes of 1500mm and 1650mm diameter. This change improves hydraulic performance and constructability within constrained urban corridors.
Museum Hill to Ruai (Left Bank of Nairobi River)	Spanning 16.7 km, this segment handles high peak flows, ranging from 5,155.80 to 6,538.75 L/s. The upgraded design utilizes precast pipes of 1650 mm and 1800 mm diameter, replacing box culverts sized 1.8m × 1.5m to 1.8m × 1.8m. The circular section provides enhanced flow characteristics and better resistance to sediment accumulation under varying flow conditions.
Kirichwa Kubwa River to Chiromo	This area, approximately 9.0km in length, accommodates peak flows from 2,201.99 to 3,762.14 L/s. The original box culverts, ranging from 1.2m × 1.2m to 1.5m × 1.2m, have been substituted with precast pipes of 1200 mm and 1500 mm diameter. These changes were introduced to streamline construction and improve maintenance access in densely populated zones.
Museum Hill to Ruai (Right Bank of Nairobi River)	Also extending over 16.7km, this stretch receives moderate to high peak flows of 3,963.52 to 5,211.85 L/s. The revised design replaces box culverts (1.5m × 1.5m to 1.8m × 1.5m) with circular trunk pipes of 1500 mm and 1650 mm diameter. The transition to circular profiles was necessary to optimize flow hydraulics and minimize excavation requirements in areas with limited construction space.

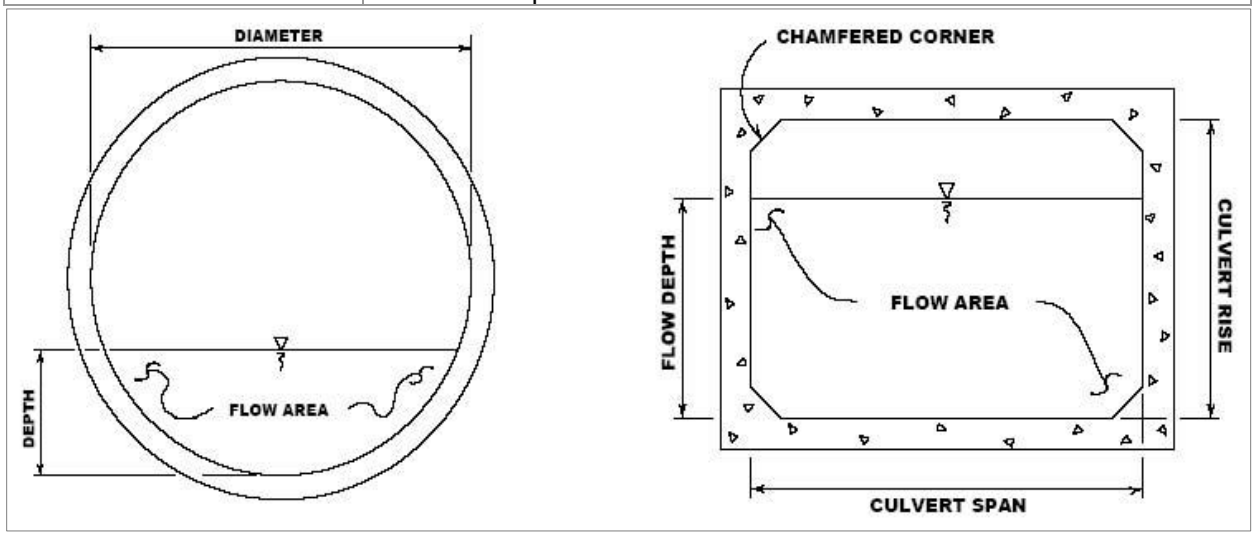

Figure 26: Cross section of a circular pipe and box culvert (Source: https://pon.sdsu.edu/protected31/cive530_lecture_17_HECRAS)

Conclusion

The design variations implemented across all four catchment areas reflect a technically justified shift from rectangular box culverts to larger diameter precast concrete circular pipes. These modifications enhance the system's hydraulic efficiency, reduce construction complexity, and ensure long-term durability and maintainability in the face of growing urban wastewater demands. The pipe sizing aligns with the peak flow estimates and site-specific hydraulic gradients, ensuring full compliance with applicable design standards and operational expectations. In summary, the proposed trunk sewer system demonstrates technical feasibility, operational reliability, and compliance with established engineering practices. It is appropriately scaled to meet both current and future wastewater management needs, supporting the broader goals of environmental protection and public health improvement along the Nairobi River corridor.

7.4. Wastewater Treatment Plant Alternative Technologies

A comprehensive evaluation of several sewage treatment technologies was considered for upgrading the Kariobangi Wastewater Treatment Plant, each with varying levels of efficiency, operational complexity, and suitability to the Nairobi River regeneration programme. Currently, the Kariobangi Wastewater Treatment Plant (KSTW) utilizes a combination of electro-mechanical and biological systems to process incoming effluent. These include mechanical screens for coarse solids removal, grit chambers, oxidation ditches for biological treatment, and secondary clarifiers. While this setup is effective for the reduction of organic load (BOD/COD), it remains insufficient in addressing nutrient pollutants such as total nitrogen (TN) and total phosphorus (TP), which are critical for ensuring compliance with modern effluent discharge standards. Given increasingly stringent discharge standards set by NEMA and the environmental sensitivity of the river, a transition to a more advanced treatment process is warranted.

7.4.1. Anaerobic-Anoxic-Oxic (AAO)

The anaerobic-Anoxic-Oxic (AAO) process, which integrates sequential biological treatment stages to achieve efficient nutrient removal was considered. The AAO configuration promotes biological phosphorus and nitrogen removal through microbial processes, making it particularly suitable for urban treatment plants discharging into natural watercourses. This technology, as successfully applied in the **Jiangnan Water Quality Purification Plant** in **China**, provides an excellent model for Kariobangi's upgrade. The AAO system also offers operational flexibility and reduced chemical dependency, contributing to long-term sustainability. However, following a benchmarking visit to China, the option of implementing advanced technologies such as the Anaerobic-Anoxic-Oxic (AAO) system or membrane-based systems was not prioritized due to the high operational cost implications. Despite their proven efficiency in nutrient removal and compliance with stringent effluent quality standards, these technologies involve elevated energy requirements, complex process control systems, and the need for highly skilled technical personnel.

7.4.2. Membrane Bioreactor

Other advanced options such as the Membrane Bioreactor (MBR) system offer superior effluent quality, including near-complete removal of pathogens and nutrients. However, MBR systems are capital-intensive and require high energy inputs and skilled operation, making them less practical for immediate deployment at Kariobangi but potentially useful for future decentralized high-value reuse schemes.

7.4.3. Constructed Wetland

Natural treatment systems such as constructed wetlands offer a low-cost, low-energy alternative for wastewater treatment by leveraging natural processes involving vegetation, microbial communities, and soil filtration to remove contaminants. These systems are particularly effective in reducing suspended solids, organic matter, nutrients (to some extent), and pathogens in secondary or tertiary effluent. However, while attractive from a sustainability standpoint, they present critical limitations in urban settings like Nairobi, especially in relation to land availability.

One of the main drawbacks of constructed wetlands is their large spatial footprint. Efficient pollutant removal in these systems requires extended hydraulic retention times and sufficient contact surface area between the wastewater and the biological treatment media. For instance, a well-functioning horizontal subsurface flow wetland typically requires between 5 to 10 square meters per person equivalent (PE) of daily wastewater production. For a treatment plant the size of Kariobangi, the land required for a full-scale constructed wetland would span several hectares.

Given the high population density and intense land use pressure in Nairobi's Eastlands especially Kariobangi area, securing such large, contiguous tracts of land within or near the existing plant boundary is practically unfeasible. Urban encroachment, informal settlements, and the high commercial value of available land further complicate the integration of land-intensive systems. Therefore, while constructed wetlands remain a viable option for tertiary polishing of pre-treated effluent potentially reducing nutrient loads or supporting ecological restoration along the river corridor they cannot feasibly replace or serve as a primary treatment solution for the Kariobangi Wastewater Treatment Plant.

7.4.4. Sequencing Batch Reactors

Sequencing Batch Reactors (SBRs) represent another alternative, operating on a fill-and-draw cycle that allows controlled treatment of wastewater in batches. While effective in nutrient removal, SBRs are more sensitive to variable influent flow rates and require sophisticated automation, which may be challenging in large-scale continuous-flow contexts of the proposed Kariobangi sewage treatment plant.

Conclusion

The decision to forego implementation of the Anaerobic-Anoxic-Oxic (AAO) process for the Kariobangi Sewage Treatment Plant expansion, despite its demonstrated technical suitability, is primarily justified by economic and operational sustainability considerations. While the AAO process is highly efficient in removing nutrients particularly nitrogen and phosphorus and aligns well with the environmental goals of the Nairobi River rehabilitation program, it also demands significant capital investment, specialized technical expertise, and continuous energy input to maintain aeration and process control. These factors translate to high long-term operational costs, which may not be sustainable given the financial constraints of public utilities in Kenya and the limited revenue recovery from wastewater services.

Moreover, the existing plant infrastructure is based on the oxidation ditch system, which, though less advanced, remains a robust and proven technology for organic load reduction in medium-income urban settings. Rather than fully replacing this system with a high-cost alternative, the proposed project will focus on optimizing and rehabilitating and expansion of the current setup. This includes upgrading mechanical components, improving sludge handling, automating certain processes, and enhancing monitoring systems. These improvements are expected to significantly boost treatment performance while remaining within feasible budget limits.

By enhancing the existing oxidation process rather than introducing a more complex AAO system, the project achieves a cost-effective balance between improved effluent quality and long-term operational viability. This strategy also ensures a phased, adaptive approach to infrastructure development, with the potential for incremental upgrades in the future as financial and institutional capacity grows.

8. PUBLIC CONSULTATION, PARTICIPATION AND INFORMATION DISCLOSURE

8.1. Introduction

Participation is crucial in the Environmental and Social Impact Assessment (ESIA) process and should be integrated throughout the entire project lifecycle, from design to decommissioning. Public participation enables individuals to express their views on matters of interest and concern. It is a consultative and inclusive process that ensures meaningful engagement with the public.

8.2. Objectives of Public Consultation

Kenya, recognized as one of the African countries with a progressive constitution, enshrines the public's right to participate in decisions that may affect them. Article 10(2)(a) of the Constitution identifies public participation as a fundamental principle of governance. This commitment is further reflected in the Environmental Management and Coordination Act (EMCA), Cap 387, and the EMCA (Environmental Impact Assessment and Audit) Regulations of 2003, both of which contain clear and stringent provisions mandating public involvement in environmental decision-making processes. The process ensures that all stakeholders are provided with this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study.

Public participation in Environmental and Social Impact Assessments (ESIA) is designed to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner, enabling them to understand the potential impacts of proposed projects and to contribute meaningfully to the decision-making process. Key objectives of public participation include but are not limited to:

- Disseminate information about the proposed project to the community members,
- Collect views and concerns to be considered in the ESIA,
- Evaluate community perceptions of the project's positive and negative impacts, and
- Gather concerns regarding Environmental and Social Impacts, as well as potential implementation challenges.

8.3. Identification of Interested and Affected Parties (I&APS) Stakeholders

An initial database of Interested and Affected Parties (I&APs) and key stakeholders has been compiled using records from previous Nairobi River Regeneration projects, as well as expanded searches to gather contact information for affected and neighboring communities. The I&APs and stakeholders identified include formal institutions, government agencies, community-based organizations, civil society groups, local businesses, landowners, and residents with vested interests in the project area. This comprehensive list as outlined below aimed to ensure inclusive and representative engagement throughout the Environmental and Social Impact Assessment (ESIA) process.

a) National Environment Management Authority (NEMA)
b) Water Resources Authority (WRA),
c) Nairobi City County Government (NCCG),
d) Nairobi City Water and Sewerage Company (NCWSC),
e) Kenya Forest Service (KFS),
f) Non-Governmental Organizations (NGOs),
g) Civil Society Organizations (CSOs),
h) Line Ministries (Ministry of Defense and State Department for Housing and Urban Development),
i) National Administration (Chief's and Assistant Chief's),
j) Contractor,
k) Specialist interest groups (Conservationist),
l) Business communities,
m) Friends of Ondiri Wetland,
n) Local/impacted communities including any vulnerable members of the project affected communities.

All landowners whose properties fall within the designated study area were formally notified about the proposed project through public notices. These notices, disseminated via print media, local administrative offices, and community notice boards, invited the landowners to actively participate in the Environmental Impact Assessment (EIA) process. The aim was to ensure transparency, foster inclusivity, and provide all potentially affected parties with

the opportunity to understand the nature and potential impacts of the project, raise concerns, and contribute their input during the assessment phase. Refer to **Annex 4** for public notifications.

8.4. Notification of Interested and Affected Parties

8.4.1. Site Notice Placement

A3-sized site notices, written in English, were displayed at ten strategic locations specifically at the offices of the Assistant County Commissioner (ACC) and area Chiefs along and around the proposed project study area on 26th March 2025. These on-site notices were intended to inform local communities and Interested and Affected Parties (I&APs) about the proposed project and to invite their participation in the Environmental Impact Assessment (EIA) process, in accordance with the legal requirements under the EMCA (EIA/EA) Regulations, 2003. The notices included the following technical information:

- Title and nature of the proposed project
- Name and contact details of the project proponent
- Geographical location and extent of the proposed development
- Contact information for submitting comments or seeking clarification
- Date and time, and
- An invitation to attend upcoming public meetings or engagement forums

Refer to Annex 4 for photographic evidence of site notices and details of their distribution.

Important Note: Public participation is a continuous and integral component of the project lifecycle. It will be sustained throughout the planning, design, implementation, and operational phases to ensure transparency, inclusivity, and responsiveness to stakeholder concerns in accordance with regulatory requirements and best environmental and social governance practices.

8.4.2. Key Stakeholder and Public Meetings

During the scoping and feasibility study period, a series of focus group discussions and high-level meetings were conducted with various stakeholders to present project information, gather their views, and solicit comments and recommendations relevant to the proposed development.

Public meetings were held from **1st to 2nd April 2025** at various locations to engage local communities and other stakeholders regarding the proposed project. On **1st Apri**l, meetings were conducted at the **Korogocho Chiefs Camp** from 9:30 AM to 12:00 Noon, and at the **Dandora Stadium** from 1:30 PM to 3:00 PM. On **2nd April 2025**, a final public meeting was held in **Gituamba, Kasarani Sub County**, from 10:00 AM to 12:00 Noon. The primary objective of these meetings was to present the scope of the proposed project, outline its potential environmental and social impacts, and provide a platform for project-affected parties to raise concerns and provide input.

Stakeholders in attendance included local residents, community leaders, business owners, environmental groups, and government representatives. These interactions were intended to ensure inclusive and transparent decision-making, gather diverse perspectives, and identify any concerns related to the project's implementation. Specific topics discussed included potential displacement, environmental mitigation measures, and opportunities for local community involvement during the project's lifecycle. The findings, discussions, and concerns raised during these meetings were recorded and analyzed to ensure that they are adequately addressed in the ongoing Environmental and Social Impact Assessment (ESIA) process. A comprehensive summary of the minutes, key discussions, and stakeholder feedback from the meetings is provided in **Annex 8.**

An additional mode of response and participation was through the submission of memoranda, allowing stakeholders and members of the public to formally present their views, concerns, and recommendations regarding the proposed project through email. This mechanism facilitated broader stakeholder engagement, ensuring that even those unable to attend in-person meetings had the opportunity to contribute.

All memoranda and email submissions were systematically logged, reviewed, and analyzed. Relevant concerns and suggestions were incorporated into the Environmental and Social Impact Assessment (ESIA) process to ensure that they were adequately addressed in the final report and decision-making procedures.

8.4.3. Summary of Comments Received

Summary of the comments and concerns raised to date is provided below, reflecting the key issues, suggestions, and feedback gathered from stakeholders through various engagement channels, including public meetings, memoranda submissions, and email correspondence.

Name/Company	Mode of Submission	Concern/Suggestion	Response
Greenday Properties Limited	Email	• **Altered River Course**: One of the key concerns raised by a private company was that the Nairobi River has gradually altered its natural course over time, resulting in encroachment onto privately owned land without any prior intervention or mitigation measures from the relevant government authorities. The company expressed concern that, despite this lack of intervention, the government now intends to repossess riparian land some of which may have been affected by the river's shifting course without first implementing measures to regulate or redirect the river flow. This was perceived by the affected party as inequitable and procedurally unfair. • **Lack of clarity in the Gazettement Process**: Stakeholders noted that the Gazette Notice issued on 26th March 2025 by Nairobi City County Government lacked sufficient detail on the project's scope, implementation, and objectives, hindering public understanding and meaningful feedback. • **Absence of EIA:** The Stakeholder expressed concern over the lack of a publicly available and transparent EIA for the Nairobi River Regeneration Project. They emphasized that moving forward with the project without ensuring inclusiveness, transparency, and access to the EIA process undermines public participation and exposes local communities to potential environmental and social risks that have not been adequately assessed or disclosed. • **Potential Disruption to Local Businesses and livelihoods:** The company raised concerns that the Nairobi River Regeneration planning process could lead to the displacement of businesses operating on private land along the river corridor. They argued	• The alignment of the proposed project will adhere strictly to the boundaries delineated in the Water Resources Authority (WRA) pegging report. All project infrastructure shall be confined within the designated riparian reserve to ensure compliance with statutory environmental regulations and to minimize encroachment on adjacent private or ecologically sensitive areas. The Environmental and Social Impact Assessment (ESIA) for the proposed development is currently underway, in accordance with the Environmental Management and Coordination Act (EMCA) Cap 387 No disruption envisioned

Name/Company	Mode of Submission	Concern/Suggestion	Response
		that, in the absence of a clearly defined relocation or compensation framework, the project poses a significant risk to the continuity of these enterprises. This, they noted, could result in job losses, reduced household incomes, and broader negative implications for the local economy. • **Exposure to Land Grabbing and Corruption:** The company cited past cases, such as the Ruai land repossession, to highlight fears of corruption and irregularities in land acquisition. They warned that similar abuses could occur under the Nairobi River Regeneration Project, potentially leading to unlawful evictions and land grabbing. This, they argued, undermines public trust and reinforces the need for transparency, accountability, and protection of private property rights. • **Financial Loss to Landowners:** The Company expressed concern that the Nairobi River Planning initiatives will introduce lengthy and complex approval processes for land subdivision, resulting in increased costs and administrative burdens. They further noted that potential demolitions would lead to significant financial losses not only from the demolition itself but also from the destruction of valuable property, ultimately limiting their ability to utilize their land effectively and sustainably. • **Land Devaluation:** They argued that increased government control and the threat of forced evictions in high-end areas such as Karen, Gigiri, and Muthaiga could lead to depreciation in land value and reduced investor confidence due to perceived insecurity in land tenure. • **Involvement of Kenya Defence Forces KDF:** The company expressed concern about the involvement of the Kenya Defence Forces (KDF) in the Nairobi River Regeneration Project, noting that their role should be limited to national defense. The exclusion of critical agencies such as NEMA, the Ministry of Lands, and County	

Name/Company	Mode of Submission	Concern/Suggestion	Response
		Government authorities raised fears of intimidation, forced evictions, and the undermining of public participation and constitutional rights. They cautioned that such an approach could result in rushed decisions rather than a transparent, democratic process. The company urged the government to halt the project until their concerns are fully addressed and called for transparency, accountability, and respect for citizens' rights.	
Joseph Shiundu Machui	Email	**Concern Regarding Evictions and Compensation:** As someone who was forcibly evicted under distressing and inhumane circumstances, I find it deeply concerning that we are now being asked to participate in the same process that disregarded our dignity and rights. He urged that fair and adequate compensation at a minimum of KES 5 million per household be provided before any further development proceeds.	The concerns shall be handled by NGAO
James Mungai Muigai	Email	**Proposed Declaration of Nairobi River Corridor as a Special Planning Area:** James Mungai Muigai and Haron Mwangi Muigai, registered proprietors of Title Number DAGORETTI/RIRUTA/1305, strongly object to the proposed designation of the Nairobi River Corridor as a Special Planning Area. They express concern that the proposal will lead to displacement, loss of their home, and economic hardship, particularly as they are currently constructing rental units on the land. Citing Article 40 of the Constitution, they urge that the declaration be abandoned to protect their proprietary rights and family welfare.	
David Otieno Odanga	Email	**Objection to Proposed Declaration:** He opposes the proposal, stating it will negatively impact many lives, especially given the current economic challenges. He expressed concern over repeated government actions without compensation and urged authorities to stop harassing citizens and to act in a fair and humane manner.	
Leonard Okwachi	Email	**Objection Based on Socio-Economic Impact:** He opposed the proposal, stating that it would adversely affect many vulnerable families. He emphasized that the timing is particularly unfavorable due to the already challenging economic conditions.	

Name/Company	Mode of Submission	Concern/Suggestion	Response
Stephen Sifuna Wafula	Email	Mr Sifuna strongly protested the proposed development, stating that the targeted land beyond the riparian zone is privately owned and acquired through personal investment. He emphasized that utilizing such land without due consultation and compensation is unconstitutional. Mr Stephen Sifuna urged the government to first engage with affected landowners, reach mutual agreements, and provide fair compensation. Additionally, He recommended that the government should provide alternative homes for the affected families preferably within the already completed affordable housing projects based on the landowners' location preferences.	

Plate 11: Dandora Stadium Public Participation Forum (Source: Fieldwork)

Recognizing that public participation is not a one-time event, but a continuous and iterative process, additional consultations and stakeholder engagement activities shall be carried out throughout the project implementation phases. These engagements will provide an opportunity to update stakeholders on project progress, gather ongoing feedback, and address emerging issues in a timely and inclusive manner.

The insights and input obtained through these consultations will be systematically documented and submitted to the relevant regulatory authorities. This will ensure that decision-making remains well-informed, transparent, and reflective of stakeholder concerns and expectations throughout the project lifecycle.

9. PROJECT GRIEVANCE REDRESS MECHANISM (GRM)

This chapter describes the procedure and mechanism through which community members and any other project aggrieved parties will be able to report, make, place/lodge or express a grievance against impacts of the proposed project activities. The chapter generally outlines the need for a grievance redress mechanism, grievance redress structure, grievance redress procedure, institutional arrangement and awareness and sensitization on grievance redress mechanism.

9.1. Project Grievance Mechanism (GRM)

The proposed (GRM) will outline the procedures for managing any grievances raised by project stakeholders (including the community, workers, and other interested parties) in relation to the project activities. The GRM will be implemented through a coordinated effort by the project manager, contractor and relevant lead agencies including (NGAO, WRA, KFS, NEMA, NCCG, NLC and Ministry of Housing and Lands .

- The NGAO will be responsible for implementing the GRM, as well as maintaining a Grievance Register capturing all grievances, and delegating the investigation and resolution of grievances to each of the Project partners as follows:
- The contractor will be responsible for responding to the operations and construction-related grievances respectively.

The success of the proposed project is dependent upon the support of stakeholders at all levels. GRM is one aspect of stakeholder feedback but often comes after other forms of communication have been inadequate or unsatisfactory, or where existing environmental and social controls have fails. The GRM is designed to facilitate feedback from any Project participant or stakeholder regarding operations, management, use of resources and impacts of activities, intentionally or otherwise, and resolution of the grievance. It forms an integral part of the overall stakeholder engagement and communications strategy.

9.2. Grievance Redress Mechanism Accessibility

For local communities or any other project-affected parties to access the Grievance Redress Mechanism (GRM), a number of procedures will be implemented, including technical, administrative, and outreach components. These include:

a) **Awareness and Communication**: The project coordinating agencies will ensure that the affected communities and all project stakeholders are aware of the existence and purpose of the project grievance redress mechanism. The interventions will be governed by relevant community structures such as committees and CBO groups. These grassroot structures will form part of the GRM structures and will be involved in the Stakeholder Engagement Plan (SEP) and trained to handle local level complaints that have to do with their area of focus. The information will be shared through community meetings, posters, and any other opportunities that may arise. The awareness will include disseminating information on how the GRM works, its purpose, procedures and contact details.

b) **Clear Procedures:** For people to access the GRM they will need to know the procedures, and these will be clearly defined. The process for submitting complaints will include various channels such as oral submissions, **written notes, audio voice notes, text messages, phone calls, email, and online forms**. Once the project commences information on designated contact persons, hotline numbers, or physical complaint boxes locations will be publicized.

c) **Training and Capacity Building**: Community members shall be provided with training on how to use the grievance redress mechanism effectively. This may involve workshops or training sessions to educate them about their rights, the process of filing a complaint, and what to expect after submitting a grievance. The national level inter-ministerial committee will also be trained in the grievance mechanism and the issues they are likely to handle. Each committee will designate an individual, who will receive special training on handling GBV/SEAH cases.

All the above steps will be implemented to encourage communities and all affected stakeholders to effectively access and utilize the project GRM as a way of ensuring sustainability.

9.2.1. Objective of the Grievance Redress Mechanism

The Grievance Redress Mechanism (GRM) is important for resolving conflicts, addressing concerns and fears and ensuring agreements by aggrieved parties and aggressors for the benefit of the project. The main aim of this Nairobi River Regeneration project grievance redress mechanism is to provide a convenient platform for community members and project stakeholders to express their concerns, feedback, and grievances regarding the project's activities and their impacts on the local environment, livelihoods, and well-being. The GRM will seeks to achieve several key goals to effectively handle grievances and concerns within the community.

- Facilitate dialogue between the project and local communities in the project areas,
- Ensure inclusivity by providing a mechanism that allows all community members, especially those from vulnerable and marginalized groups, easy access to the grievance process,
- Recognize and protect the rights of project-affected people, ensuring confidentiality and inclusivity, and
- Prioritize mediation and dialogue to foster constructive engagement between project stakeholders, including local communities and project implementers, aiming to resolve conflicts amicably and build trust among all involved parties.

9.2.2. Scope

The GRM will address a variety of pertinent issues related to the proposed project, including environmental impacts, land use conflicts, socio-economic disruptions, discrimination in benefit sharing, and cultural heritage preservation. It will focus specifically on the impacts and risks stemming from the Nairobi River Regeneration project throughout its life cycle. This framework will handle complaints and concerns, which may include but are not limited to:

a) Misconduct of project workers towards communities,
b) Gender Based Violence\Sexual Exploitation Abuse and Harassment (GBV\SEAH),
c) Misconduct of project contractors,
d) Water and land pollution,
e) Damage to private assets, community, and public infrastructure,
f) Inappropriate waste disposal,
g) Environmental degradation,
h) Project implementation and operation issues,
i) Social inclusion and labour issues,
j) Livelihood and land issues, and
k) Other project related concerns

While the GRM will impartially accept all complaints from affected communities pending investigation, it will not address complaints that:

i. Arise from other projects in the area;
ii. Relate to government policy and institutions;
iii. Are of a criminal nature, which should be directed to the judicial system;
iv. Involve complex labor issues covered by the Labor Management Act;
v. Pertain to contractors' contractual agreements or professional obligations.

9.3. Principles

The Grievance Redress Mechanism (GRM) has been designed to uphold effectiveness, fairness, transparency, and accessibility, ensuring it is easily accessible, transparent, and culturally appropriate, while also guaranteeing confidentiality and protection against retaliation for complainants. The key principles that will guide GRM implementation include:

- Accessibility and Inclusivity,
- Transparency,
- Accountability,
- Fairness and Impartiality,
- Cultural Sensitivity,
- Timeliness, and
- Capacity Building
-

9.4. GRM Structure

The GRM will set up structures at National and Project Site (Community) level. The lead Project Coordinating Unit (PCU) from the multi-agency team and other stakeholders will establish project Grievance Redress Committee (GRC). The GRC will set the terms of reference and how the grievances will be handled and addressed. Community Project Implementing Units will handle grievances arising from the communities or escalating from the community levels. The composition of the committees will ensure a balance between men and women.

The grievance redress structure for the proposed project shall be of a 3 tier of amicable review and settlement of disputes. The tiers shall consist of; Site–Level Grievance Redress Committee, NGAO level and Joint Project Supervising Committee. In spite of having different tiers, an aggrieved party is free to lodge a complaint at any level. Though it's encouraged that the complaint should be made at the lowest level possible for quick and prompt response and only escalated if the issue is complex and cannot be handed at such a level.

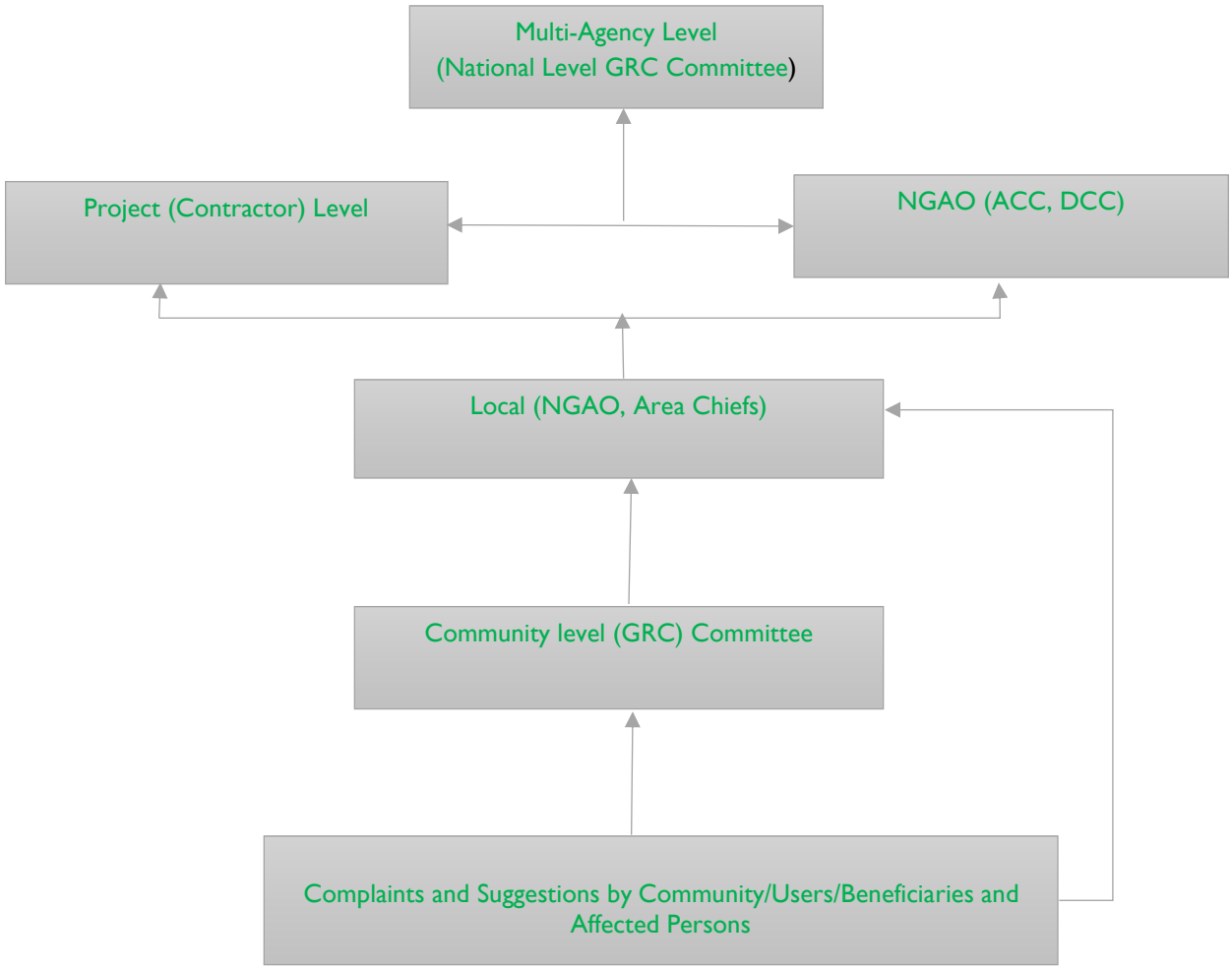

Figure 27: Grievance Redress Committees (GRCs) at Different Levels

9.5. Grievance Redress Mechanism Procedure

9.5.1. Complaint Submission

Grievances will be submitted through various channels such as oral submissions, written notes, audio voice notes, text messages, phone calls, email, and online forms. Each proposed grievance committee at the national and community level will have a designated focal person responsible for receiving and recording submissions. The committees will establish an email address at both the National levels and agree on contact numbers for grievance submissions. At the local level, it is expected that the contact numbers of focal persons will be widely shared to ensure accessibility. All complaints will be registered, and the designated grievance mechanism committee personnel will complete a form (Annex 5). The complaint will include relevant details, such as the nature of grievance, date, location, and any supporting evidence. Special attention will be given to the issues of GBV/SEAH.

9.5.2. Complaint Receipt

Upon receipt, the complaint will be acknowledged promptly by the grievance handling team. A unique reference number will be assigned to track the complaint throughout the process. The complainant will receive confirmation of receipt and information on the expected timeframe for resolution. The complaint will be logged using the grievance log form (Annex 6).

9.5.3. Investigating Grievances and Reviewing

The grievance handling team will conduct a thorough review and investigation of the complaint. This may involve gathering additional information, consulting relevant stakeholders, and conducting site visits if necessary. The team will ensure impartiality and confidentiality throughout the process. In cases of GBV and SEAH, once a report is received, an impartial investigation process will be initiated. Investigations will be conducted by a specialized team, which may include representatives from relevant governmental bodies, NGOs, and/or legal experts. The investigation will follow a structured protocol to ensure fairness and thoroughness, including gathering evidence, interviewing witnesses, and assessing the credibility of the claims. The process will adhere to the principles of due process and respect for the rights of all parties involved.

9.5.4. Grievance Resolution

After reviewing the complaint, the grievance handling team will present various resolution options to the relevant stakeholders. These options may include mediation, compensation, corrective actions, or policy changes. The team will then communicate the proposed resolution to the complainant and seek their feedback before finalizing the decision. On GBV and SEAH all actions taken will be aligned with the zero-tolerance policy in ensuring that such cases are addressed decisively and effectively.

9.5.5. Decision Appeals

If the complainant is not satisfied with the resolution, they have the right to appeal. An appeal process will be put in place to address grievances that remain unresolved after the initial review. Community appeals will be managed by the PCU GRM sub-committee and only escalated to the national GRC if a resolution cannot be reached. The GRC may involve relevant technical experts and government legal professionals to ensure a fair and transparent resolution. Complainants choosing to appeal will be informed that the appeals process is final, and no additional resources will be allocated to the case. If the national GRC fails to resolve the issue satisfactorily, the complainant may seek recourse through national institutions like judicial courts.

9.5.6. Structure of the Grievance Redress Mechanism

The following structure and roles/responsibilities are proposed for establishing a project grievance redress mechanism for the proposed project (Nairobi River Regeneration Programme).

a) **The Project Management Unit (PMU)**: The PMU (Multi agency team) will have an oversight role mainly to provide resources and ensure that the GRM structure are established.

b) **National inter-ministerial Grievance Redress Committee (GRC):** The GRC will be composed of specialists and representatives from other implementing ministries and agencies, including WRA, KFS, NCCG, Ministry of Housing and Public Works and NEMA amongst others. The committee will meet quarterly and in between there should be complaints to resolve. The GRC will have a maximum of 7 people and a minimum of 5 people.

c) **Community Grievance Committees/Community Project Committees**: The GRM will use local structures, such as community committees/CBOs, who will receive training to handle project grievances from community members. Each committee will designate one or two members to receive and record complaints and convene the committee to address any received complaints. The committees will be representative, inclusive, and diverse to ensure fair representation and effective decision-making. In communities where specific disciplinary or conflict resolution committees already exist, these structures can be adopted and trained to manage the project's grievance redress mechanism (GRM) instead of the project committees.

9.6. Roles and Responsibility

The GRC (Inter-Ministerial)

- Develops grievance redress mechanisms policies and procedures,
- Provides oversight, guidance, and support to sub-county and community grievance committees,
- Reviews and addresses escalated grievances that cannot be resolved at the local community level,
- Compilation of all complaints from local to national level on a monthly basis and shares with the GRC and PMU,
- The GRC will designate one of its members to receive and handle GBV/SEAH complaints,

Community Grievance Committees/Project Committees

- Receive and document grievances from community members,
- Investigate grievances through dialogue with relevant stakeholders,
- Facilitate mediation and resolution of grievances, aiming for consensus whenever possible,
- Provide regular updates to community members on the status of grievances, and
- Submit unresolved grievances to the National GRC committee for further review and action if necessary.

9.7. Training

The training for the project grievance redress mechanism would involve several key components. Firstly, community members would need to be educated on the purpose and function of the grievance redress mechanism, ensuring they understand how it can address their concerns regarding the project's impact. Secondly, training sessions would focus on effective communication and conflict resolution skills to facilitate constructive dialogue between community members and project stakeholders.

Additionally, training would cover the procedures for submitting grievances, including documentation requirements and timelines for resolution. Finally, training would emphasize the importance of confidentiality and impartiality in grievance handling to build trust and credibility in the mechanism. Overall, the training would aim to empower local communities to effectively engage in the grievance process and ensure their voices are heard and respected throughout the project implementation. Training on conflict resolution and administration of the GRM will also be provided to the liaison officer, and the various grievance committees so that they are able to dispense of their responsibilities.

9.8. GRM Budget

For a Grievance Redress Mechanism (GRM) to function effectively, it must be supported by a well-planned budget that covers all necessary operational expenses. These include the establishment of appropriate structures, training for staff and stakeholders, and the implementation of awareness campaigns to ensure that the public and affected parties are informed about the GRM and how to access it. Additionally, the budget should account for the costs of investigating grievances, organizing meetings, and maintaining proper documentation and reporting systems.

It is imperative to allocate adequate financial resources and develop a comprehensive budget to facilitate the effective implementation of the Grievance Redress Mechanism (GRM). This will ensure timely resolution of stakeholder concerns and support compliance with environmental and social safeguard requirements throughout the project lifecycle.

Table 12: GRM Budget

No:	Activity
1.	GRM Awareness campaigns at National and local levels
2.	Setting up and inducting the GRCs National and local level
2.	Capacity building sessions for GRCs, setting up systems for receiving and addressing conflicts
3.	Disclosure of the GRC and Processes
4.	Field inspections for verification of complaints
5.	Management meetings
6.	Documentation/Reporting
7.	Coordination and facilitation
Total	

9.9. Monitoring, Auditing and Reporting

The monitoring, auditing, and reporting processes for the GRM are crucial for ensuring transparency, accountability, and effectiveness. Monitoring involves regular assessment of grievance submissions, response times, and resolution outcomes to ensure grievances are addressed promptly and adequately. Auditing entails periodic reviews of the grievance redresses mechanism's procedures and compliance with established protocols and legal requirements, ensuring fairness and impartiality. Reporting involves documenting and communicating grievance data, trends, and outcomes to stakeholders, including community members, project partners, and relevant authorities, fostering transparency and accountability in grievance resolution efforts. Additionally, continuous stakeholder engagement and feedback mechanisms are essential to improve the grievance redress mechanism's responsiveness and effectiveness in addressing community concerns. In addition, conduct community and stakeholder satisfaction surveys independent monitoring of GRM operations and provide any corrective measures for the project grievance redress committee.

10. CLIMATE RISK AND VULNERABILITY ASSESSMENT

10.1. Introduction

Climate change is one of the greatest threats facing the world in the 21st century. If not addressed, it will have significant and long-lasting impacts on the lives of people around the globe. Taking action to mitigate and adapt to climate change is therefore not optional, but an urgent necessity. While the effects of climate change are already being observed, it is generally accepted that if the global temperature rise reaches 1.5°C above pre-industrial levels, the impacts on natural and human systems will be severe and potentially irreversible. These impacts include: -

- Loss of ecosystems, sea-level rise, and more frequent,
- Severe weather events, such as droughts, and
- Heatwaves, and storms,

The adoption of the Paris Agreement on Climate Change, followed by its signing by nearly 200 countries, marked a historic turning point in global climate action. Under the Paris Agreement, signatory nations committed to limiting the average global temperature increase to well below 2°C, aiming for 1.5°C. In line with this global goal, Kenya has committed to developing and implementing an ambitious Climate Action Plan (CAP) under C40's Deadline 2020 programme. This plan will align with international climate targets and contribute to mitigating climate change impacts at both the national and global levels.

10.2. Kenya Climate

Kenya's climate is highly diverse, with variations primarily influenced by altitude. The highlands experience a moderate mean annual temperature of around 15°C, while the lowland areas in northern and eastern Kenya can reach temperatures as high as 29°C. In contrast, the coastal region and the shores of Lake Victoria in the far west enjoy a tropical climate, with temperatures typically ranging between 23°C and 27°C. Annual precipitation in Kenya varies significantly across the country, with amounts ranging from as low as 200mm in the arid northern and eastern regions, characterized by steppe landscapes, to more than 1,600 mm in the western areas. The highland regions of Kenya experience a more moderate climate, with annual precipitation totals ranging between 800 mm and 1,000 mm.

Kenya has two rainy seasons (bimodal precipitation regime) – a major one from March to May and a minor one from October to December[6].

10.2.1. Projected Climate Changes

In response to rising greenhouse gas (GHG) concentrations, air temperatures over Kenya are projected to increase by 1.2 to 3.2°C (very likely range) by 2080, relative to the baseline year of 1876. The extent of this temperature rise will depend on the future GHG emissions scenario (Figure below). Compared to pre-industrial levels, median climate model projections indicate a temperature increase of approximately 1.4°C by 2030, and 1.7°C by both 2050 and 2080, under the low emissions scenario (RCP2.6). Under the medium to high emissions scenario (RCP6.0), median temperature increases are projected to reach 1.3°C by 2030, 1.6°C by 2050, and 2.2°C by 2080.

[6] Climate Risk Profile: Kenya

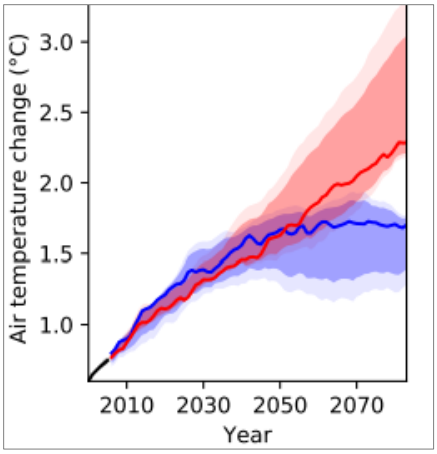

Figure 28: Air temperature projections for Kenya for different GHG emissions scenarios.

10.2.2. Very Hot Days

In line with rising mean annual temperatures, the annual number of very hot days (days with daily maximum temperature above 35°C) is projected to rise substantially and with high certainty, in particular over central and eastern Kenya. Under the medium/high emissions scenario RCP6.0, the multi-model median, averaged over the whole country, projects 25 more very hot days per year in 2030 than in 2000, 36 more in 2050 and 59 more in 2080. In some parts, especially in northern and eastern Kenya, this amounts to about 300 days per year by 2080.

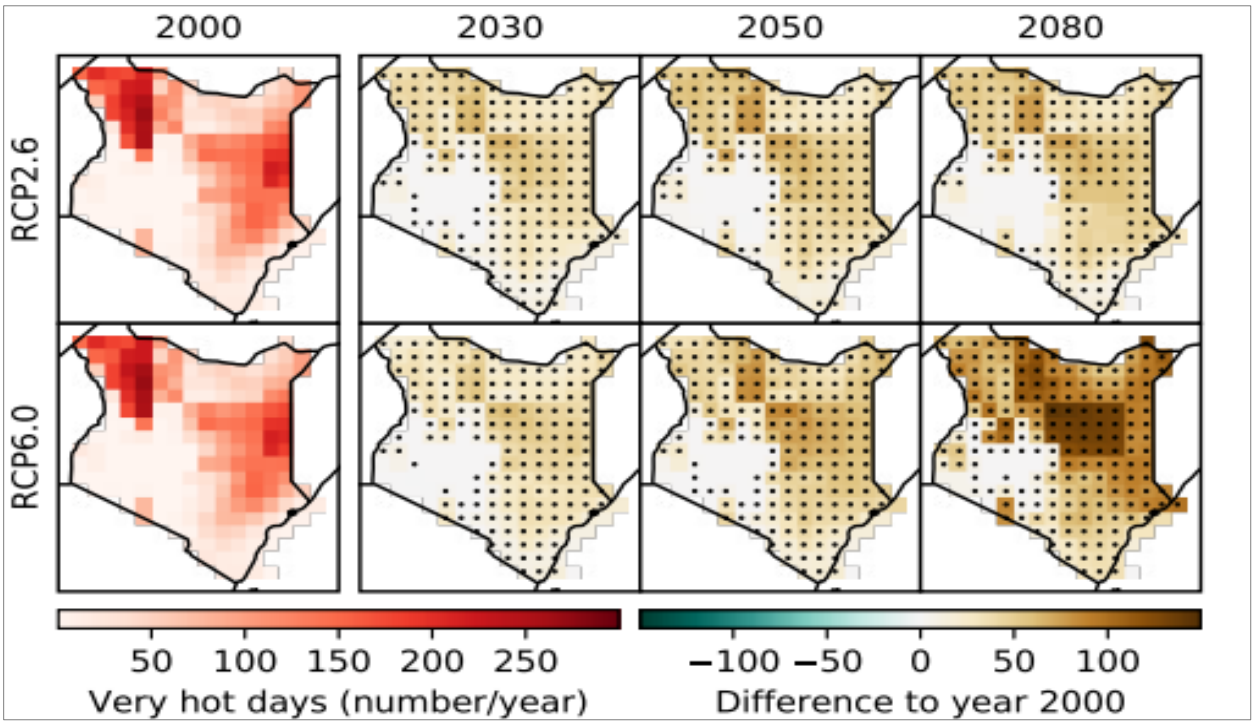

Figure 29: Projections of the annual number of very hot days (daily maximum temperature above 35 °C) for Kenya for different GHG emissions scenarios.

10.2.3. Sea Level Rise

In response to globally increasing temperatures, the sea level off the coast of Kenya is projected to rise (Figure 4). Until 2050, very similar sea levels are projected under both emissions scenarios. Under RCP6.0 and compared to year 2000 levels, the median climate model projects a sea level rise by 10 cm in 2030, 21 cm in 2050, and 40 cm in 2080. This threatens Kenya's coastal communities and may cause saline intrusion in coastal waterways and groundwater reservoirs.

10.2.4. Precipitation

Future projections of precipitation in Kenya are less certain than those for temperature change, primarily due to the high natural year-to-year variability in rainfall patterns. Among the three climate models used for this analysis, one model predicts either no change or a slight decrease in mean annual precipitation under the RCP6.0 scenario, while the other two models project an increase under the same emissions scenario. For the RCP2.6 scenario, median model projections suggest a slight increase in precipitation towards 2030, followed by an overall decrease towards the end of the century. Under RCP6.0, however, the projected increase in precipitation is expected to intensify after 2050, with an estimated rise of 53 mm per year by the end of the century, compared to 2000 levels. Higher emissions pathways indicate an overall wetter future for Kenya, with increased rainfall likely in certain regions.

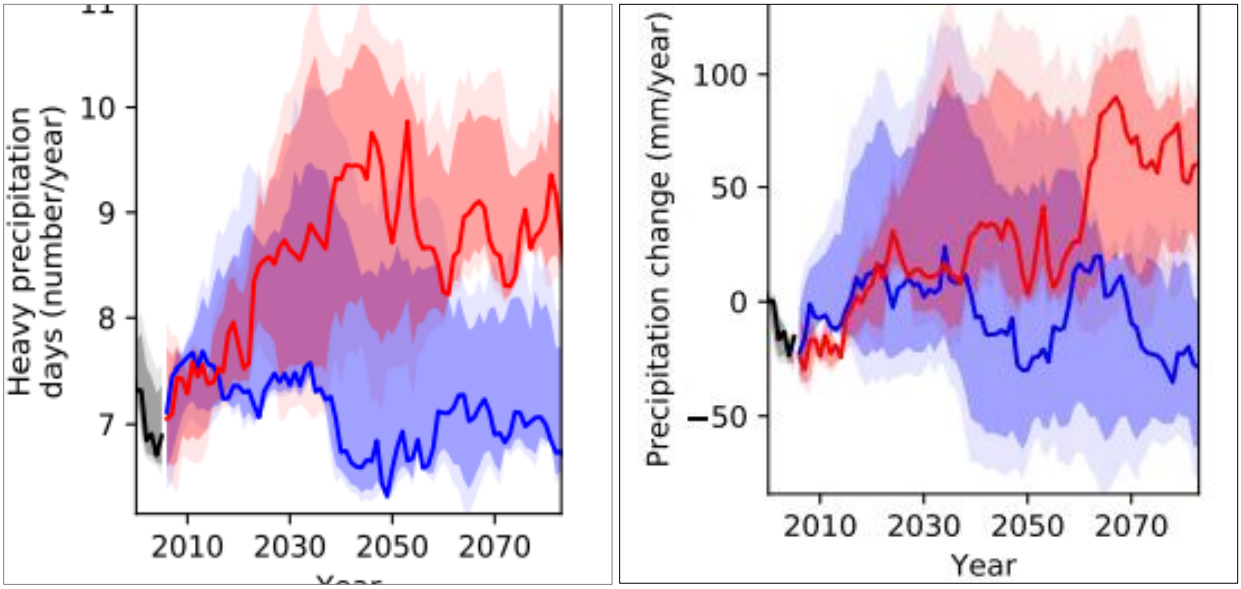

Figure 30: Projections of the number of days with heavy precipitation over Kenya for different GHG emissions scenarios, relative to the year 2000

In response to global warming, heavy precipitation events are expected to become more intense in many parts of the world due to the increased water vapour holding capacity of a warmer atmosphere. At the same time, the number of days with heavy precipitation events is expected to increase. This tendency is also found in climate projections for Kenya as outlined in the Figure above, with climate models projecting an increase in the number of days with heavy precipitation, from 7 days per year in 2000 to 9 days per year in 2080 under RCP6.0. Under RCP2.6, the number of days with heavy precipitation remains unchanged.

10.3. Climate Change Impacts to Key Sectors

10.3.1. Infrastructure

Climate change is projected to severely impact Kenya's transport infrastructure through extreme weather events like floods and droughts. High precipitation and temperatures will cause infrastructure damage, leading to increased maintenance costs. Since road transport is vital for agriculture, trade, and access to services, especially in rural areas, investing in climate-resilient road networks is essential. Additionally, road transport accounts for 99% of non-aviation transport GHG emissions in Kenya.

Extreme weather events will have devastating impacts on human settlements and economic sites, particularly in densely populated urban areas like Nairobi and Mombasa. Informal settlements, which often lack stable infrastructure and are built in high-risk areas such as riverbanks and coastal zones, are especially vulnerable. These areas experience severe flooding, leading to loss of housing, water contamination, and even death. Residents, who typically have low adaptive capacity due to poverty and lack of infrastructure, are particularly affected. In Nairobi's Kibera settlement, for instance, over 50% of residents reported flooding during the 2015 rainy season, resulting in deaths, disease outbreaks, and destruction of property.

10.3.2. Ecosystems

Climate change is expected to significantly impact tropical ecosystems, though the exact extent remains uncertain. Rising temperatures, more frequent and intense droughts, and changing conditions are putting wetlands, river systems, and forests at risk of transformation. These changes can lead to habitat loss for both plants and animals, disrupt forest succession, and increase the spread of invasive species. Additionally, factors such as low agricultural production and population growth may drive further agricultural expansion, leading to deforestation, land degradation, and forest fires, which will negatively affect biodiversity.

10.3.3. Agriculture

Smallholder farmers in Kenya face growing challenges due to the unpredictability of weather patterns caused by climate change. Since most crops rely on rainwater, yields are increasingly affected by erratic rainfall, while the limited use of irrigation (only 28% of the potential irrigated area in 2003) further exacerbates the situation. This is due to poor extension services, irrigation management, lack of credit, and technical equipment. The primary irrigated crops are vegetables, fruit, coffee, rice, and maize. The uncertainty in water availability projections translates into high variability in drought predictions. According to median projections, the national crop land area exposed to drought annually will only slightly increase due to global warming, though other models predict a much stronger rise. Under RCP6.0, the range of drought exposure for crop land widens from 0-0.8% in 2000 to 0-1.6% in 2080, with the very likely range increasing from 0-1.9% to 0-9.8%. Some models project a fivefold increase in drought exposure, while others show no change. Climate change will have a negative impact on yields of millet and sorghum.

10.3.4. Water Resources

Current projections of water availability in Kenya show high uncertainty, with median models suggesting an increase under RCP6.0 and no change under RCP2.6. However, when factoring in population growth (SSP2 projections), per capita water availability is projected to decline significantly by 73% under RCP2.6 and 63% under RCP6.0 by 2080, compared to 2000 levels. While population growth is the primary driver, these projections emphasize the need for investment in water-saving measures. Regional projections show varying trends: under RCP2.6, water availability will decrease by up to 25% in western Kenya and increase by up to 25% in southern Kenya by 2080. Under RCP6.0, the focus shifts to eastern Kenya, where water availability is expected to increase by up to 80%.

10.4. Nairobi City County

Nairobi acknowledges both the current and future threats posed by climate change and the urgent need for targeted action at the city level. The Nairobi Climate Action Plan (CAP) is a direct response to this climate crisis, aiming to achieve its goals through a transformational approach. The plan focuses on leveraging the city's unique strengths and capacities while considering the broader context of regional and global climate challenges.

10.4.1. Nairobi Current Situation

Results from the Nairobi City inventory indicated that, in 2016, the total greenhouse gas (GHG) emissions in Nairobi amounted to 4.7 million metric tons of CO_2 equivalent (MtCO2e), which translates to approximately 1.2 tons of CO_2 equivalent (tCO2e) per person. The transport sector was identified as the largest contributor to these emissions, accounting for a significant portion of the city's overall carbon footprint. This highlights the urgent need for targeted action in reducing emissions from transportation, which is a major driver of air pollution and climate change in Nairobi. Efforts to transition to cleaner and more sustainable transport systems will be crucial for reducing GHG emissions and achieving the city's climate goals.

10.4.2. Future Projections

Through the analysis of future climate projections and historical trends, three key climate hazards have been identified as prominent drivers of change in Nairobi: flooding and storms, extreme heat, and drought. A Climate Rapid Assessment (CRA) has further highlighted the potential impacts of these hazards, which may pose significant risks to the city's social, natural, and economic capital. These risks include damage to infrastructure, disruption of livelihoods, loss of biodiversity, and strain on water resources.

10.5. Climate Change Adaptation

The table below outlines the potential climate risks and their associated impacts on the project, along with the specific adaptation measures designed to mitigate these risks. These measures have been developed to ensure the project's resilience in the face of climate-related challenges, addressing both short-term and long-term environmental, social, and economic factors.

Table 13: Climate Risks and Adaptation

Project Component / Activity	Potential Climate-Related Impacts	Adaptation / Resilience Measures
River Dredging and Channel Widening	○ Increased flood frequency damaging riparian vegetation ○ Accelerated soil erosion and sedimentation ○ Degradation of aquatic habitats	○ Implement improved floodplain management ○ Reinforce soil conservation using rip-rap, gabions, and vegetation buffers ○ Restore wetlands and natural vegetation along riparian zones to stabilize banks and increase resilience
Riverbank and Road Infrastructure Protection	○ Flooding of riverbank roads and adjacent communities ○ Structural damage to river-edge assets	○ Strengthen embankments using bioengineering and structural solutions ○ Install floodwalls, check dams, and culverts where needed ○ Routine desilting and maintenance of channels to sustain flow capacity
Stormwater and Wastewater Management	○ Contamination from urban runoff and combined sewer overflows ○ Elevated risk of waterborne diseases after flooding	○ Implement separate stormwater and sanitary sewer systems ○ Construct stormwater retention basins and bio-retention dams ○ Promote sustainable drainage systems and green infrastructure
Wastewater Collection and Treatment (Kariobangi STP)	○ Overflow of effluent during intense rainfall events ○ Energy demand increases vulnerability to outages and operational failures	○ Upgrade plant capacity and introduce modular systems ○ Integrate gravity-based systems to minimize energy dependency ○ Incorporate AAO or other advanced biological treatment options with lower environmental footprint
Solid Waste Management Systems	○ Waste blockages exacerbate urban flooding and pollute waterways	○ Provide secure solid waste collection points near informal settlements ○ Ensure regular collection and controlled disposal at Dandora landfill ○ Conduct waste audits and integrate community-based waste sorting and recycling
Informal Settlements Sanitation (Faecal Sludge Management)	○ Raw sewage discharge into river during floods- Exposure to health hazards in vulnerable populations	○ Establish manual transfer stations for faecal sludge collection ○ Promote decentralized treatment units in high-density areas ○ Raise community awareness on hygiene and climate-resilient sanitation
Flood Risk Monitoring and Early Warning (ICT System)	○ Delayed or inadequate response to heavy rainfall events and river overflow	○ Implement Nairobi River Management Information System (NRMIS) ○ Deploy remote sensors and telemetry for real-time flood monitoring ○ Strengthen institutional capacity for forecasting, planning, and community outreach

Project Component / Activity	Potential Climate-Related Impacts	Adaptation / Resilience Measures
Recreational Parks and Riverfront Amenities	○ Increased risk of infrastructure damage during floods- Disruption of community access to services and social amenities	○ Design flood-resilient park infrastructure using elevated pathways and permeable surfaces ○ Incorporate flood buffers (e.g. retention ponds, green zones) ○ Maintain accessibility through climate-resilient urban planning
Tree Planting and Riverbank Greening	○ Damage or loss of newly planted vegetation due to seasonal flooding	○ Select climate-resilient indigenous tree and shrub species ○ Incorporate phased planting schedules to match hydrological cycles ○ Engage local communities in stewardship programs

10.5.1. Greenhouse gas (GHG) Emissions During Construction

This project is expected to generate greenhouse gas (GHG) emissions during the construction phase, primarily from the use of vehicles, machinery, and the activities of workers. To estimate these emissions, the following assumptions were made, utilizing the carbon calculation tool available at http://carbonneutral.com.au/ as outlined in the Table below.

Description	Qty	Fuel Type	Consumption (L)	CO_2 Emissions (t)
Diesel Heavy 4WD ...	1	Diesel	1260	4.27
Diesel Medium 4WD...	1	Diesel	945	3.2

GHG emissions during the operational phase of the project will primarily arise from the operation of the wastewater treatment components. The main sources of emissions will include the release of carbon dioxide (CO_2) and nitrous oxide (N_2O), which are produced during the wastewater treatment processes. These emissions are largely a result of the biological and chemical treatments used to process and treat wastewater. Effective mitigation strategies, such as optimizing treatment processes and incorporating renewable energy sources, will be key in reducing these emissions over the long term. Aerobic wastewater treatment systems produce primarily CO_2, whereas anaerobic systems produce a mixture of methane (CH_4) and CO_2. It is estimated that the project CO_2 and CH_4 emissions for WWTP operation will be approximately 56,166 tonnes CO2e yr-1.

10.5.2. Carbon Sinks and Net Project GHG Emissions

The proposed greening initiatives under the Nairobi River regeneration program including riverside tree planting and the restoration and protection of critical wetland ecosystems such as Ondiri Swamp and Kikuyu Springs are anticipated to function as significant carbon sinks. These nature-based solutions are strategically integrated into the project to enhance ecosystem services and contribute to climate change mitigation.

Specifically, the vegetation established along riparian corridors and in restored wetlands will sequester atmospheric carbon dioxide (CO_2), thereby offsetting a proportion of the greenhouse gas (GHG) emissions associated with both the construction and operational phases of the project. The carbon sequestration potential of these interventions has been quantified in accordance with the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, ensuring alignment with internationally recognized methodologies for estimating carbon sink capacity.

This approach not only supports national climate commitments under the Paris Agreement but also promotes long-term sustainability, ecological resilience, and compliance with Kenya's climate adaptation and mitigation strategies (IPCC, 2006)[7].

[7] Annual increase in biomass carbon (C) stocks due to biomass growth CG is calculated by the following equation.

10.5.3. Possible Impact Matrix (Rating)

The Climate Risk Impact Rating for the Nairobi River Regeneration project provides a structured assessment of how climate-related threats such as extreme weather, rising temperatures, and altered rainfall patterns could affect the project's infrastructure, ecosystems, public health, and community livelihoods. Using a standard Risk Matrix approach, each climate risk is rated based on Table 14.

Table 14: Climate Risk Rating and Mitigation Measures

Risk Category	Climate Risk	Likelihood (L)	Consequence (C)	Significance	Remarks / Mitigation Measures
Hydrology & Flooding	Increased rainfall intensity leading to riverine flooding	4 – Likely	4 – Major disruption to infrastructure & settlements	High	Enhance riverbanks, buffer zones; climate-resilient infrastructure; improve drainage capacity
Water Quality	Prolonged drought periods reducing dilution of pollutants	3 – Possible	3 – Moderate degradation of water quality	Medium	Establish wastewater controls, reforestation to reduce runoff, wetland restoration
Ecosystem Health	Temperature increases affecting aquatic biodiversity	3 – Possible	4 – Major loss of species	High	Riparian zone restoration, afforestation, native species planting
Public Health	Increased vector-borne diseases due to warmer and wetter conditions	4 – Likely	3 – Moderate public health impact	High	Community health programs, vector control, sanitation improvements
Infrastructure Damage	Heat stress and storm events damaging roads, bridges, drainage	2 – Unlikely	4 – Major repair costs	Medium	Use of climate-resilient materials and engineering standards
Livelihoods	Climate variability affecting informal activities along the river	3–Possible	3–Moderate impact on income	Medium	Support livelihood diversification, climate-smart agriculture

Table 15: Score Ratin Matrix Table

Score Type	Scale	Description
Likelihood (L)	1	Rare
	2	Unlikely
	3	Possible
	4	Likely
	5	Almost Certain
Consequence (C)	1	Insignificant
	2	Minor
	3	Moderate
	4	Major
	5	Catastrophic
Impact Rating *(L × C)*	1–4	Low
	5–9	Medium
	10–15	High
	16–25	Very High

11. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP)

11.1. Introduction

This section outlines the Environmental and Social Management Plan (ESMP) for the proposed Nairobi River Regeneration project, detailing the technical advisory roles essential for successful implementation. Chapter 6 identifies significant potential environmental and social impacts, providing measures to mitigate or eliminate these impacts, along with clear strategies for their implementation. The ESMP covers mitigation and monitoring requirements for the design/pre-construction phase, construction phase, and operational phase of the project. This comprehensive plan will serve as a guiding framework to ensure that environmental and social safeguards are applied effectively throughout all stages of the project, including any technical advisory services or physical works associated with it.

11.2. Objectives

The Environmental and Social Management Plan (ESMP) outlines the various environmental and social issues associated with the project and details the management strategies to mitigate potential adverse impacts. It also defines the project's environmental and social constraints. The project will adhere to all relevant local laws and regulations to ensure that Nairobi River Regeneration programme construction and operation do not negatively impact the environment or community resources. The Environmental and Social Management Plan (ESMP) serves the following key purposes:

- Acts as a commitment and reference document for project planners and implementers, including compliance with NEMA approval conditions,
- Provides detailed specifications for managing and mitigating activities that could negatively impact on the environment,
- Addresses any necessary capacity-building requirements within the proponent team,
- To provide instructions to relevant project personnel regarding procedures for protecting the environment and minimizing environmental effects, thereby supporting the project goal of minimal or zero incidents, and
- Guides environmental and social monitoring activities, supporting future studies and requisite progress reports

11.3. Organizations and Their Responsibilities for ESMP Implementation

The implementation of the Environmental and Social Management Plan (ESMP) will involve multiple stakeholders, each with specific roles and responsibilities. Amongst the key ones shall include.

a) National Environment Management Authority (NEMA)
b) Water Resources Authority (WRA),
c) Nairobi City County Government (NCCG),
d) Nairobi City Water and Sewerage Company (NCWSC),
e) Kenya Forest Service (KFS),
f) Non-Governmental Organizations (NGOs),
g) Kenya National Highway Authority (KeNHA)
h) Kenya Urban Roads Authority (KURA),
i) Civil Society Organizations (CSOs),
j) Nairobi Rivers Commission (NRC),
k) Athi Water Works Development Agency (AWWD),
l) Friends of Ondiri,
m) Line Ministries (Ministry of Defense and State Department for Housing and Urban Development),
n) National Administration (Chief's and Assistant Chief's) NGAO,
o) Project Contractor (China Energy Engineering Group),
p) Project affected person's (Local communities)

Table 16: Environmental and Social Management Plan

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
Construction Phase	Soil Erosion and Sedimentation	• The contractor will prepare a Construction Waste Management Plan as part of the C-ESMP in alignment with GIIP and national regulation requirements, • Use geotextile tubes, dewatering basins, or settling ponds to separate water from dredged sediments before transportation to landfills or abandoned quarry sites, • Stabilize contaminated sediments with lime, cement, or bentonite to prevent leaching, and • Use engineered containment cells lined with HDPE geomembranes to isolate toxic material.	Contractor, Supervising Engineer	Presence of silt traps, erosion signs	Weekly during construction	10,000,000.00
	Air Pollution (dust, machinery emissions)	• Regularly spray water on unpaved haul roads and access roads at least once daily to suppress dust. Erect hoardings around areas with high dust-generating activities to contain dispersion, • Maintain construction vehicles and machinery in good working conditions through regular servicing, and switching off engines when not in use to minimize emissions, • Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin, • During periods of high wind, dust-generating operations shall be prohibited within 200 meters of residential areas,	Contractor, Site Supervisor	Daily visual inspections; PM_{10} readings Air log monitoring	Daily Daily	2,000,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		• Cover stockpiles of loose materials with dust shrouds or tarpaulins to prevent wind-blown dust, and • Provision of appropriate PPEs for construction workers • Vehicles transporting pre-treated sediment to the temporary storage site will be fully covered with tarpaulin sheets to prevent spillage during transport. Additionally, the vehicles will not be overloaded, ensuring that they operate within their capacity limits, • Odor levels will be regularly monitored in sensitive areas, • Ensure that sediment at the temporary storage site is covered with a layer of mulch, followed by soil, and compacted with ventilation holes to minimize odor emissions, and • The sediment pre-treatment sites will be located at least 200m downwind from residential areas and other sensitive receptors such as schools and Hospitals				
	Water Pollution	• Store fuels, oils, paints, and other hazardous materials in secure, covered areas with secondary containment to prevent accidental spills leaking into the river, • Designate specific refueling areas with spill containment systems, away from the riverbanks and stormwater drains, • Maintain on-site spill kits and train personnel in spill prevention, containment, and response procedures, • Provide mobile toilets and handwashing stations for construction workers, to be	Contractor, NEMA, WRA	Water quality tests (pH, turbidity, BOD)	Monthly	2,150,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		regularly serviced by licensed waste handlers, and • Clean up exposed waste near the river and construct leachate collection systems including HDPE pipes and concrete drainage channels				
	Noise Pollution	• Inform residents prior to construction about the anticipated noise levels and duration, • Conduct regular interviews with residents adjacent to construction sites to identify concerns. This will be used to adjust working hours of noisy machinery, • Regularly monitor noise levels at sensitive areas as per EMCA (Noise and Vibration) Regulation 2009. If noise is exceeded by more than 3-dB, equipment and construction conditions shall be checked, and appropriate mitigation measures instituted to rectify the situation, • The construction activities shall be restricted to daytime from 700hrs to 1700hrs. No night construction activities unless authorization are given by relevant Authorities, • Prioritize machinery and vehicles with noise-reduction technology or certified noise emission ratings, • Ensure all equipment and vehicles are well-maintained to avoid unnecessary noise from faulty parts or worn-out engines, • Fit machines with silencers, mufflers, and acoustic enclosures where applicable,	Contractor	Noise levels < 70dB at site boundary	Weekly	4,200,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		• Stage high-noise operations activities to minimize cumulative noise levels, • Install temporary noise barriers (e.g., hoarding, earth berms, soundproof curtains) near high-noise machinery and along construction boundaries close to sensitive areas, • Provide and enforce the use of ISO certified PPEs (e.g., earplugs or earmuffs) for workers exposed to noise levels above **85 dB(A),** and • Ensure adherence to legal thresholds (e.g., **60 dB(A)** in residential areas during the day) and document findings in environmental monitoring reports.				
	Solid and Liquid Waste Management	• Provide suitable waste storage containers at workers' construction sites. Install appropriately color-coded waste collection bins and ensure they are placed away from sensitive receptors., • Regularly transport the construction waste to an approved disposal facility through a registered NEMA waste handler, • Prohibit the burning of construction waste and encourage the reuse and recycling of solid waste to the greatest extent practically possible, • Ensure waste is sorted into categories (organic, recyclable, inert, hazardous) at generation points, • Reuse excavated materials (where uncontaminated) for backfilling or landscaping. Recycle metal, plastic, and wood waste where feasible,	Contractor, Nairobi County Government	Waste tracking records, disposal receipts	Weekly	3,500,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		• Adhere to the Environmental Management and Coordination (Waste Management) Regulations, 2024, and • The contractor to develop and implement the Construction Waste Management Plan (C-WMP).				
	Dredged Sediments	• The contractor will prepare a Construction Waste Management Plan as part of the C-ESMP in alignment with GIIP and national regulation requirements, • Use geotextile tubes, dewatering basins, or settling ponds to separate water from dredged sediments before transportation to landfills or abandoned quarry sites, • Stabilize contaminated sediments with lime, cement, or bentonite to prevent leaching, and • Use engineered containment cells lined with HDPE geomembranes to isolate toxic material	Contractor	Waste tracking and disposal records	Weekly	4,250,000.00
	Occupational Health & Safety (OHS)	• Provide ISO Certified personal protection equipment (PPEs), such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations (OSHA 2007), for workers, • The contractor will develop an Emergency Response Plan (ERP) to effectively manage emergencies, including those related to environmental and public health risks, such as hazardous material spills and other similar incidents,	Contractor/DOSH	OHS compliance reports, accident logs Safety audit reports	Weekly	4,300,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates

		• Ensure that safety, rescue, and industrial health protocols are prominently communicated to all individuals present on-site, whether regularly or occasionally through training and inductions,
		• The contractor will provide comprehensive training for all construction workers on basic sanitation and healthcare practices, general health and safety protocols, and the specific hazards associated with their work,
		• Obtain necessary licenses, permits, and approvals for construction and hazardous operations,
		• The contractor will develop an OHS policy manual accessible to all workers and contractors and establish an OHS Management team responsible for:
		  ○ Policy enforcement
		  ○ Hazard identification
		  ○ Incident response
		• Continuous improvement
		• The contractor shall conduct a baseline Work Hazard Analysis and develop mitigation plans for each hazard,
		• The contractor shall provide mandatory safety induction for all personnel including task-specific training (e.g., for dredging operators, welders, sewage handlers) and maintain records of all training and certifications,
		• The contractor shall conduct pre-employment medical checks and periodic health screenings as well as the				

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		provision of first aid kits and trained first aiders on site, • The contractor shall provide clean drinking water, sanitary facilities, and rest areas for workers, • Install warning signs and barriers around hazardous areas and moving equipment, • The project EHS personnel shall hold daily safety briefings and toolbox talks				
	Community Health & Safety	• Clear signage will be installed at construction sites to warn the public of potential hazards such as moving vehicles, hazardous materials, and open excavations and to raise awareness about safety, • All active construction sites will be secured, with appropriate fencing and high-visibility tapes to deter public access where necessary, • Secure machinery after construction works and restrict access with trained security, • The contractor to develop and communicate Emergency Preparedness and Response Plans through community Liaison office, • The project team to establish a Grievance Redress Mechanism (GRM), • Track incidents and complaints using a GRM monitoring log, • Provide First Aid facilities and trained personnel near construction zones	Contractor, NGAO (Area Chiefs, Local Administration)	Number of complaints received/resolved Incident logs; PPE compliance rate	Monthly	3,500,000.00
	Disruption of Utilities/Access	• The contractor will conduct detailed mapping using ground-penetrating radar (GPR) and consult with utility service	Contractor,	Number of disruptions and complaints	As needed	10,000,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		providers (e.g., Nairobi Water, Kenya Power, Safaricom), • The contractor will notify service providers early and plan for temporary rerouting or supporting services during construction, • The contractor will establish on-site emergency repair teams to handle accidental damage to utilities immediately, • Stagger construction works to minimize simultaneous access blockages in the same locality, • The contractor shall provide clearly marked detours, temporary footbridges, and vehicle bypasses, • The contractor will ensure the temporary access paths are suitable for people with disabilities and emergency vehicles	Nairobi County Government/NCWSC/Athi Water Works/ KeNHA/KPLC/KURA/Telcos			
	Biodiversity Disturbance	• Carry out works of embankment protection section by section while implementing greening works at the same time in order to minimize soil erosion and restore habitats, • Take special precautions during construction to protect local fauna which includes measures to safeguard habitats where small animals, reptiles, and common bird species reside particularly trees and vegetated areas along the riverbanks, • Ensure construction sites are well demarcated prior to any works and, that workers are fully informed of "no-go" areas,	Contractor, KFS, NEMA	Area rehabilitated (hectares), species planted % change in vegetation cover (baseline vs current) GIS analysis, field survey	Quarterly	6,500,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		• Increase awareness of construction workers on the need to protect the environment, wildlife and vegetation around the construction sites. Training shall be conducted for all construction workers, • In the event that any injured animals are found during construction, these will be immediately reported to the project team, • Engage ecologists to relocate affected fauna where feasible, • Avoid nighttime construction in sensitive habitats to reduce disturbance to nocturnal species, • The contractors will sanitize equipment before moving between work zones to prevent the spread of invasive species along the corridor, • Collaborate with local conservation groups, schools, and residents to support replanting and awareness programs				
	Gender Base Violence	• The contractor will establish workers' safety committee which will include at least one trained female worker representative, • The contractor will develop and implement a workers' code of conduct, including GBVH policies, and mandatory training of all workers on sexual harassment and GBVH protocols.	Contractor, Labour ministry/local administration	Number of trainings	Weekly	2,250,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
Operation Phase	Health and Safety	• Install fixed gas detection systems for Hydrogen Sulfide (H_2S), Ammonia (NH_3), and Methane (CH_4) in treatment units, pumping stations, and confined spaces, • Provide adequate mechanical ventilation systems in enclosed or high-risk areas to dilute hazardous gases, • Design safe access systems, including guardrails, anti-slip flooring, and enclosed ladders to prevent falls, • Develop and implement a comprehensive OHS Management System aligned with the Occupational Safety and Health Act, 2007 and ISO 45001 standards, • Conduct routine risk assessments and safety audits across all operational sites, • Establish Standard Operating Procedures (SOPs) for high-risk tasks such as confined space entry, chemical handling, and machine operation, • Maintain safety signage and demarcations throughout the facilities to indicate hazard zones, PPE requirements, and emergency exits, • Provide mandatory training for all personnel on workplace hazards, emergency response, and safe work practices, • Conduct regular safety drills (e.g., fire, chemical spill, rescue operations) to enhance preparedness and response capacity, • Provide and enforce PPE usage through supervision and compliance monitoring,	NCWSC	Availability of PPEs and Incident Records	Daily	4,300,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates

		• Establish a health monitoring program including:
		  ○ Pre-employment and periodic medical exams
		  ○ Vaccination programs (e.g., Hepatitis A & B, Tetanus)
		• Maintain a fully equipped first aid station at each operational facility,
		• Develop and communicate emergency response procedures including contacts for medical evacuation, and
		• Maintain a safety file with all training records, incident logs, permits, and inspection reports.				

	Solid Waste Accumulation along Riverbanks & Walkways	• Install labeled and covered bins at strategic intervals along walkways, parks, recreational spaces, and public gathering areas, • Develop and enforce a strict waste collection schedule (daily/weekly depending on foot traffic), • Run regular sensitization campaigns on proper waste disposal through signage, local media, • Collaborate with community-based organizations (CBOs) to monitor waste hotspots and report illegal dumping, • Register and integrate informal waste pickers into formal systems, and • Regularly clear trapped waste to avoid clogging and flooding.	Nairobi City County, NEMA, Local CBOs	Cleanliness level, number of bins, waste collection frequency Waste collection logs	Weekly	2,500,000.00
	Sewer Blockage or Leakage (New Trunk Sewer)	• Establish a proactive inspection schedule to monitor leaks, blockages, or structural weaknesses,	Nairobi Water and Sewerage Company., WRA	Sewer system condition, number of blockages	Monthly	5,000,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		• Periodically flush and desilt sewer lines to prevent buildup of solids, grease, and debris, • Educate residents and businesses on proper waste disposal to prevent the introduction of non-biodegradable materials into the sewer, • Integrate sewer infrastructure maintenance into broader urban planning and drainage management frameworks.				
	Degradation of Green Landscaping	• Engage professional landscapers or trained local personnel to manage upkeep, • Fence or demarcate landscaped areas clearly with signage to prevent foot traffic and unauthorized use, • Engage local residents, youth groups, and schools in "adopt-a-park" or "adopt-a-riverbank" programs, • Provide adequate bins to prevent littering and degradation of vegetation, and • Provide continuous training for maintenance staff on sustainable landscaping techniques.	County Environment Dept, KFS, Local CBOs	Vegetation cover status, survival rate of plants	Monthly	4,200,000.00
	Pollution of River Water from Domestic and Commercial Sources	• Ensure all domestic and commercial premises within the riparian zone are connected to the expanded trunk sewer system, • Enforce the use of proper sanitation facilities and prohibit direct discharge into the river, • Monitor commercial and industrial facilities for compliance with NEMA's Effluent Discharge Standards,	WRA, NEMA, Public Health Dept.	Water quality parameters (BOD, pH, etc.) Effluent test results compliant with NEMA	Quarterly	3,250,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		• Increase access to regular and reliable solid waste collection services in nearby settlements and market areas, • Prohibit and penalize illegal dumping of waste into storm drains and waterways, • Run targeted awareness campaigns on the dangers of water pollution and the importance of proper waste disposal, • Establish river watch groups made up of residents, especially youth, to monitor pollution and report illegal discharge, • Provision of designated manual waste disposal facilities or sanitation points within informal settlements located along the river corridor. These facilities will serve as controlled disposal sites, effectively deterring the direct release of raw sewage and greywater into the riverine ecosystem				
	Flood Risk and Water Level Fluctuations	• Conduct regular dredging to remove sediment buildup that reduces river flow capacity, • Install and maintain gabions, levees, and reinforced embankments to contain rising water levels, • Rehabilitate and protect natural vegetation buffers along riverbanks to absorb flood-waters and reduce surface runoff, • Restrict development within designated buffer zones, • Upgrade drainage systems to reduce urban surface runoff into the river, • Enforce zoning that prohibits settlement or construction in high-risk floodplains, • Promote tree planting and soil conservation in upstream catchment	WRA, County Disaster Response Unit	Flood occurrence records, drainage functionality	Annually and before/after rainy season	5,000,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		areas to improve water retention and reduce runoff, • Continuously collect data on rainfall, water levels, and land use changes using GIS and remote sensing.				
	Public Safety Risks (Bridges, Parks, Lighting and diseases outbreak)	• Conduct routine structural assessments by qualified engineers, • Install high-quality guardrails and anti-slip surfaces, • Post clear signage for load limits, emergency contacts, and usage guidelines, • Ensure universal access to public amenities (ramps, handrails, tactile paving) for children, elderly, and persons with disabilities.	County Government/KURA Public Health Officer	Safety audit reports, incident logs Number of sanitation units; health inspection records	Quarterly	4,000,000.00
	Air Quality	• Seal sludge tanks, grit chambers, and primary sedimentation units using impermeable covers to contain gases, • Install biofilters, chemical scrubbers, or activated carbon units at high-emission points to remove hydrogen sulfide (H_2S), ammonia (NH_3), and volatile organic compounds (VOCs), • Ensure rapid dewatering and disposal of sludge to prevent anaerobic decay and foul odors, • Apply water sprays or dust-binding agents on unpaved access roads and dry sludge areas, • Pave frequently used roads and plant vegetative ground cover in non-operational areas to reduce windblown dust, • Install continuous or periodic monitoring stations to assess, Hydrogen sulfide (H_2S), Ammonia (NH_3),	NWSC	Air quality test results (H2S, NH3)	Quarterly	3,500,000.00

Phase	Potential Impact	Proposed Mitigation Measures	Responsible Parties	Verification/Monitoring Indicator	Monitoring Frequency	Cost Estimates
		Particulate matter (PM_{10}, $PM_{2.5}$) and general odour levels • Provide appropriate Personal Protective Equipment (PPE) to all operational personnel handling wastewater and sludge treatment processes, including but not limited to: • Respirators or face masks (for odour and particulate exposure) ○ Protective gloves and waterproof boots ○ Coveralls or overalls ○ Eye protection (e.g., goggles) ○ Hearing protection (in high-noise areas). •				
	Encroachment on Riparian Zone	• Use visible markers, fencing, or signage to clearly define protected riparian areas along the river, • Utilize satellite imagery and GIS systems to monitor land use changes and detect illegal encroachment in real-time, • Schedule periodic patrols by enforcement officers, especially in high-risk or previously encroached areas, • Enforce EMCA, Physical and Land Use Planning Act, and County by-laws that prohibit construction or settlement in riparian zones.	NEMA, County Lands Dept., Ministry of Lands	Encroachment reports, boundary maps	Biannually	4,000,000.00

11.4. Training Requirement

Advanced training on environmental and social management and monitoring would be useful for the project implementors of the proposed project in successfully implementing environmental and social management. It is also necessary to provide basic training for key personnel on regulatory requirements, and environmental impacts. The training program for proposed project personnels shall be based on their expanded functions and new and additional safeguards. Training shall be imparted, on a regular interval, to the Project team and Staffs.

11.5. Decommissioning Phase

11.5.1. Decommissionings Impacts

Decommissioning activities have the potential to generate environmental impacts comparable to those experienced during the construction phase. Key concerns include soil disturbance, erosion, sedimentation, and potential contamination of adjacent watercourses or other sensitive ecological features. Accordingly, many of the mitigation measures, environmental management practices, and regulatory compliance requirements that were implemented during the construction phase shall be similarly enforced during decommissioning. These may include erosion and sediment control measures, controlled dismantling and waste management procedures, site rehabilitation plans, and continued environmental monitoring to ensure that decommissioning activities do not adversely affect surrounding ecosystems.

11.6. Decommissioning Activities

11.6.1. Pre-Dismantling Activities

At the end of the Project's operational life, decommissioning will begin with the safe de-energization and isolation of all electrical systems from external power lines to eliminate any electrical hazards. Following this, designated staging areas will be clearly delineated within appropriate locations along the project corridor. These areas will serve as controlled zones for equipment dismantling, material storage, and waste segregation to ensure an orderly and environmentally responsible decommissioning process.

11.6.2. Equipment Dismantling and Removal

Following de-energization and site preparation, the dismantling and removal of project infrastructure will be undertaken in a systematic and controlled manner. All physical components, including buildings, equipment, electrical systems, sewer trunk pipelines, and auxiliary facilities, will be carefully disassembled using appropriate machinery and manual labor where necessary to minimize dust, noise, and environmental disturbance. Materials and equipment deemed reusable, or recyclable will be sorted and transported to designated facilities, while non-recyclable or hazardous waste will be handled, stored, and disposed of in accordance with applicable national regulations and best international practices. All dismantling activities will be conducted under strict safety protocols to protect workers and the surrounding environment. Upon completion, the site will be cleared of debris and prepared for rehabilitation or transition to alternative land use.

11.6.3. Site Rehabilitation/Restoration

At the time of decommissioning, the Project Proponent will prepare and implement a comprehensive site rehabilitation plan in accordance with the requirements of the Environmental Management and Coordination Act (EMCA), Cap 387 and EIA license conditions. The rehabilitation plan will outline specific restoration measures aimed at returning all disturbed areas to their pre-construction conditions to the extent practicable. These measures may include regrading land, replacement of topsoil, re-vegetation using native plant species, erosion control interventions, and the removal of temporary structures. The goal of the plan will be to promote ecological recovery, minimize long-term environmental impacts, and ensure that the site is safe, stable, and compatible with surrounding land uses.

11.6.4. General Rehabilitation/Restoration Practices

The rehabilitation plan will generally include, but will not be limited to, the following measures:

- Minimization of Ground Disturbance: All ground disturbance during decommissioning activities will be minimized to the extent practicable to reduce soil erosion, habitat loss, and disruption of existing land features.
- Restoration of Site Topography: The site will be restored to align with adjacent natural ground contours, where feasible. This may involve regrading of access roads, platforms, and other disturbed areas to reinstate natural drainage patterns and preexisting topographical features.
- Removal of Roads and Drainage Infrastructure: As part of road decommissioning, culverts and associated stormwater infrastructure will be dismantled. Streams and drainage channels impacted by the project will be restored to their original elevations and stabilized using appropriate erosion and sediment control measures, in accordance with applicable permit conditions in effect at the time of decommissioning, and
- Drainage restoration: Any preexisting drainage systems within the Project Site that were altered or disrupted during construction and operation will be repaired or replaced. These systems will be returned to their original or improved condition to ensure continued functionality and to prevent adverse hydrological impacts.

11.7. Decommissioning Costs

The cost estimate for decommissioning activities shall be prepared by a team of qualified and competent Quantity Surveyors and Engineers. This estimate will comprehensively account for all anticipated expenses related to dismantling, removal, transportation, waste management, site rehabilitation, and environmental restoration. The purpose of the estimate is to ensure that adequate financial resources are allocated and reserved to support a safe, effective, and environmentally responsible decommissioning process in compliance with regulatory requirements.

Table 17: Decommissioning ESMP

Potential Impact	Proposed Mitigation Measures	Monitoring / Verification Indicator	Method	Frequency	Responsible Party
Soil contamination from waste	• The decommissioning contractor shall develop a site-specific WMP outlining how different types of solid waste (hazardous, recyclable, organic, construction debris) will be handled, stored, transported, and disposed, • The decommissioning contractor will set up clearly labeled bins or collection points to separate waste into categories for appropriate disposal and management, • Partner with licensed recycling firms for proper disposal of scrap metal, plastic, and e-waste, • All non-recyclable and non-hazardous waste should be transported to licensed landfills or dumpsites approved by NEMA and Nairobi City County, • The decommissioning contractor shall maintain records of types and volumes of waste generated, recycled, reused, or disposed, • Conduct induction training for decommissioning workers on proper waste handling procedures and the importance of waste minimization, • Remove all debris, packaging, and unused materials from site, and • Restore and rehabilitate waste-handling areas with soil stabilization and vegetation where appropriate.	Presence of contaminated hotspots or residual pollutants	Soil sampling and laboratory testing	Once before handover	Contractor, NEMA-licensed Waste Handler
Disruption to public access or utilities	• Conduct thorough utility surveys prior to decommissioning and coordinate with service providers (water, power, telecom) for safe removal or rerouting, • Inform communities, businesses, and institutions well in advance about planned disruptions and provide timelines, • Provide temporary solutions such as water tanks, mobile toilets, generators, or bypass roads where permanent services are disrupted, and • Maintain a standby maintenance team to address accidental service interruptions promptly	Restoration of community access and infrastructure	Walk-through inspection with community reps	Once after restoration	Contractor, Community Liaison Officer

Potential Impact	Proposed Mitigation Measures	Monitoring / Verification Indicator	Method	Frequency	Responsible Party
Loss of planted trees or wetlands	• Ensure young trees and restored wetlands are protected and monitored post-project,	Survival rate of trees, water levels and biodiversity in wetlands	Field survey, photographic monitoring	Quarterly (1 year)	Nairobi River Regeneration Agency
Community health and safety risks	• Erect proper fencing, warning signs, and access control around all hazardous and active demobilization sites, • Establish a confidential and accessible reporting system for safety concerns, GBV, and other community risks, • Ensure community security around sensitive project components and during off-hours, and • Collaborate with local administration, community health workers, and police to monitor safety issues and promptly address them.	No injuries, exposed pits, or sharp materials left behind	Health & safety audit	Final stage	HSE Officer
Noise and Vibration from removal works	• Restrict all demobilization and dismantling activities to daytime working hours only (e.g., 08:00 to 17:00) to avoid disturbing nearby residents during sensitive hours, • Employ modern machinery and equipment fitted with noise suppression devices such as silencers and mufflers, • Ensure all machinery and equipment are properly maintained to operate within manufacturer noise specifications, • Erect temporary acoustic screens or barriers (e.g., metal sheets) around noise-generating equipment especially near schools, hospitals, residential areas, and other sensitive receptors, • Apply low-impact demolition techniques such as manual dismantling where applicable, • Locate high-noise equipment (e.g., aerators, mechanical screens) away from property boundaries and sensitive receptors such as homes, • Display signage in high-noise areas and provide Personal Protective Equipment (PPE) (e.g., earmuffs or plugs) for staff,	Measured in decibels (dB(A)) during peak and off-peak periods. Log of noise and vibration measurements with GPS-tagged monitoring points	Sound level meter	Quarterly	Contractor

Potential Impact	Proposed Mitigation Measures	Monitoring / Verification Indicator	Method	Frequency	Responsible Party
	• Establish a grievance redress mechanism for community members to report noise-related disturbances, • Conduct periodic ambient noise monitoring using calibrated sound level meters at facility boundaries and nearby receptors, • Compare results against national guidelines (e.g., NEMA Noise and Excessive Vibration Pollution Control Regulations, 2009) and take corrective actions as needed, and • Maintain records of noise levels and mitigation actions for regulatory reporting and auditing				
Air Quality (Dust Pollution)	• Regularly spray water on exposed surfaces, roads, and demolition areas to suppress dust, especially during dry and windy conditions, • Use dust nets or screens around active demobilization zones, particularly near sensitive receptors (schools, homes, hospitals), • Ensure all vehicles and machinery used during demobilization are well-maintained and regularly serviced to minimize emissions of carbon monoxide, nitrogen oxides, and particulates, • Cover trucks transporting demolition of waste or loose material (e.g., soil, rubble) using tarpaulins or equivalent materials, • Avoid overloading trucks and ensure debris is moistened before loading/unloading to reduce particulate matter emissions, • Conduct periodic air quality monitoring using portable air quality sensors or passive samplers to detect dust (PM_{10}, $PM_{2.5}$) and gaseous emissions (e.g., NO_2, CO), • Provide appropriate PPE **(e.g., N95 dust masks)** to all workers on-site	PM_{10} levels, community complaints	Air quality sampling; feedback box	Daily (active removal)	Contractor, NEMA
Employment loss or worker exit	• Implement a phased demobilization schedule to reduce the sudden loss of employment,	% of workers who exit with full documentation and pay	HR records audit	Once at closure	Project HR Officer

Potential Impact	Proposed Mitigation Measures	Monitoring / Verification Indicator	Method	Frequency	Responsible Party
	• Offer capacity building and vocational training programs during the project life cycle to prepare workers for new job opportunities, • Partner with government agencies and NGOs to support redeployment of skilled labor to other ongoing infrastructure projects or private sector initiatives, • Facilitate access to financing and training for small-scale entrepreneurship in sectors like recycling, urban farming, or eco-tourism, • Inform workers and community members in advance of the project timeline and planned closure activities to reduce uncertainty, and • Work with Nairobi County and national government agencies to absorb affected personnel into ongoing urban or environmental programs				

12. CONCLUSION AND RECOMMENDATIONS

12.1. Conclusion

A comprehensive Environmental Impact Assessment (EIA) study for the project components and activities has been conducted in compliance with Kenyan regulations and contemporary international EIA best practices. This EIA Report outlines the project plans and activities, documenting both the positive and potential negative effects on the environment (biophysical), socio-economic conditions, and public health. The identified significant negative impacts have been evaluated in detail, and appropriate mitigation measures have been proposed.

Measures to avoid, minimize, and mitigate potential environmental and social impacts of the project have been comprehensively outlined within an Environmental and Social Management Plan (ESMP). The ESMP serves as the principal framework for systematic management, monitoring, and reporting of the project's environmental and social impacts, in accordance with both national and international standards. The plan includes specific actions and performance indicators to ensure compliance with regulatory requirements and best practices throughout the project's implementation.

Public participation for the Nairobi River Regeneration Programme has been conducted in compliance with the Constitution of Kenya and EMCA, Cap 387. Consultations have ensured that stakeholder and project affected parties (PAPs) views are integrated into the Environmental and Social Management Plan (ESMP). However, consultation is a continuous process that will be maintained throughout the project lifecycle to promote transparency, inclusivity, and effective stakeholder engagement. A dedicated Grievance Redress Mechanism (GRM) will be developed and implemented as presented in this report (Chapter 9) at the national, county, and site levels to address any complaints or issues raised by affected stakeholders. The GRM will establish clear procedures for the resolution of grievances and ensure that all complaints are handled in a transparent and timely manner.

The implementation of the ESMP will be overseen by a multi-Agency Project team comprising representatives from relevant line ministries, regulatory agencies, contracted entities (Contractor), environmental and social consultants, as well as specialists in wetland and riverine ecosystems. This collaborative framework is designed to ensure that all identified environmental and social mitigation measures are executed effectively and in accordance with legal and regulatory requirements.

The implementation process will be supported by a robust monitoring system, with continuous performance tracking to assess compliance and the efficacy of the proposed mitigation strategies. Regular progress reports will be compiled and submitted to the appropriate oversight bodies, detailing implementation outcomes, challenges encountered, and any corrective actions taken. This approach ensures adaptive management and accountability throughout the lifecycle of the project.

12.2. Recommendations

For proper implementation and overall success of the proposed Nairobi River Regeneration Programme, we highly recommend the following measures, among others:

a) Public participation should remain an ongoing process throughout the project lifecycle. This includes structured community consultations, grievance redress mechanisms, and information dissemination,

b) Ensure that all project activities align with existing national laws (e.g., EMCA Cap 387, Water Act, Physical Planning Act) and international best practices in environmental and social safeguards,

c) Develop and implement a comprehensive monitoring and evaluation system with clearly defined indicators for tracking the effectiveness of mitigation measures in the ESMP,

d) Incorporate employment creation, skill development (transfer), and entrepreneurship initiatives targeting local communities, particularly vulnerable groups,

e) Prepare a detailed decommissioning and maintenance strategy, including restoration of affected ecosystems and infrastructure handover to relevant agencies or community, and

f) Prior to commencement of any construction or rehabilitation activities, secure all required legal and regulatory approvals.

13. APPENDICES

Annex 1: ESL NEMA Practicing License

EAE 2 3063292

FORM 7 (r.15(2))

nema
Mazingira Yetu | Uhai Wetu | Wajibu Wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/22533

Application Reference No: NEMA/EIA/EL/29470

M/S **Earthcare Services Limited**
(individual or firm) of address
P.O. Box 22433-00100, Nairobi

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts** registration number **1799**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/10/2025** Expiry Date: **12/31/2025**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2015 Certified

EAE 2 3063291

FORM 7

(r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/22534

Application Reference No: NEMA/EIA/EL/29476

M/S **John Damascene Mabala Kuloba**
(individual or firm) of address
P.O. Box 22433 - 00100 Nairobi

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert General**

registration number **1018**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/10/2025**

Expiry Date: **12/31/2025**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2015 Certified

Annex 2: Bill of Quantity (BoQ)

Section No.	FINAL SUMMARY	Page NO	Amount
1	PRELIMINARIES	19	**1,037,116,000.00**
2	TRUNK SEWER WORKS	33	**6,051,741,470.00**
3	KARIOBANGI WASTE WATER TREATMENT PLANT	97	**5,054,278,439.31**
4	CATCHMENT RESTORATION AND PROTECTION	102	**642,488,970.00**
5	FLO0D CONTROL AND STORM WATER WORKS	119	**6,421,385,895.30**
6	SOLID WASTE MANAGEMENT WORKS	122	**2,849,153,579.00**
7	CAR WASH GREASE INTERCEPTORS	126	**17,648,460.00**
8	TRANSPORT INFRASTRUCTURE	137	**5,369,112,886.58**
9	COMPREHENSIVE URBAN SCAPE (CORE SECTOR)	153	**1,918,255,646.06**
10	SUPPORTING BUILDINGS AND STRUCTURES	159	**425,520,000.00**
11	SURVEYS, DESIGN AND PROJECT MANAGEMENT	163	**4,997,867,075.74**
12	SUPERVISION	164	**1,315,000,000.00**
13	CONTINGENCIES	165	**1,500,000,000.00**
	Carried to Form of Tender	**KES**	**37,599,568,421.99**

Republic of Kenya

WATER RESOURCES AUTHORITY

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WATER RESOURCES AUTHORITY
Accounting for every Drop!

Marked and Pegged Riparian Reserves

FEBRUARY 2023

1

Table of Contents

1 Problem statement:

The rampant encroachment on the riparian reserves; compounded with environmentally proscribed activities, has denied the reserve functional role of ecological buffer zone and habitat to the terrestrial biodiversity; and this resultantly contributed to the deteriorating quality of water resources from the anthropogenic activities in the catchment.

2 Recommendations:

1. Marking and pegging the riparian reserves;
2. Removal and prohibition of the proscribed structures and activities on the riparian reserves;
3. Restoration of the riparian reserve ecosystems through sustainable conservation and protection measures.

3 Marking and Pegging the Riparian Reserves

3.1 Kirichwa Kubwa River

S/NO	KIRICHWA KUBWA RIVER (Right Bank) 10M Reserve		KIRICHWA KUBWA RIVER (Left Bank) 10M Reserve	
	RIVER EDGE	Extent	RIVER EDGE	Extent
1	-1.300	36.738	-1.300	36.738
	-1.300	36.738	-1.299	36.738
2	-1.300	36.739	-1.300	36.739
	-1.300	36.739	-1.299	36.739
3	-1.300	36.74	-1.300	36.739
	-1.300	36.739	-1.299	36.739
4	-1.299	36.741	-1.300	36.740
	-1.300	36.741	-1.300	36.740
5	-1.299	36.741	-1.299	36.740
	-1.299	36.741	-1.299	36.740
6	-1.299	36.743	-1.299	36.742
	-1.299	36.742	-1.299	36.742
7	-1.299	36.743	-1.299	36.742
	-1.299	36.743	-1.299	36.742
8	-1.298	36.744	-1.299	36.743
	-1.298	36.744	-1.298	36.743
9	-1.297	36.744	-1.298	36.743
	-1.298	36.744	-1.298	36.743
10	-1.297	36.744	-1.297	36.744
	-1.297	36.745	-1.297	36.744

11	-1.297	36.745	-1.297	36.744
	-1.297	36.745	-1.297	36.744
12	-1.297	36.745	-1.297	36.744
	-1.297	36.745	-1.297	36.744
13	-1.296	36.746	-1.296	36.746
	-1.296	36.746	-1.296	36.746
14	-1.296	36.747	-1.296	36.746
	-1.296	36.747	-1.296	36.746
15	-1.296	36.747	-1.296	36.745
	-1.296	36.747	-1.296	36.745
16	-1.294	36.749	-1.296	36.747
	-1.295	36.749	-1.296	36.747
17	-1.295	36.749	-1.296	36.748
	-1.294	36.750	-1.296	36.748
18	-1.294	36.750	-1.296	36.748
	-1.295	36.750	-1.295	36.748
19	-1.294	36.751	-1.295	36.749
	-1.294	36.751	-1.295	36.749
20	-1.293	36.751	-1.295	36.750
	-1.293	36.751	-1.294	36.750
21	-1.293	36.752	-1.294	36.751
	-1.294	36.752	-1.294	36.751
22	-1.294	36.753	-1.294	36.751
	-1.294	36.753	-1.294	36.751
23	-1.294	36.753	-1.293	36.752
	-1.294	36.753	-1.293	36.752
24	-1.294	36.754	-1.294	36.753
	-1.294	36.754	-1.294	36.753
25	-1.294	36.754	-1.293	36.753
	-1.294	36.754	-1.293	36.753
26	-1.293	36.757	-1.294	36.754
	-1.293	4E+08	-1.294	36.754
27	-1.294	36.757	-1.293	36.755
	-1.294	36.757	-1.293	36.755
28	-1.294	36.758	-1.295	36.761
	-1.295	36.758	-1.295	36.762
29	-1.295	36.761	-1.295	36.762
	-1.296	36.761	-1.295	36.762
30	-1.295	36.762	-1.296	36.774
	-1.296	36.762	-1.296	36.774
31	-1.293	36.777	-1.296	36.774
	-1.293	36.777	-1.296	36.775
32	-1.292	36.777	-1.295	36.776

	-1.292	36.777	-1.294	36.776
33	-1.292	36.777	-1.293	36.777
	-1.292	36.777	-1.293	36.777
34	-1.29	36.78	-1.293	36.777
	-1.29	36.78	-1.293	36.777
35	-1.289	36.78	-1.292	36.777
	-1.289	36.78	-1.292	36.777
36	-1.285	36.785	-1.285	36.785
	-1.285	36.785	-1.285	36.785
37	-1.286	36.784	-1.284	36.787
	-1.286	36.784	-1.284	36.786
38	-1.284	36.787	-1.275	36.8
	-1.284	36.787	-1.275	36.786
39	-1.284	36.787	-1.275	36.8
	-1.289	36.787	-1.275	36.8
40	-1.283	36.787	-1.275	36.8
	-1.283	36.788	-1.275	36.8
41	-1.283	36.788	-1.275	36.8
	-1.283	36.788	-1.275	36.8
42	-1.283	36.789	-1.277	36.797
	-1.282	36.789	-1.277	36.797
43	-1.282	36.79	-1.276	36.798
	-1.283	36.79	-1.276	36.798
44	-1.282	36.794	-1.276	36.798
	-	-	-1.276	36.798
45	-1.278	36.797	-1.275	36.799
	-1.277	36.797	-1.275	36.799
46	-1.277	36.797	-1.275	36.799
	-1.277	36.797	-1.275	36.799
47	-1.277	4E+08	-1.275	36.799
	-1.277	36.797	-1.275	36.799
48	-1.276	36.798	-1.275	36.800
	-1.276	36.798	-1.275	36.800
49	-1.276	36.798	-1.283	36.788
	-1.276	36.798	-1.283	36.788
50	-1.276	36.799	-1.283	36.789
	-1.276	36.799	-1.282	36.789
51	-1.275	36.799	-1.282	36.789
	-1.275	36.799	-1.282	36.789
52	-1.275	36.800	-1.282	36.791
	-1.275	36.800	-1.282	36.791
53	-1.275	36.800	-1.282	36.791
	-1.275	36.800	-1.282	36.791

54	-1.275	36.801	-1.282	36.792
	-1.275	36.801	-1.282	36.792
55	-1.274	36.801	-1.282	36.792
	-1.274	36.801	-1.282	36.792
56	-	-	-1.282	36.793
	-	-	-1.282	36.793
57	-	-	-1.282	36.793
	-	-	-1.282	36.794
58	-	-	-1.282	36.794
	-	-	-1.282	36.794
59	-	-	-1.282	36.794

Kirichwa Kubwa River	GPS at the highest water edge	GPS at the Edge of 10 metres riparian reserve
P1	-1.28293 , 36.78766	-1.28280, 36.78745
P2	-1.28297, 36.78757	-1.28306 , 36.78741
P3	-1.2830604, 36.78748	-1.28306 , 36.78741
P4	-1.26876, 36.76989	-1.26866, 36.77015
P5	-1.26857, 36.77082	-1.26887, 36.76912

3.2 Gatharaini River

S/NO	Gatharaini River (Left Bank) 10M Reserve		Gatharaini River (Right Bank) 10M Reserve	
	River Edge	Extent	River Edge	Extent
1	-1.20279	-1.2027	-1.20301	-1.20309
	36.89718	36.89723	36.89693	36.89697
2	-1.20281	-1.20273	-1.20283	-1.20289
	36.89749	36.8975	36.89788	36.89784
3	-1.20278	-1.20271	-1.20298	-1.20301
	36.89806	36.8981	36.89844	36.89842
4	-1.20295	-1.2029	-1.2031	-1.20315
	36.89862	36.89869	36.89902	36.899
5	-1.20294	-1.20285	-1.20299	-1.20308
	36.89963	36.89963	36.89987	36.89985
6	-1.20289	-1.2028	-1.20293	-1.20298
	36.9003	36.9003	36.90085	36.90086
7	-1.20285	-1.20279	-1.20403	-1.20409
	36.90076	36.9008	36.90237	36.90231
8	-1.20308	-1.20305	-1.20463	-1.20471
	36.90144	36.90146	36.90299	36.90298

9	-1.20362	-1.20353	-1.20509	-1.20514
	36.90191	36.90196	36.90343	36.90337
10	-1.20363	-1.2036	-1.2057	-1.20579
	36.90188	36.90193	36.90411	36.90407
11	-1.20401	-1.20403	-1.20602	-1.20609
	36.90248	36.90258	36.90504	36.90501
12	-1.20477	-1.2047	-1.20621	-1.20629
	36.90327	36.90331	36.90595	36.90596
13	-1.2053	-1.20524	-1.20637	-1.20648
	36.90385	36.90394	36.90695	36.907
14	-1.20585	-1.20573	-1.20628	-1.20635
	36.90486	36.90488	36.9082	36.90825
15	-1.20613	-1.20607	-1.20618	-1.20624
	36.90601	36.906	36.90985	36.90992
16	-1.20629	-1.20625	-1.20633	-1.20641
	36.90706	36.90708	36.91114	36.91112
17	-1.20563	-	-1.20752	-1.20761
	36.90768	-	36.91307	36.91296
18	-1.20619	-1.2061	-1.22958	-1.22966
	36.90823	36.90825	36.96473	36.96466
19	-1.20611	-1.20611	-1.22932	-1.22938
	36.90917	36.90917	36.9642	36.96418
20	-1.20612	-1.20604	-1.23007	-1.23014
	36.91004	36.91007	36.96561	36.96558
21	-1.20605	-1.20616	-1.22983	-1.22988
	36.91076	36.91074	36.96593	36.96601
22	-1.20640	-1.20628	-1.22981	-1.22988
	36-9116295	36.91169	36.9668	36.9668
23	-1.20668	-1.20669	-1.22983	-1.22994
	36.91217	36.9122	36.9678	36.9678
24	-1.2079	-1.20783	-1.22983	-1.22992
	36.91352	36.91359	36.96832	36.96832
25	-1.2086	-1.20861	-1.22989	-1.22997
	36.91405	36.91414	36.96937	36.96934
26	-1.20982	-1.20976	-1.22976	-1.22985
	36.9146	36.91467	36.97014	36.97016
27	-1.21112	-1.21117	-1.22907	-
	36.91498	36.91507	36.97074	-
28	-1.21152	-1.2115	-1.22865	-1.22866
	36.91491	36.915	36.9714	36.97138
29	-1.21189	-1.21182	-1.22846	-1.22854
	36.91562	36.9157	36.97234	36.9724
30	-1.21241	-1.21239	-1.22805	-1.22813

	36.91601	36.91608	36.97312	36.97318
31	-1.2121	-	-1.22762	-1.22766
	36.91611	-	36.97377	36.97381
32	-1.21331	-1.21327	-1.22314	-1.22322
	36.91665	36.9167	36.93935	36.93935
33	-1.21365	-1.21359	-1.22404	-1.2241
	36.9182	36.91817	36.94087	36.94086
34	-1.21381	-	-1.22521	-1.22529
	36.91819	-	36.94216	36.94214
35	-1.21421	-1.21414	-1.22593	-1.22604
	36.91865	36.91864	36.94343	36.94337
36	-1.21456	-	-1.22671	-1.22679
	36.91877	-	36.94473	36.94464
37	-1.21469	-	-1.22736	-1.22746
	36.91881	-	36.94647	36.9464
38	-1.2149	-1.21466	-1.22731	-1.2274
	36.91966	36.91975	36.94829	36.94827
39	-1.21586	-1.21582	-1.22791	-1.22799
	36.92059	36.92074	36.9503	36.95028
40	-1.21698	-1.21702	-1.22844	-1.22855
	36.92159	36.92162	36.95223	36.95227
41	-1.21763	-1.21752	-1.22888	-1.22896
	36.92185	36.92187	36.95468	36.95462
42	-1.21768	-1.2176	-1.22981	-1.22991
	36.92211	36.92219	36.95629	36.95622
43	-1.21825	-1.21818	-1.23033	-1.2304
	36.92292	36.92293	36.95763	36.95763
44	-1.21851	-1.21839	-1.20864	-1.20872
	36.92373	36.92369	36.91359	36.91355
45	-1.21832	-1.21821	-1.20896	-1.20896
	36.92457	36.92456	36.91428	36.91428
46	-1.21817	-1.21817	-1.20935	-1.20937
	36.92495	36.92505	36.91417	36.91404
47	-1.21845	-1.2184	-1.21105	-1.21107
	36.92556	36.92561	36.91469	36.91439
48	-1.21905	-1.21893	-1.21171	-1.21181
	36.92634	36.92635	36.91495	36.91486
49	-1.21966	-1.21954	-1.21214	-1.2122
	36.92724	36.92728	36.91562	36.91554
50	-1.22051	-1.22042	-1.21256	-1.21264
	36.92813	36.92814	36.91588	36.91575
51	-1.22141	-1.22133	-1.21338	-1.21344
	36.92969	36.92973	36.91651	36.91641

52	-1.22202	-1.22193	-1.21382	-1.21392
	36.93105	36.93106	36.91756	36.91747
53	-1.22261	-1.22251	-1.21436	-1.21441
	36.93178	36.93181	36.9184	36.91835
54	-1.22245	-1.22236	-1.21496	-1.21503
	36.93297	36.93294	36.91877	36.91871
55	-1.22209	-1.22203	-1.21566	-1.21574
	36.93345	36.93339	36.91977	36.91973
56	-1.22159	-1.22151	-1.21711	-1.21718
	36.93403	36.93397	36.9213	36.92121
57	-1.22181	-1.22171	-1.21721	-1.21787
	36.93462	36.93467	36.92208	36.92175
58	-1.22195	-1.22186	-1.21836	-1.21846
	36.93543	36.93544	36.92265	36.92257
59	-1.22186	-1.22176	-1.22065	-1.22065
	36.93605	36.93608	36.92371	36.92371
60	-1.22189	-1.22182	-1.21847	-1.21855
	36.93688	36.93691	36.92465	36.92463
61	-1.22194	-1.22187	-1.21875	-1.21884
	36.93783	36.93784	36.9252	36.92518
62	-1.22187	-1.22177	-1.21879	-1.21877
	36.93892	36.93898	36.92528	36.92521
63	-		-1.21912	-1.21914
			36.92553	36.92546
64	-1.22799	-1.22787	-1.2191	-1.2192
	36.96196	36.96203	36.92581	36.92581
65	-1.22804	-1.22796	-1.21911	-1.21915
	36.96214	36.96219	36.92629	36.92622
66	-1.2279	-1.22783	-1.21959	-1.21963
	36.96268	36.96273	36.92679	36.92679
67	-1.22838	-1.22832	-1.21997	-1.22001
	36.96321	36.96328	36.92725	36.92723
68	-1.22858	-1.22849	-1.22072	-1.22078
	36.96339	36.96342	36.92811	36.92808
69	-1.22871	-1.2286	-1.22116	-1.22126
	36.9636	36.96368	36.92881	36.92876
70	-1.22907	-1.229	-1.22126	-1.22133
	36.9643	36.96437	36.92943	36.92943
71	-1.22954	-1.22946	-1.22157	-1.22158
	36.96495	36.96499	36.92995	36.9299
72	-1.22975	-1.22967	-1.22167	-1.22175
	36.96556	36.96553	36.93045	36.93041
73	-1.2297	-1.22962	-1.2223	-1.22236

	36.96612	36.96613	36.93112	36.93105
74	-1.2297	-1.22959	-1.22293	-1.223
	36.96668	36.96674	36.93179	36.93178
75	-1.22968	-1.22963	-1.2228	-
	36.96728	36.96736	36.93249	
76	-1.22971	-1.22961	-1.22268	-1.22268
	36.96836	36.96838	36.93294	36.93294
77	-1.22969	-1.22959	-1.22252	-1.22261
	36.96926	36.96926	36.9332	36.93325
78	-1.22944	-1.22939	-1.22196	-1.22204
	36.97015	36.97007	36.9339	36.93399
79	-1.22878	-1.22871	-1.22202	-1.22211
	36.97075	36.97069	36.93498	36.93499
80	-1.22824	-1.22817	-1.22147	-1.22204
	36.97183	36.97181	36.93613	36.93614
81	-1.22782	-1.22775	-1.22239	-1.2225
	36.97317	36.97311	36.93694	36.93696
82	-1.22717	-1.22709	-1.22266	-1.22266
	36.97388	36.97381	36.93763	36.93763
83	-1.22661	-1.22658	-1.22353	-1.22361
	36.97446	36.9744	36.93994	36.93994
84	-1.22619	-1.22608	-1.2247	-1.22479
	36.9751	36.97505	36.94152	36.94147
85	-1.22591	-1.22585	-1.22554	-1.22562
	36.97561	36.97557	36.94285	36.94282
86	-1.22574	-1.22565	-1.22643	-1.22652
	36.97666	36.97666	36.94397	36.94391
87	-1.22533	-1.22529	-1.22739	-1.22739
	36.97723	36.97721	36.94527	36.94527
88	-1.22492	-1.22489	-1.22683	-1.22695
	36.97787	36.97781	36.94748	36.94748
89	-1.22452	-1.22443	-1.2E+08	-1.22753
	36.9782	36.97824	36.94941	36.94944
90	-1.22473	-1.22466	-1.22788	-1.22794
	36.99037	36.99033	36.95136	36.95137
91	-1.22475	-1.22464	-1.22828	-1.22836
	36.99025	36.99027	36.95358	36.95358
92			-1.22959	-1.22665
			36.95553	36.95545
93			-1.23033	-1.23038
			36.95696	36.95694
94			-1.22895	-1.22902
			36.96366	36.9636

95	-	-1.22691	-1.22701
		36.97429	36.97439
96		-1.22701	-1.22628
		36.97439	36.9751
97		-1.22628	-1.2264
		36.9751	36.97521
98		-1.22606	-1.22616
		36.97575	36.97574
99		-1.22586	-1.22595
		36.97676	36.97678
100		-1.22586	-1.22595
		36.97676	36.97678
101		-1.22525	-1.22536
		36.9777	36.97777
102		-1.22462	-1.22441
		36.97824	36.97825
103		-1.22454	-1.22464
		36.97912	36.97914
104		-1.22443	-1.22453
		36.97973	36.97974
105		-1.22438	-1.22439
		36.98064	36.98047
106		-	-1.22441
		-	36.98143
107		-	-1.22439
		-	36.98224
108		-1.22416	-1.22422
		36.98273	36.9828
109		-1.22439	-1.2244
		36.98632	36.9863
110		-1.22446	-1.22453
		36.98561	36.98562
111		-1.22439	-1.22458
		36.98631	36.98701
112		-1.22462	-1.22472
		36.9877	36.98769
113		-1.22459	-1.22467
		36.98839	36.98841
114		-1.22486	-1.22495
		36.98919	36.98918
115		-1.22502	-1.22513
		36.99013	36.99009

116		-1.22506	-1.22506

3.3 Manyatta River

S/NO	RIVER MANYATTA (Right Bank) 10M Reserve		RIVER MANYATTA (Left Bank) 10M Reserve	
	RIVER EDGE	EXTENT	RIVER EDGE	EXTENT
1	-1.28879	-1.2889	278512	272508
	37.00947	37.00953	9857470	9857477
2	-1.28843	-1.28849	278531	278518
	37.00969	37.00972	9857504	9857510
3	-1.28852	-1.28861	278564	278518
	37.01012	37.01015	9857507	9857518
4	-1.28852	-1.28857	278680	278673
	37.01078	37.01079	9857507	9857528
5	-1.28835	-1.28844	278738	278738
	37.01139	37.01172	9857525	9857535
6	-1.28833	-1.28841	278826	278774
	37.01169	37.01172	9857579	9857549
7	-1.28836	-1.28845	278826	278821
	37.01235	37.0124	9857579	9857588
8	-1.28852	-1.28855	278862	278872

	37.01256	37.01249	9857543	9857547
9	-1.28873	-1.28881	278898	278908
	37.01281	37.01285	9857512	9857507
10	-1.28891	278944	278938	-
	37.01285	9857522	9857534	-
11	-1.28891	-1.28904	9857536	9857545
	37.01285	37.01362	279026	279016
12	-1.28865	-1.28875	279026	279016
	37.01358	37.014	9857585	9857595
13	-1.28854	-1.2886	279053	279060
	37.01393	37.014	9857587	9857592
14	-1.28844	-	279096	279093
	37.01402	-	9857586	9857597
15	-1.28838	-	272151	279150
	37.01398	-	9857648	9857658
16	-1.28821	-1.28828	-	-
	37.01403	37.01407	-	-
17	-1.28793	-1.28798	-	-
	3.7E+08	37.01437	-	-
18	-1.28777	-1.28785	-	-
	37.01473	37.01476	-	-

3.4 Nairobi River

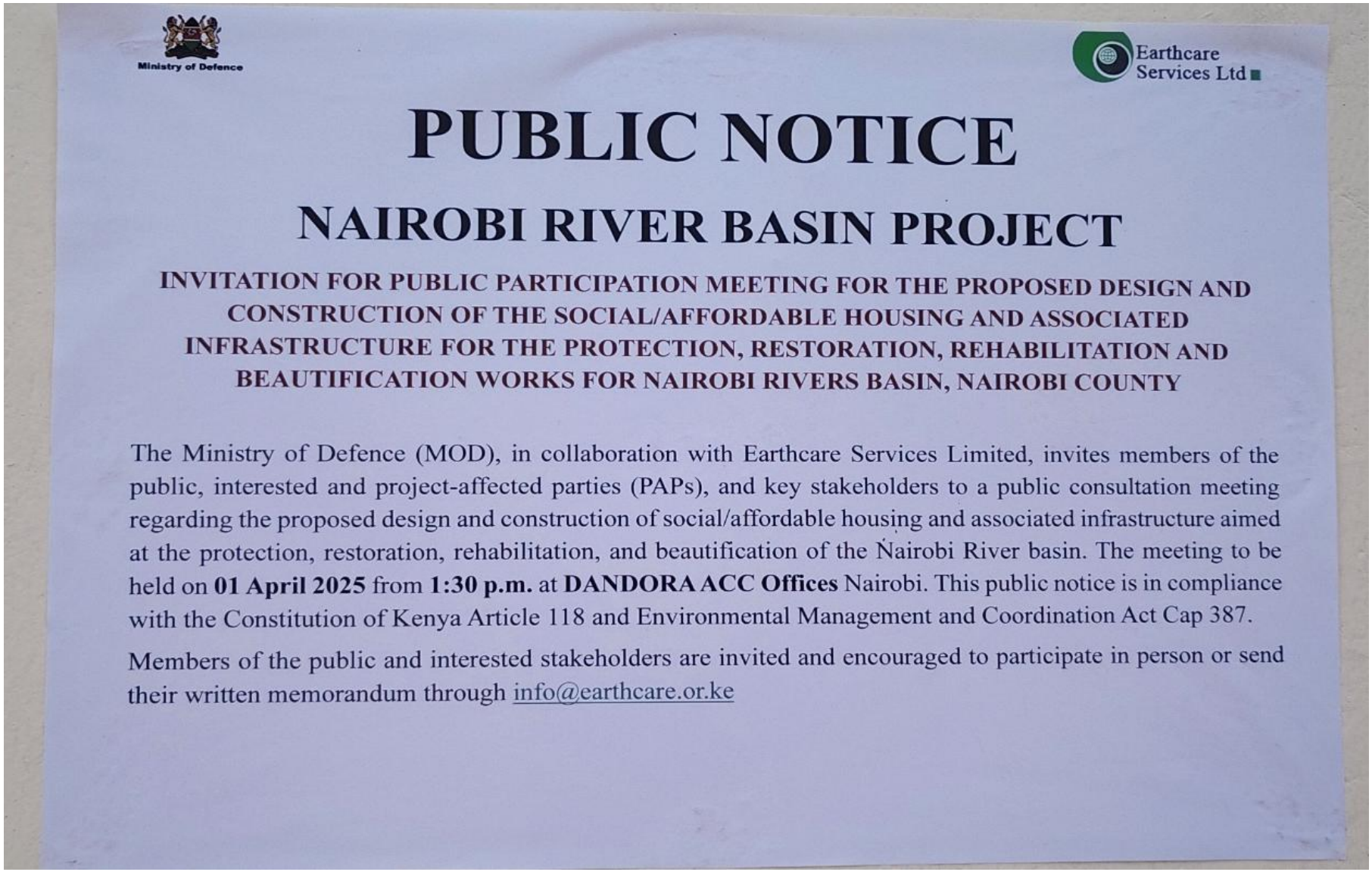
S/NO	NAIROBI RIVER (Right Bank) 10MReserve		NAIROBI RIVER (Left Bank) 10M Reserve	
	RIVER EDGE	Extent	RIVER EDGE	Extent
1	-1.279047	-1.27904	-1.2788573	-1.2501476
	36.8223746	36.822375	36.82225488	36.7935942
2	-1.2789974	-1.279087	-1.27885021	-1.2795903
	36.8225749	36.82267	36.82242847	36.8227633
3	-1.2789393	-1.278992	-1.27879428	-1.2791564
	36.8229992	36.82308	36.82314333	36.8231557
4	-1.2788524	-1.278937	-1.2788072	-1.2793035
	36.8234268	36.82346	36.82313979	36.82324
5	-1.2786994	-1.278853	-1.27887509	-1.2805468
	36.8239554	36.824051	36.82368801	36.8235328
6	-1.2787152	-1.278792	-1.27855476	-1.278917
	36.8245529	36.824552	36.82443116	36.8246882
7	-1.2787244	-1.278867	-1.2875789	-1.2789328

	36.8253761	36.825385	36.82490692	36.8246756
8	-1.2789364	-1.278947	-1.27851708	-1.2790648
	36.8260271	36.826007	36.8254867	36.8255431
9	-1.2789719	-1.279054	-1.27868512	-1.2789808
	36.826432	36.826435	36.82612755	36.8254647
10	-1.2792459	-1.279329	-1.28018112	-1.8027616
	36.8270672	36.827027	36.82950883	36.8295765
11	-1.2793291	-1.279545	-1.2808112	-1.2804865
	36.8270272	36.827598	36.83045932	36.8306452
12	-1.2798551	-1.279891	-1.28093228	-1.28091385
	36.8282715	36.828223	36.83157458	36.8315972
13	-1.2801671	-1.280249	-1.28524687	-1.28526
	36.8289691	36.8289	36.83614268	36.8362359
14	-1.2808103	-1.280877	-1.28565368	-1.2852515
	36.8301727	36.830112	36.83621882	36.8362008
15	-1.281099	-1.281161	-1.28579895	-1.285898
	36.8306815	36.830683	36.83643635	36.8363409
16	-1.2810419	-1.281116	-1.28596109	-1.2860298
	36.8312861	36.83131	36.83701364	36.8368435
17	-1.2812326	-1.281355	-1.28620413	-1.2861409
	36.8319522	36.831909	36.83752845	36.8375347
18	-1.2815402	-1.281638	-1.28616679	-1.2862649
	36.8326787	36.832614	36.83810384	36.8379758
19	-1281881	-1.281935	-1.28630809	-1.2862605
	36.832924	36.832868	36.83818628	36.8384056
20	-1.2824074	-1.282359	-1.28632508	-1.2863079
	36.8331586	36.833153	36.83891701	36.8388472
21	-1.2827647	-1.282772	-1.28632214	-1.2863139
	36.8336187	36.833515	36.83925123	36.8391206
22	-1.28332	-1.283354	-1.28644677	-1.2862585
	36.8339079	36.833452	36.83974358	36.8395121
23	-1.2836599	-1.283692	-1.28620151	-1.2861686
	36.8341553	36.834105	36.84039768	36.8403784
24	-1.2837918	-1.283948	-1.28654722	-1.2864322
	36.8346778	36.83464	36.84079075	36.8406633
25	-1.2860495	-1.286136	-1.28683039	-1.2866709
	36.836347	36.83249	36.84095106	36.8409855
26	-1.286892	-1.286409	-1.28723586	-1.2869765
	36.837355	36.837346	36.84122043	36.8411611

27	-1.2863083	-1.286485	-1.2827391	-1.28738
	36.8377897	36.8378	36.8422387	36.84242
28	-1.2866108	-1.286655	-1.28728	-1.28678
	36.8390895	36.839036	36.84261	36.84268
29	-1.2865356	-1.286615	-1.28673	-1.28666
	36.8404971	36.840481	36.84317	36.84306
30	-1.2871554	-1.28723	-1.2864	-1.28668
	36.8410095	36.840992	36.84341	36.8432
31	-1.2875678	-1.287633	-1.28688	-1.28701
	36.841373	36.841332	36.84466	36.8444
32	-1.2876798	-1.287745	-1.28725	-1.2869
	36.8425543	36.842583	36.844225	36.84472
33	-1.2875907	-1.287648	-1.28735	-1.28725
	36.8428603	36.842924	36.845	36.84508
34	-1.2872595	-1.287318	-1.28724	-1.2872
	36.8429274	36.843013	36.84779	36.8468
35	-1.2869045	-1.286991	-1.28716	-1.28707
	36.8431177	36.843208	36.84606	36.84596
36	-1.2865552	-1.286691	-1.28715	-1.28708
	36.8434005	36.843392	36.84614	36.84618
37	-1.2864858	-1.286599	-1.2873762	-1.2872976
	368437433	36.843752	36.8469183	36.846925
38	-1.28621	-1.286903	-1.287642	-1.2875852
	36.8439484	36.843885	36.471252	36.8471736
39	-1.2869949	-1.287163	-1.2879822	-1.2878837
	36.8442098	36.844208	36.8475352	36.8475775
40	-1.2870025	-1.287151	-1.2883169	-1.2882801
	36.8443603	36.844407	36.8478724	36.8479512
41	-1.2870778	-1.287165	-1.2885781	-1.2885583
	36.8445547	36.844607	36.8487439	36.8487933
42	-1.2871721	-1.28732	-1.2890699	-1.2891566
	36.8449163	36.844921	36.8491941	-
43	-1.2872375	-1.287361	-1.2891169	36.8491861
	36.8452589	36.845206	36.8491009	-
44	-1.2873314	-1.287397	-1.2892754	-1.2891869
	36.8456872	36.845699	36.8491763	36. 8492172
45	-1.2874606	-1.287397	-1.2893424	-1.289259
	36.8461258	36.84608	36.8492863	36.8493094
46	-1.2876495	-1.28765	-1.28929	-1.2891897
	36.849098	36.84691	36.8497333	36.8497148
47	-1.2887925	-1.28888	-1.2892487	-1.2891704

	36.85	36.8498178	36.85069	36.85071
14	-1.313	-1.3131693	-1.31334	-1.31335
	36.849	36.8493449	36.84868	36.84871
15	-1.313	-1.3133242	-1.31362	-1.3136
	36.848	36.8483427	36.84853	36.84851
16	-1.314	-1.3134752	1.31361	-1.31272
	36.847	36.8473667	36.84847	36.54781
17	-1.313	-1.313296	-1.31351	-1.31354
	36.847	36.8467386	36.84649	36.84726
18	-1.313	-1.3128267	-1.31364	-1.31354
	36.846	36.8460817	36.84708	36.84726
19	-1.312	-1.3123341	-1.31364	-1.31354
	36.845	36.8451765	36.84708	36.84726
20	-1.312	-1.3119329	-1.31335	-1.31341
	36.844	36.8443374	36.84649	36.84658
21	-1.312	-1.3115319	-1.31271	-1.31307
	36.844	36.8440154	36.84592	36.84578
22	-1.311	36.8432379	-1.31267	-1.31271
	36.843	-	36.8454	36.84539
23	-	-1.309697	-1.31241	-1.31243
	-	36.8411265	36.84493	36.84469
24	-1.31	-1.3096637	-1.31224	-1.31204
	36.841	36.841124	36.84471	36.84425
25	-1.308	36.8414785	-1.31176	-1.31163
	36.841	-	36.84371	36.84368
26	-1.307	-1.3067361	-1.31093	-1.31092
	36.841	36.8414889	36.84328	36.84319
27	-1.306	-1.3063955	-1.31032	-1.3102
	36.84	36.840151	36.84244	36.84242
28	-1.307	-1.3070258	-1.30994	-1.30999
	36.84	36.840151	36.84178	36.84161
29	-1.307	-1.3072324	-130921	-1.30955
	36.839	36.8390848	36.84071	36.84084
30	-1.307	-	-1.30946	-1.30873
	36.838	-	36.84076	36.24084
31	-1.308	-	-1.30796	-130873
	36.837	-	36.84118	36.84135
32	-1.308	-1.3075523	-1.3068	-1.30715
	36.836	36.8363446	36.84123	36.84122
33	-1.307	-1.306644	-1.30643	-1.30655
	36.836	36.835864	36.84064	36.84082
34	-1.306	-1.30592863	-1.30728	1.30719
	36.833	36.8328911	36.83929	36.83939

Annex 4: Public Notices



Ministry of Defence

Earthcare Services Ltd

PUBLIC NOTICE

NAIROBI RIVER BASIN PROJECT

INVITATION FOR PUBLIC PARTICIPATION MEETING FOR THE PROPOSED DESIGN AND CONSTRUCTION OF THE SOCIAL/AFFORDABLE HOUSING AND ASSOCIATED INFRASTRUCTURE FOR THE PROTECTION, RESTORATION, REHABILITATION AND BEAUTIFICATION WORKS FOR NAIROBI RIVERS BASIN, NAIROBI COUNTY

The Ministry of Defence (MOD), in collaboration with Earthcare Services Limited, invites members of the public, interested and project-affected parties (PAPs), and key stakeholders to a public consultation meeting regarding the proposed design and construction of social/affordable housing and associated infrastructure aimed at the protection, restoration, rehabilitation, and beautification of the Nairobi River basin. The meeting to be held on **01 April 2025** from **1:30 p.m.** at **DANDORA ACC Offices** Nairobi. This public notice is in compliance with the Constitution of Kenya Article 118 and Environmental Management and Coordination Act Cap 387.

Members of the public and interested stakeholders are invited and encouraged to participate in person or send their written memorandum through info@earthcare.or.ke

Annex 5: Sample Grievance Registration Form

Project Title: Nairobi River Regeneration Project

Date:_____

Name of Complainant: _____

Contact Information:

- Address: _____
- Phone Number: _____
- Email Address: _____

Description of Grievance:

[Please provide a detailed description of the grievance, including relevant dates, locations, and any individuals or entities involved.]

Supporting Documentation:

[Attach any relevant documents or evidence that support your grievance, such as photographs, videos, or correspondence.]

Resolution Sought:

[Explain what outcome or resolution you are seeking through this grievance process.]

Signature of Complainant: _____ Date: _____ Please submit this form to the designated grievance officer.

Note: Your grievance will be handled in accordance with the grievance resolution procedures outlined in the Nairobi River Regeneration Grievance redress mechanism. You will be informed of the progress and outcome of your grievance within a reasonable timeframe. Thank you for bringing your concerns to our attention.

Annex 6: Grievance Monitoring and Tracking Log

Case no.	Date Claim Received	Name of Person Receiving Complaint	Where/how the complaint was received	Name & contact details of complainant (if known)	Type of Claim Add content of the claim (include all grievances, suggestions, inquiries) *Please note if the complaint was related to the project. If not, note it here and refer complainant to PMT for further processing	Was Receipt of Complaint Acknowledged to the Complainant? (Y/N – if yes, include date, method of communication & by whom)	Expected Decision Date	Outcome Decision (include names of participants and date of decision)	Was Decision communicated to complainant? Y/N If yes, state when, by whom and via what method of communication	Was the complainant satisfied with the decision? Y/N State the decision. If no, explain why and if known, will pursue appeals procedure.	Any follow up action (and by whom, by what date)?

Annex 7: Project Design (Model Layout)

Annex 8: Public Consultation Minutes