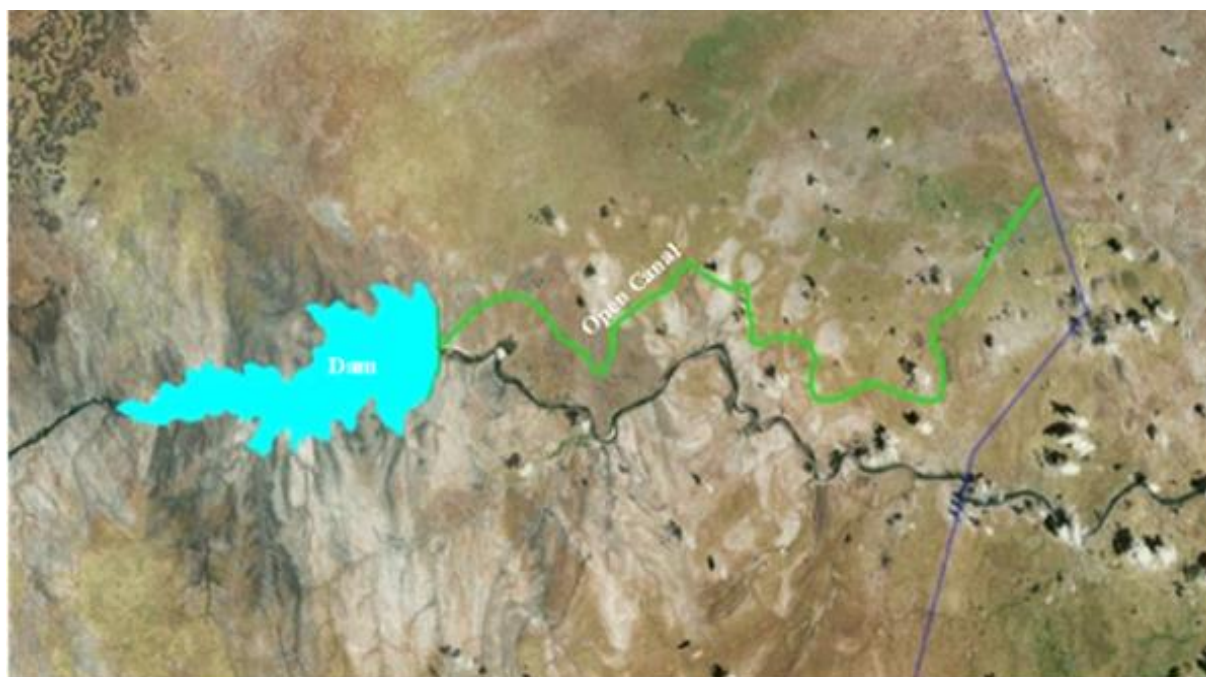




ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR ATHI DAM AND ASSOCIATED IRRIGATION WATER CONVEYANCE SYSTEM WITHIN TSAVO EAST NATIONAL PARK



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MARCH, 2026



DOCUMENT AUTHENTICATION

This Environmental and social Impact Assessment report has been prepared by Greenspace Planning and Environmental Consultants Limited (NEMA Reg. No. 6524) in accordance with the Environmental Management and Coordination Act CAP 387 and the Environmental (Impact Assessment and Audit) Regulations 2003 vide Legal notice 31 of 2019 which requires that every development project must have an EIA report prepared for submission to the National Environmental Management Authority (NEMA). We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

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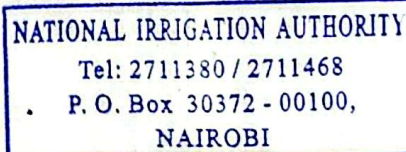
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**FACT SHEET**

Assignment name	Environmental and Social Impact Assessment (ESIA) for Athi Dam and Associated Irrigation Water Conveyance System
Proposed dam Project design details	Type of dam: Mixed dam type (concrete dam & Concrete faced rockfill dam) Storage capacity: 306.4 MCM Length: 13km Width: 6km Submerged area: 38km ² Design water level: 232.0m Check water level: 232.5m Normal water level: 232.0m Catchment: 33610 km ² Average annual flow: 76.2 m ³ /s Annual Sediment discharge: 2.334 million tons Design irrigation flow: 46 m ³ /s length of the concrete faced rockfill dam: 3308m Crest width: 10.0m Maximum dam height: 34.0m Length of concrete dam section: 164.0m Gate chamber section: 20.0m Intake section: 10.5m Flushing sluice section: 11.5m Main spillway: 122.0m
Project proponents and key stakeholders	National Irrigation Authority (NIA) with KWS being a key stakeholder and CCCC, the project contractor
Location	Tsavo East National Park along Galana River (LR No. 27743)
Project Budget	300 Million USD (38.841 Billion Kenya Shillings)
Consultant	Greenspace Planning & Environmental Consultants Limited NEMA REG. No.: 6524 P.O. Box 27674-00100, Nairobi



ABBREVIATIONS AND ACRONOMYNS

EIA	Environmental Impact Assessment
ADC	Agricultural Development Corporation
CCCC	China Communication Construction Company
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental & Social Management and Monitoring Plan
GDP	Gross Domestic Product
HWC	Human Wildlife Conflict
IEM	Integrated Ecosystem Management
KPLC	Kenya Power and Lighting Company
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
NEAP	National Environment Action Plan
NEC	National Environment Council
NEMA	National Environment Management Authority
NIA	National Irrigation Authority
NIB	National Irrigation Board
OHSO	Occupational Health and Safety Office
PAC	Problem Animal Control
PPE	Personal Protective Equipment
SHE	Safety, Health and Environment
SQM	Square Meters
SWM	Solid Waste Management
TCA	Tsavo Conservation Area
TENP	Tsavo East National Park
TOR	Terms of Reference
WRA	Water Resources Authority
WRA	Water Resource Authority
WRTI	Wildlife Research and Training Institute



EXECUTIVE SUMMARY

Introduction

Kenya as a country faces frequent severe perennial droughts which results to food insecurity. The country is classified as a water scarce country with the country's annual freshwater availability being 600 cubic meters per capita which places it in the bottom 8 percent of countries globally. In addition, over 80 percent of the country is comprised of arid or semi-arid lands which further escalates the food insecurity problem. In order to overcome the food shortages and insecurity, the Government of Kenya through National Irrigation Board is currently rehabilitating and extending large scale irrigation schemes, developing new schemes through optimum utilization of available resources and developing water storage facilities so as to harness excess rain water thereby reducing negative impacts related to floods. The aim of this is to develop arid and semi-arid areas for both crops and livestock, transform land use to ensure better utilization of high and medium potential lands and increase productivity through provision of widely accessible inputs and services to farmers and pastoralists.

The National Irrigation Authority is implementing a total of 119 developments projects. These projects are spread out in the 47 counties and are at various stages of implementation: feasibility studies, detailed designs preparation, tendering for construction and construction. It is expected that once the projects are completed a total of 342,412 acres will be brought under irrigation. Examples of the projects include but not limited to Bura and Hola Schemes in the Tana River County, Bunyala Scheme in Bungoma County, Ahero Scheme in Kisumu County, Katilu, Elelea, Lokbae, and Wei Wei Schemes in Turkana County and Mwea Scheme in Kirinyaga County among others.

Project Description

The proposed project is called Athi Dam and Associated Irrigation Water Conveyance System. Its main purpose is to store water from Galana River and provide water for irrigation for the Galana-Kulalu Food Security Project. The project has four main components; the dam/reservoir, open canal, workers' camp and support transport infrastructure.

The dam/reservoir is for water storage for irrigation (Galana-Kulalu Food Security Project) and it covers an area of approximately 38km². The length and width of the reservoir area are about 13km and 6km. It has a storage capacity of 306.4MCM.



The open canal will be a water supply canal for transporting water from the reservoir to the Galana Kulalu irrigation area. The canal will be designed along the terrain and has a total length of approximately 40 kilometers. The canal will have a total depth of 4.5 meters with the water level being at 3.6 meters. The total width of the canal at the top will be 13.7 meters with a base of 6 meters. It will have five wildlife overpasses and two drinking pools strategically located along wildlife corridors.

The workers' camp will be temporary with its ancillary facilities for purposes of supporting the development of the dam. It will be located 22 kilometers from Sala gate. The whole camp will cover a total area of 13.97Ha with dimensions of 605 meters by 231 meters. However, the built-up area will only be approximately 4Ha. The main components of the camp include project department office area, laboratory, KWS accommodation area, staff accommodation area, parts warehouse and machine warehouse, sand and gravel storage area, concrete mixing area.

The transport infrastructure will entail access roads and a bridge. As part of the project, there will be rerouting of a section of the C103 road (sections which will be flooded by the dam) which is approximately 13 kilometers in length. Additionally, to ensure accessibility to both the left and right banks of the dam during construction, it is planned to build an access bridge with a total length of 150 meters and temporary access roads. The bridge will be located along Galana River at Koito area and it will be a Steel Trestle Bridge.

Project Location

The dam project is located within the Tsavo East National Park. It is along the Galana River downstream of Luggard Falls. It is about 25km East of the Sala Gate at the eastern entrance of Tsavo East National Park. The geographical coordinates are; latitude of -3.021319°S and longitude of 39.021992°E. Has three access points to the project site: Manyani Gate, Voi Town Gate and Sala Gate.

Objective of the Project

It serves as the water source for the Galana-Kulalu Food Security Project aimed at:

1. Transforming Kenya from food importing country to food exporting country
2. Reduce the annual foreign exchange expenditure
3. Increase local employment



4. Expand national tax revenue
5. Promote economic development
6. Play a significant role in environmental protection
7. Boost the development of local tourism

Policy, Legal and Institutional Framework

The relevant policies, international treaties, laws, regulations and institutions that affect the implementation of the proposed Athi Dam and Associated Irrigation Water Conveyance System were reviewed and analyzed. The emphasis is on their relevance to the dam project and compliance/adherence of the project to the same. The policies, international treaties, laws, regulations analyzed are those that are mainly related to water resources, wildlife and environmental management. The institutional framework entails institutional structure of the water sector, wildlife resource, land resource and project institutional management structure.

Public consultation

Public consultation was undertaken with project affected persons and key stakeholders to obtain views and concerns so as to incorporate their contribution into the proposed project in order to safeguard the Tsavo Conservancy Area and the interests of key stakeholders and the local community. The exercise was aimed at disclosing details of the proposed project, provide an interaction platform with the project proponents, project contractor and the EIA Consultants, collection of additional baseline data/information, facilitate consideration of project alternatives, mitigation measures and trade-offs, ensure that important impacts are not overlooked and benefits are maximized and reduce conflict through early identification of contentious issues.

The stakeholders were categorized into two; Primary Stakeholders and secondary stakeholders. The primary stakeholders are the key decision makers and implementers mainly representing the government agencies and the contractors in the project and include NIA, KWS, WRTI, ADC, CCCC, KURA, Rural Electrification and Renewable Energy Corporation and county governments (Taita Taveta, Kilifi & Tana River). The secondary stakeholders are organizations directly or indirectly involved in wildlife and environmental conservation within the Tsavo Ecosystem and the communities living adjacent to the conservation areas. They were further categorized into two; Wildlife and Environmental Conservation Groups and Non-Governmental Organizations and Communities and community-based organizations. The Wildlife and Environmental Conservation



Groups and Non-Governmental Organizations category, supplement government work in wildlife conservation and environmental conservation and include; Tsavo Trust, Wildlife Works, Team Tsavo, World Wildlife Fund, African Wildlife Fund, Taita Taveta Wildlife Ranches and Save The Elephant. The Communities and community-based organizations category, are the communities living in Kilifi and Tana River Counties have a huge stake in the project because they derive their livelihoods from Galana River where the project is located.

The consultation methodology used entailed one-on-one consultation meetings with KWS, NIA and CCCC to discuss project details and share project documents, meetings and discussions with wildlife conservation stakeholders with the assistance of KWS and public consultation meetings/public barazas organized under the leadership of the Deputy County Commissioners (DCC) for Kilifi and Tana River counties in conjunction with KWS officers. There were three meetings and discussions with wildlife conservation stakeholders on 16th May 2024, 7th June 2024 and 17th February 2026 all conducted at Tsavo East Education centre. There were also three Public Consultation Meetings/Public Barazas; on 29th May, 2024 at Shakahola PEFA Church, 31st May, 2024 at Bombi PCEA Church and 18th February, 2026 at Bombi PCEA Church.

Summary of Key Issues of Concern Raised by the Conservation Stakeholders

Key Issues and Concerns Raised	Responses and Strategies to Addressed the Concerns
Location of the dam inside the park	Thorough assessments and analysis of various options for the location of the outside the park and inside the park
Public participation with affected counties	Public participation is an ongoing process through various forums and channels.
Safety hazard associated with open canal	Final detailed designs to consider the options given and the concerns raised during the public participation meetings.
Negative impacts on the flora and fauna	Plans to be included in the ecological monitoring plans and procedures.
Provision of water for wildlife	Provision of drinking points in design phase.
Risks of dam failure	Design and construction work to be in accordance to internationally acceptable standards
Long term impacts on	The dam targets to harvest over flow water without affecting



downstream communities	the normal flow of water downstream.
Increased traffic volume and conflicts on the access road	Preparation of transport management plan
Environmental degradation resulting from storage yards	Preparation of pollution prevention and waste management plans
Adequacy of animal overpasses	Mapping of animal movement routes and aligning the overpasses with the same
Control of water pollution coming from upstream	Measures the National Government is putting in place to address river pollution
Wildlife accidents	Fencing of water conveyance canal.

Summary of Key Issues of Concern Raised During Community Public Meetings

Key Issues and concerns raised	Responses and Strategies to Addressed the Concerns
Reduced water levels downstream	The dam targets to harvest over flow water especially during the rainy seasons.
Risks of dam failure	Design and construction work to be in accordance to internationally acceptable standards
Water supply of water to local communities	The proposal of providing domestic water to the local communities.
Corporate social responsibility projects	Identification of priority projects for consideration as part of corporate social responsibility.
Human wildlife conflicts due to construction machinery	- Continuous monitoring of animal movements during the project implementation by KWS - Preparation of operational plans and guidelines to ensure minimal disruptions of wildlife animals.
Employment of community members in the project	- Contractor to commit to use of local communities for both unskilled and skilled labour - The community leaders to oversee the process of recruitment of community members for employment



Climate Change and Disaster Risks Considerations

The proposed project site lies within climate-vulnerable the agro-ecological zone VI-VII characterized by recurrent droughts, high rainfall variability, and increasing temperatures. Thus, climate change and disaster consideration are crucial for the project.

Summary of climate adaptation and resilience benefits of the proposed Athi Dam

Impact category	Positive effect	Climate relevance
Wildlife	Reduced drought mortality	Adaptation
Ecosystem	Reduced pressure on natural water sources	Ecosystem resilience
Irrigation system	Reduced fossil fuel use	Mitigation
Agriculture	Drought-resilient food production	Adaptation
Communities	Improved food and livelihood security	Socio-economic resilience

Potential climate related negative impacts of the proposed project

- i. Construction-phase emissions are anticipated from Earthworks and excavation and heavy machinery fuel combustion
- ii. Reservoir related emissions (methane generation) are likely to result from decomposition of submerged vegetation and anaerobic breakdown of organic matter
- iii. Increased agricultural/ land-use intensification emissions downstream from N₂O emissions from fertilized soils and methane emissions from poorly drained irrigated fields
- iv. Altered down stream flow regime
- v. Reduced sediment transport
- vi. Evaporation losses from reservoir surface
- vii. Ecological and micro climate effects
- viii. Extreme rainfall and flood risk
- ix. Human-wildlife conflict dynamics

Methodology of Impact Identification and Assessment

The study is considering both qualitative and quantitative data analysis procedure. Leopold's matrix was applied during ranking and analysis of the impacts. The parameters considered during the analysis included; Biodiversity, large carnivores, elephants, riverine, scenic value, aquatic life,



grassland, soil and socio-economic and cultural impacts. These are the critical environmental and natural resources within the TCA. The Impacts were ranked based on their effect on the baseline of TCA. Information was derived from key resources such as Tsavo East National Park Management Plan 2021-2031, relevant studies on Tsavo Conservancy area, community and stakeholders' input, Key informants and experts' opinion. The impacts were rated and assigned specific colour codes based on their significance on key parameters under consideration.

Anticipated Environmental and Social Impacts of the dam project

Positive Impacts

a. Within the park

- i. Water supply to wildlife
- ii. Moderate the micro-climatic conditions
- iii. Flood control
- iv. Drought mitigation
- v. Habitat creation
- vi. Controlled water flow
- vii. Research opportunities
- viii. Educational resources
- ix. Improvement of transport infrastructure
- x. Job creation

b. Within Galana-Kulalu irrigation area

- i. Provision of water for irrigation
- ii. Provision of water for domestic uses
- iii. Improved livelihood
- iv. Boost investments
- v. Enhance development and growth of local markets

c. To the country in general

- i. Food security
- ii. Implementation of government's infrastructure plans
- iii. Source of revenue to the government
- iv. Increase the country's per capita annual freshwater availability

**d. To the communities downstream (Galana River)**

Flood control: The dam will help manage and control flooding, protecting the surrounding ecosystems and human communities. The reservoir regulates river flows by storing varying volumes of floodwaters and meticulously controlling the timing of water discharge.

Anticipated Negative Impacts**During Pre-Construction Phase**

The activities for this phase entail; Feasibility study, statutory approvals, site clearance, gathering of building materials and construction of temporary camp site. The anticipated negative impacts include:

- i. Disturbance to wildlife
- ii. Wildlife displacement
- iii. Water flow alteration
- iv. Habitat loss
- v. Land use change
- vi. Noise pollution
- vii. Air pollution
- viii. Increased traffic volume and conflicts on the access roads
- ix. Soil erosion
- x. Increased water demand

Construction Phase

- a. Loss of habitat
- b. Habitat fragmentation
- c. Loss of biodiversity
- d. Human-wildlife conflict
- e. Poaching
- f. Accidents on wildlife
- g. Disturbance to wildlife



- h. Water pollution
- i. Air pollution-dust, emissions from machinery and vehicles
- j. Noise pollution- from machinery and vehicles, construction workers
- k. Increased traffic volume and conflicts on the access roads
- l. Incidents, accidents and dangerous occurrences/ health and safety
- m. Solid waste pollution
- n. Liquid waste pollution
- o. Soil erosion
- p. Natural landscape alteration
- q. Increased demand for power supply

Operation phase

- a. Dam safety risks
- b. Change in river discharge
- c. Deterioration of water quality in the reservoir
- d. Human-wildlife conflict
- e. Land use conflicts
- f. Invasion of new species
- g. Siltation
- h. Natural landscape alteration
- i. Wildlife congregation/Influx of wildlife
- j. Water loss

Proposed Mitigation Measures

To minimize the occurrence and magnitude of the negative impacts, mitigation measures have been proposed against each of the anticipated impacts. Other measures have been integrated in the project designs with a view to ensuring compliance with applicable environmental laws and guidelines. The proposed mitigation measures include the following:

- i. Disturbance to wildlife: Provision of adequate wildlife overpasses and establishment of continuous ecological monitoring on vegetation composition and structure and wildlife distribution.



- ii. Wildlife displacement: Increase aerial and ground surveillance on wildlife and setting up a Problem Animal Control (PAC) camps along the park's boundary.
- iii. Land Use Change: Preparation of a restoration plan on the entire dam project area, demarcation and restriction of construction site and compensation of the land taken by the project through establishment and strengthening of community conservancies.
- iv. Water flow alteration: Provision of artificial water pools for utilization by hippos and crocodiles and restricting construction works to dry season when there is low water flow to ensure minimal river diversion.
- v. Loss of habitat: Prohibit unnecessary vegetation clearing, demarcation and restriction of construction site, vegetated buffer zones around the dam, establishment of continuous ecological monitoring on vegetation and wildlife and collaboration between KWS and other stakeholders on habitat rehabilitation plans/programs.
- vi. Habitat fragmentation: Provision of adequate wildlife overpasses prioritizing the migratory routes and wildlife corridors, phasing of construction works to minimize the fragmentation of habitat, backfilling of all open excavation areas and establishment of continuous ecological monitoring on vegetation and wildlife.
- vii. Loss of biodiversity: Establishment of continuous ecological monitoring on biodiversity, strengthening KWS and WRTI in Tsavo to conduct ecological monitoring, restoration programs of the degraded areas and updating the Tsavo East National Management Plan 2021-2031 to include the dam project.
- viii. Human-wildlife conflict: Fencing the construction site and workers' camp, training construction workers on health and safety and environmental awareness, implementation of a joint security plan aiming at protecting the workers, conducting continuous risk assessment reports, provision of adequate PPEs and compliance to Occupational Health and Safety measures Work Injury Benefit Act.
- ix. Increased water demand: Drilling a well near the river to provide water for the camp and building sedimentation tank and reservoir in the camp.
- x. Increased demand for power supply: Construction of a KPLC sub-station, use of ecofriendly generators and use of renewable sources of energy i.e. solar panels.



- xi. Poaching: Increased aerial and ground surveillance, inclusion of a KWS camp within the worker's camp, benefit sharing programs, education and awareness campaigns on conservation and strict enforcement of existing laws.
- xii. Accidents on wildlife: Sensitize drivers to observe park speed limits, adequate hoarding of the construction site, adequate signage on key wildlife corridors, observing Park working hours and proper record keeping of any wildlife accidents.
- xiii. Water pollution: Conducting regular water quality analysis, construction of check dams control siltation, inter-agency coordination between NIB, KWS, Water Resource Authority and NEMA for regulation of water resource and liaison with communities on the catchment areas upstream.
- xiv. Air pollution: Provision of adequate and appropriate PPEs, regular servicing and maintenance of construction equipment, regular air quality monitoring, dampening the working areas and access roads and covering of construction materials during transportation.
- xv. Risks of fire: Provision of firefighting equipment, fire detection and detection system and fully equipped first aid kits, regular trainings of the construction workers, developing a fire management and response plan, conducting regular fire drills, clear marking and demarcation of the fire assembly points and good maintenance of the access roads acting as fire breaks.
- xvi. Noise and vibrations: Regular servicing and maintenance of construction equipment, regular noise monitoring and restricting working hours to daytime only.
- xvii. Increased traffic volume and conflicts on the access roads: Using access roads that are less tourism traffic, observing the recommended park speed limits, enforcement of the speed limits and restricting delivery of materials to off peak game drive hours.
- xviii. Solid waste pollution: Ensure waste materials are disposed at the County and NEMA approved sites, use of the 3Rs – Reduce, Re-use, Re-cycle, appropriate disposal of solid waste, waste segregation at source and engaging licensed, competent and effective waste handlers.
- xix. Liquid waste pollution: Provision of temporary conservancy tank within the workers' camp, engaging NEMA and County licensed waste handlers, provision of a service bay for machinery and equipment, ensuring proper decommissioning of the conservancy tank after completion of the construction works and provision of mobile lavatories.



- xx. Soil erosion: Create and maintain soil traps and embankments, excavated soil to be used for back filling, confining vegetation removal to the surveyed dam extent only, sprinkling water on the construction sites and undertake soil stabilization and conservation measures.
- xxi. Natural landscape alteration: Habitat rehabilitation using the indigenous tree species, backfilling of excavations and continuous monitoring of the revegetation process.
- xxii. Dam safety risks: Provision of clear emergency preparedness strategies, regular maintenance and upgrade of the dam and the associated infrastructure, provision of safe water access points, enhance close surveillance of the dam, sensitizing the public and tourists on dam safety issues associated with the dam, provision of clear emergency preparedness strategies, integrating simulated flood release programme in the dam operations, undertaking a detailed assessment study for the proposed dam and establish quantifiable risks to social, economic and ecological features at dam site and downstream.
- xxiii. Water loss: Creation of a buffer zone around the dam and lining the canal with concrete on the floor and both banks reduce seepage losses.
- xxiv. Change in river discharge: Installation/reactivate river gauging stations around the dam and upstream to monitor effects of the dam to the river basin over time and controlled abstraction of water from the Galana River to the dam.
- xxv. Deterioration of water quality in the reservoir: Clearing and removal of all vegetation materials at the dam site, instituting a broad water quality monitoring system and maintaining appropriate records on water quality.

Environmental and Social Monitoring and Management Plan

A monitoring and management plan has been elaborated for purposes of addressing identified adverse/positive impacts. Under the EMP, various mitigation measures have been organized into well-formulated plan, which will serve as a guide for construction and operation phases of the proposed project.

Conclusion and Recommendations

The analysis of the ESIA study indicates that the proposed project has significant benefit to the TCA, Galana Kulalu Irrigation area and the country at large. The analysis reveals that the benefits far outweigh the associated costs and negative impacts. The benefits include help to achieve an annual



output of 2 million tons of staple food grains, reduce the annual foreign exchange expenditure, increase local employment, expand national tax revenue, promote economic development and boost the development of local tourism. Nevertheless, the project will come with some negative impacts such as effect on ecology (flora) and fauna, increased pressure on existing infrastructure and pollution (to air, water, soil).

In relation to the proposed mitigation measures that will be incorporated during implementation and operation phases; the project's input to the food security in the country and cognizance of the fact that the project proponents are environmentally conscious, the subject project is beneficial and important to the country. It is our recommendation that the proponents be granted EIA license to implement the project. Major concerns should nevertheless be geared towards minimizing the occurrence of impacts that would degrade the general environment. This will however be overcome through close following and implementation of the outlined Environmental Management and Monitoring Plans (EMPs); which have been strategically packaged with key environmental sustainability elements, tailored toward enhancing the adoption of Integrated Ecosystem Management (IEM). This will form the widely accepted keystone of the environmental action agenda.



TABLE OF CONTENTS

DOCUMENT AUTHENTICATION	ii
FACT SHEET	iii
ABBREVIATIONS AND ACRONYMS	iv
EXECUTIVE SUMMARY	v
LIST OF FIGURES.....	xxii
LIST OF TABLES	xxiii
ANNEXES	xxiii
CHAPTER ONE: INTRODUCTION	1
1.1 Project Background	1
1.2 Background Information for Tsavo East National Park.....	2
1.3 The Environmental and Social Impact Assessment Study	3
1.3.1 Significance and Objectives of the ESIA	3
1.3.2 Specific Terms of Reference of the ESIA Study	4
1.3.3 Scope of the ESIA Study	4
1.3.4 The Approach.....	5
1.3.5 ESIA Methodology.....	5
1.3.6 Literature Review.....	7
1.3.7 Field Assessment	7
1.3.8 Detailed ESIA Study Activities	8
1.3.9 Public Participation.....	9
1.3.10 Reporting.....	11
1.4 ESIA Team of Experts	11
CHAPTER TWO: PROJECT DESCRIPTION	12
2.1 Objective of the Project.....	12
2.2 Proposed Project Description.....	12
2.2.1 Dam/Reservoir.....	12
2.2.2 Open Canal.....	15
2.2.3 Workers' Camp.....	18
2.2.4 Transport Infrastructure	19
2.3 Project Location and Site Description.....	20
2.3.1 Justification for location of the dam project within the park.....	23
2.4 Project Proponents and Key Stakeholders	24
2.5 Project Justification	26
2.6 Dam Type and Site Selection of Project.....	27
2.7 Major Activities of the Proposed Project	29
2.7.1 General Project Activities	29
2.7.2 Main project construction (Dam Construction).....	29
2.8 Equipment to be used during Construction	32



2.9 Project Budget.....	32
CHAPTER THREE: ANALYSIS OF PROJECT ALTERNATIVES	33
3.1 Introduction	33
3.2 Alternatives on Location of the Dam Project.....	33
3.2.1 Alternative Dam Sites Outside the Park	33
3.2.2 Alternative Dam Sites Inside the Park.....	34
3.3 Alternatives on project design.....	35
3.3.1 Alternatives designs of the dam/reservoir	35
3.3.2 Alternative design of the canal	36
3.3.3 Alternatives for open canal type and route selection.....	37
3.4 The “No Project Alternative” Option.....	39
CHAPTER FOUR: BASELINE INFORMATION FOR THE STUDY AREA.....	40
4.1 The Tsavo Conservation Area	40
4.2. Climate	41
4.3 Water.....	41
4.4 Soils.....	42
4.5 Tsavo Ecosystem Human Population Outlook.....	43
4.6 Land Use.....	43
4.6.1 Wildlife conservation	43
4.6.2 Forestry	44
4.6.3 Tourism.....	44
4.6.4 Agriculture.....	46
4.6.5 Ranching.....	47
4.6.6 Mining	47
4.7 Ecological Characteristics	49
4.7.1 Flora.....	49
4.7.2 Fauna.....	54
4.7.3 Human –Wildlife conflict.....	61
4.7.4 Siltation in Water Bodies.....	61
4.7.5 Invasive Species	62
4.7.6 Drought.....	62
CHAPTER FIVE: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK.....	64
5.1 Introduction	64
5.2 Relevant Policies, Conventions and Treaties	64
5.2.1 Convention on International Trade in Endangered Species (CITES).....	64
5.2.2 Ramsar Convention	64
5.2.3 United Nations Framework Convention on Climate Change (UNFCCC)	65
5.2.4 Convention on Biological Diversity (CBD)	65
5.2.5 Convention on Migratory Species (CMS)	66
5.2.6 World Bank Environmental and Social Safeguards.....	66



5.2.7 Irrigation policy	67
5.2.8 National Environment Action Plan (NEAP)	67
5.2.9 National Policy on Water Resources Management and Development.....	68
5.2.10 Water Policy.....	68
5.2.11 Environmental Policy.....	69
5.2.12 The Land Policy.....	70
5.2.13 The Kenya Vision 2030.....	70
5.2.14 National Climate Change Response Strategy	71
5.2.15 Kenya National Adaptation Plan (NAP) 2015-2030	72
5.2.16 National Climate Change Action Plan (NCCAP 2023–2027).....	73
5.3 Legal Framework.....	75
5.3.1 The Constitution of Kenya, 2010	75
5.3.2 The Environmental Management and Co-ordination Act (EMCA), 1999.....	76
5.3.3 The Water Act of 2016	77
5.3.4 Energy Act No. 1 of 2019	77
5.3.5 Occupational Health and Safety Act No. 15 of 2007	78
5.3.6 The Public Health Act, Chapter 242.....	78
5.3.7 The Physical and Land Use Planning Act (PLUPA)	78
5.3.8 Wildlife Conservation and Management Act, 2013	78
5.3.9 Health Act, 2017.....	79
5.3.10 The Forest Conservation and Management Act (FCMA) of 2016.....	79
5.3.11 The Agriculture and Food Authority (AFA) Act No. 13 of 2013.....	79
5.3.12 Kenya Roads Act, No 2 of 2007.....	80
5.3.13 Climate Act, 2016.....	80
5.3.14 Employment Act, 2007	80
5.3.15 National Construction Act (NCA)	80
5.3.16 Work Injury Benefits Act, 2007.....	80
5.3.17 Lands Act, No. 6 of 2012.....	81
5.3.18 Land Registration Act, 2012.....	82
5.3.19 County Government Act, 2012	82
5.3.20 Community Land Act, 2016	83
5.3.21 National Land Commission Act, 2012.....	83
5.3.22 Irrigation Act, No. 14 of 2019.....	84
5.4 Institutional Framework	85
5.4.1 Institutional Structure of the Water Sector	85
5.4.2 Institutional Structure of the Wildlife Resource.....	86
5.4.3 Institutional Structure of Land Resources	87
5.4.4 Project Institutional Management Structure	88
CHAPTER SIX: PUBLIC CONSULTATION AND PARTICIPATION.....	90
6.1 Introduction	90



6.2 Role of public consultation and participation in ESIA process.....	90
6.3 Stakeholders Analysis	91
6.3.1 Primary Stakeholders	91
6.3.2 Secondary Stakeholders.....	93
6.4 Consultation Methodology	93
6.5 Consultations with Key Stakeholders	94
6.5.1 Consultation with Kenya Wildlife Service	94
6.5.2 Consultation with the NIA and CCCC.....	95
6.5.3 Meetings and Discussions with Wildlife Conservation Stakeholders	96
6.5.4 Public Consultation Meetings/Public Barazas	99
6.5 Grievance Redress Mechanism	102
CHAPTER SEVEN: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS	
IDENTIFICATION/ASSESSMENT AND ANALYSIS.....	103
7.1 Existing key Environmental and Social Impacts.....	103
7.1.1 Existing Positive Impacts.....	103
7.1.2 Existing Negative Impacts	105
7.2 Anticipated Environmental and Social Impacts occasioned by the Dam Project	108
7.2.1 Anticipated Positive Impacts.....	108
7.2.2 Anticipated Negative Impacts	111
7.3 Climate Change and Disaster Risks Considerations.....	116
7.3.1 Introduction	116
7.3.2 Potential climate related positive impacts	117
7.3.3 Potential climate related negative impacts of the proposed project.....	119
7.4 Methodology for Impacts' Analysis.....	120
CHAPTER EIGHT: PROPOSED MITIGATION MEASURES.....	125
8.1 Introduction	125
CHAPTER NINE: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)	131
9.1 Introduction	131
9.2 Environmental Monitoring and Evaluation.....	131
CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS	146
10.1 Conclusion	146
10.2 Recommendation.....	146
REFERENCES.....	149



LIST OF FIGURES

Figure 1-1: Schematic Presentation of the ESIA Process in Kenya.....	6
Figure 2-1: Upstream view of concrete section	14
Figure 2-2: Typical section of Concrete faced rockfill dam	14
Figure 2-3: Layout of Open Canal	15
Figure 2-4: Layout of Culverts/Overpasses and Drinking Pools	16
Figure 2-5: Overpass for Wildlife	16
Figure 2-6: Drinking Pool	17
Figure 2-7: General Layout of the Dam and Canal.....	17
Figure 2-8: Depiction of the Dam and Canal.....	18
Figure 2-9: Workers' Camp Layout.....	19
Figure 2-10: Access Roads Layout.....	20
Figure 2-11: Location of the Project Site.....	22
Figure 2-12: The Dam Project Site along Galana River	24
Figure 2-13: Distribution of the Dam Site Options.....	28
Figure 3-1: Distribution of the dam options	35
Figure 4-1: Tsavo Ecosystem Map	41
Figure 4-2: Galana River	42
Figure 4-3: Wildlife within TCA	44
Figure 4-4: Tsavo East National Park Visitor Use Zones	45
Figure 4-5: Tsavo East National Park.....	46
Figure 4-6: Roads within the wilderness zone of TENP.....	46
Figure 4-7: Landcover Map of the Tsavo Conservation Area	48
Figure 4-8: Herbaceous Flora Families at the Proposed Project Site.....	53
Figure 4-9: Shrubs within TENP	54
Figure 4-10: Shrubs found in the project area; Cordia senesis (left) and Grewia bicolor (right).....	54
Figure 4-11: Savanna Elephant.....	58
Figure 4-12: Elephant Distribution within TENP	59
Figure 4-13: Distribution of Wildlife in the project site.....	61
Figure 4-14: Existing Water Pans in Tsavo National Park.....	63
Figure 6-1: First consultative meeting with Key stakeholders.....	96
Figure 6-2: Second Key Stakeholders' Meeting	97
Figure 6-3: Third Key Stakeholders' Meeting.....	97
Figure 6-4: Community Meeting at Shakahola Market Centre	100
Figure 6-5: First Community Meeting at Bombi Market Centre	100
Figure 6-6: Second Community Meeting at Bombi Market Centre.....	101



LIST OF TABLES

Table 1-1: ESIA Team Members	11
Table 2-1: Project's Key Stakeholders	25
Table 4-1: Trees Species Recorded in the Project Area.....	49
Table 4-2: Shrub Species Recorded in the Project Area.....	51
Table 4-3: Grass Species Recorded in the Project Area	53
Table 4-4: Mammals in Recorded in the Proposed Project Area in Tsavo East National Park	55
Table 6-1: Summary of Key Issues of Concern Raised by the Conservation Stakeholders.....	98
Table 7-1: Summary of climate adaptation and resilience benefits of the proposed Athi Dam	118
Table 7-2: Impact Significance Analysis Rating	121
Table 7-3: Definitions of the Impact Significance Analysis Rating	122
Table 7-4: Impact Analysis Matrix	123
Table 8-1: Proposed Mitigation Measures	126
Table 9-1: Environmental and Social Management and Monitoring Plan (ESMMP)	132

ANNEXES

Annex 1:	Design Layouts/Drawings
Annex 2:	Invitation Letters
Annex 3:	Minutes and attendance list of the first key stakeholders meeting
Annex 4:	Minutes and attendance list of the second key stakeholders meeting
Annex 5:	Minutes and attendance list of the third key stakeholders meeting
Annex 6:	Minutes and attendance list of the community meeting at Shakahola Market Centre
Annex 7:	Minutes and attendance list of the first community meeting at Bombi Market Centre
Annex 8:	Minutes and attendance list of the second community meeting at Bombi Market Centre
Annex 9:	Questionnaires filled during the key stakeholders' meetings
Annex 10:	Questionnaires filled during the community meetings
Annex 11:	Framework agreement between KWS & NIA in relation to the environmental responsibility
Annex 12:	KWS Consent
Annex 13:	NIA Documents
Annex 14:	Practicing License of the Lead Expert



CHAPTER ONE: INTRODUCTION

1.1 Project Background

Kenya has experienced severe perennial droughts and long periods of food shortages and starvation and occasionally with thousands of people needing emergency food aid. Policy makers and development experts believe that irrigation is the panacea to frequent drought related crop failure and to meet the demand for cheap and stable food supply. Policy makers adopt irrigated agriculture for food security, since irrigation doubles crop production. According to AIAP (2020), Kenya has not fully developed her irrigation potential estimated at 1.342 million hectares. The country has only developed approximately 180,503 ha of irrigation which is about 13.5% of the potential. The land under irrigation accounts for 1.7 percent of total land area under agriculture, and contributes about 3% to the gross domestic product (GDP). It is from this premise that the Galana-Kulalu Irrigation Project was mooted. Galana Kulalu project is one of the initiatives identified in the Kenya Vision 2030 that has potential to contribute to the achievement of food security under the “Big 4” initiatives in Kenya.

The Galana-Kulalu irrigation project and food security scheme was unveiled in 2014 as a one-million-acre model farm. The irrigated farm and accompanying projects were to provide food security for Kenya and lead to marked increases in agricultural exports. The project is meant to harness water from Galana River for utilization in Galana Kulalu irrigation project. In addition, it will avail water for wildlife within the park and the site can be used for ecotourism.

Many assessments have been done on Galana-Kulalu irrigation project and various challenges facing the project have been documented. One of the challenges that is now clearer and may not have been detected during the pre-feasibility studies is the availability of water, or lack thereof, in this semi-arid region. The project mainly relies on pumping water and it has been estimated that annual pumping requirement is 492 million kW, with pump capacity ranging from 6,700kW to 13,000kW, resulting in a pumping cost of KES 6.2 billion, per year. However, experts have argued that it is possible to divert enormous amount of water from Galana River to the irrigated farmlands using canals and this would save the cost of pumping water. This has led to the design of the current Galana-Kulalu Food Security Project will focus on providing water for irrigation by building a new reservoir for water storage and an open canal to convey water to the farming areas. A dam will be constructed on



Galana River resulting to a reservoir for water storage and the water supply canal will be constructed for conveying water to the farming areas of Galana Kulalu Irrigation Project. The proposed Athi Dam will be located on UTM 502443, 9666050.

1.2 Background Information for Tsavo East National Park

The Tsavo National Park consisting of Tsavo East and Tsavo West National Park were established in 1948. The Tsavo East National Park (TENP) covers an area of about 11,747 km² while Tsavo West National Park (TWNP) covers an area of about 9,065 km². These two parks together form the largest protected area in Kenya accounting for about 50% of the total protected areas in Kenya. The park has beautiful sceneries that include the magnificent Mudanda rock outcrop that spans about 1.5km, the Yatta Plateau spanning over 300km originating from Ol Donyo Sabuk and ending in the TENP, the Lugard falls on the Galana River, and the Aruba Dam to mention just a few. The Park is crossed by two perennial rivers the Athi and Tsavo River which merge downstream within the park to form the Galana River. The park has three main seasonal rivers: the Voi, Mbololo, and Tiva. The park hosts all the big five: elephant (*Loxodonta africana*), rhino (*Diceros bicornis*), buffalo (*Syncerus caffer*), leopard (*Panthera pardus*) and lion (*Panthera leo*). In addition to the big five, the park is rich in other species that include giraffe (*Giraffa camelopardalis*), zebra (*Equus burchelli*), oryx (*Oryx beisa callotis*), waterbuck (*Kobus ellipsiprymnus*), gerenuk (*Litocranius walleri*), dikdik (*Madoqua kirkii*), impala (*Aepyceros melampus*), Thomson gazelle (*Eudorcas thomsonii*), and kudu (*Tragelaphus imberbis*) among others. In addition, the park has a prolific birdlife with over 500 species recorded. The Ostrich (*Struthio camelus*) which is the largest ground bird is found in large numbers in this park.

TENP is also rich in plant diversity, with several vegetation communities represented. The park's diverse vegetation communities are integral to its ecological health and biodiversity. From open grasslands and savanna woodlands to riverine forests and resilient scrublands, each community plays a vital role in supporting the park's rich wildlife and maintaining ecological balance. Effective conservation and management of these vegetation communities are essential for sustaining the park's natural heritage and the various species that depend on it. The dominant vegetation in the park consists of Acacia-Commiphora



1.3 The Environmental and Social Impact Assessment Study

Environmental and social Impact Assessment (ESIA) study was conducted to systematically examine the proposed Athi Dam construction, operation, and decommissioning activities in order to identify potential adverse impacts on the environment as stipulated in Section 58 of the Environmental Management and Coordination Act (EMCA), 1999 and Regulations 11 to 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003.

Pursuant to the prevailing legal requirements as envisaged in the EMCA 1999 and to ensure sustainable environmental management, the project proponents contracted the services of Greenspace Planning and Environmental Consultants Ltd a NEMA registered firm to carry out an Environmental and Social Impact Assessment study for the proposed Athi Dam and Associated Irrigation Water Conveyance System.

1.3.1 Significance and Objectives of the ESIA

The significance of ESIA lies in its comprehensive approach to evaluating and managing the environmental and social impacts of development projects. By integrating environmental protection, social responsibility, regulatory compliance, risk management, and stakeholder engagement, ESIA plays a vital role in promoting sustainable and responsible development. It ensures that projects contribute positively to the environment and society, while also mitigating potential negative impacts, thus balancing development needs with environmental stewardship and social equity.

The Environmental Management and Coordination Act (EMCA), Cap 387 provides for the screening of policies, programmes and projects which are likely to have significant impacts through (Environmental Impact Assessment) EIA. The Act also recommends development of sector guidelines for management of anticipated environmental impacts from the sector activities. The purpose of the EIA study is to ensure that the project option under consideration is environmentally sound and sustainable, and that environmental consequences are recognized early in the project and considered in the project design, implementation and operation. This study has been conducted as required under Section 58 of EMCA and section 7 of Environmental (Impact Assessment and Audit) (Amended) Regulations 2019.



1.3.2 Specific Terms of Reference of the ESIA Study

The specific TORs for the Athi Dam ESIA study are:

- i. To provide baseline information in relation to the proposed project.
- ii. To review and assess the proposed project activities.
- iii. To review the statutory and legislative conditions for the implementation of the project.
- iv. To identify potential environmental and social impacts of the proposed project.
- v. To obtain views of interested or affected stakeholders on the proposed project.
- vi. To assess the significance of anticipated project impacts.
- vii. To identify project alternatives in terms of design, technology, and location.
- viii. To propose appropriate cost-effective mitigation measures to minimize possible negative impacts.

1.3.3 Scope of the ESIA Study

The study was conducted to evaluate the potential and foreseeable impacts of the proposed dam project covering the four main components; the dam/reservoir, open canal, workers' camp and support transport infrastructure. The physical scope entails the proposed dam project site in the context of the Tsavo East National Park and the Galana Kulalu irrigation area as well as the areas that may be affected by or may affect the proposed project and especially the communities living downstream of the Galana River. Any potential impacts (localized or delocalized), are also evaluated as guided by EMCA 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003. This study report includes an assessment of impacts of the proposed dam project with reference to the following;

- i. Description of the proposed project
- ii. Baseline information (Biophysical and Socio-Economic environment, land use etc.).
- iii. Assessment of the potential environmental and social impacts of the proposed dam project.
- iv. A review of the policy, legal and administrative framework.
- v. Development of the mitigation measures and future monitoring plans.
- vi. Proposition of alternatives.
- vii. Occupational Health and Safety -OHS



1.3.4 The Approach

The ultimate goal of this approach was to identify impacts resulting from the proposed Athi Dam and Associated Irrigation Water Conveyance System to be determined on the basis of the baseline conditions established during the field work and information obtained from literature review. Analysis of the impacts was done using Leopold's matrix. The parameters considered during the analysis included; Biodiversity, large carnivores, elephants, riverine, scenic value, aquatic life, grassland, soil and socio-economic & cultural. These are the critical environmental and natural resources within the Tsavo Conservancy Area (TCA).

The Impacts were ranked based on their effect on the baseline of TCA. Information was derived from key resources such as Tsavo East National Park Management Plan 2021-2031, relevant studies on Tsavo Conservancy area, community and stakeholders' input, Key informants and experts' opinion.

The impacts were rated and assigned specific colour codes based on their significance on key parameters under consideration.

1.3.5 ESIA Methodology

Following a preliminary visit of the proposed site, the following was undertaken:

- i. Screening of the project, a process that identified the project as being high risk as per Legal Notice 31 of 2019.
- ii. A scoping exercise that identified the key issues to be addressed.
- iii. Documentary review on the nature of the proposed project, policy and legal framework, environmental setting of the project area and other available relevant data/information.
- iv. Public participation and consultation entailing consultative meetings with the project proponent, the contractor, affected communities and key stakeholders at various levels in order to determine the potentially significant issues of the proposed project.
- v. Physical investigation of the project site and the surrounding areas using a pre-prepared checklist identifying possible environmental and human safety issues that are likely to be affected.
- vi. Reviewing the proposed project designs and implementation plan/schedules with a view to suggesting suitable alternatives.



- vii. Developing an environmental management plan outline with responsibilities, schedules, monitorable indicators and time frames among other aspects
- viii. A comprehensive report including issues as listed in the Environmental (Impact Assessment) Regulations 2003.

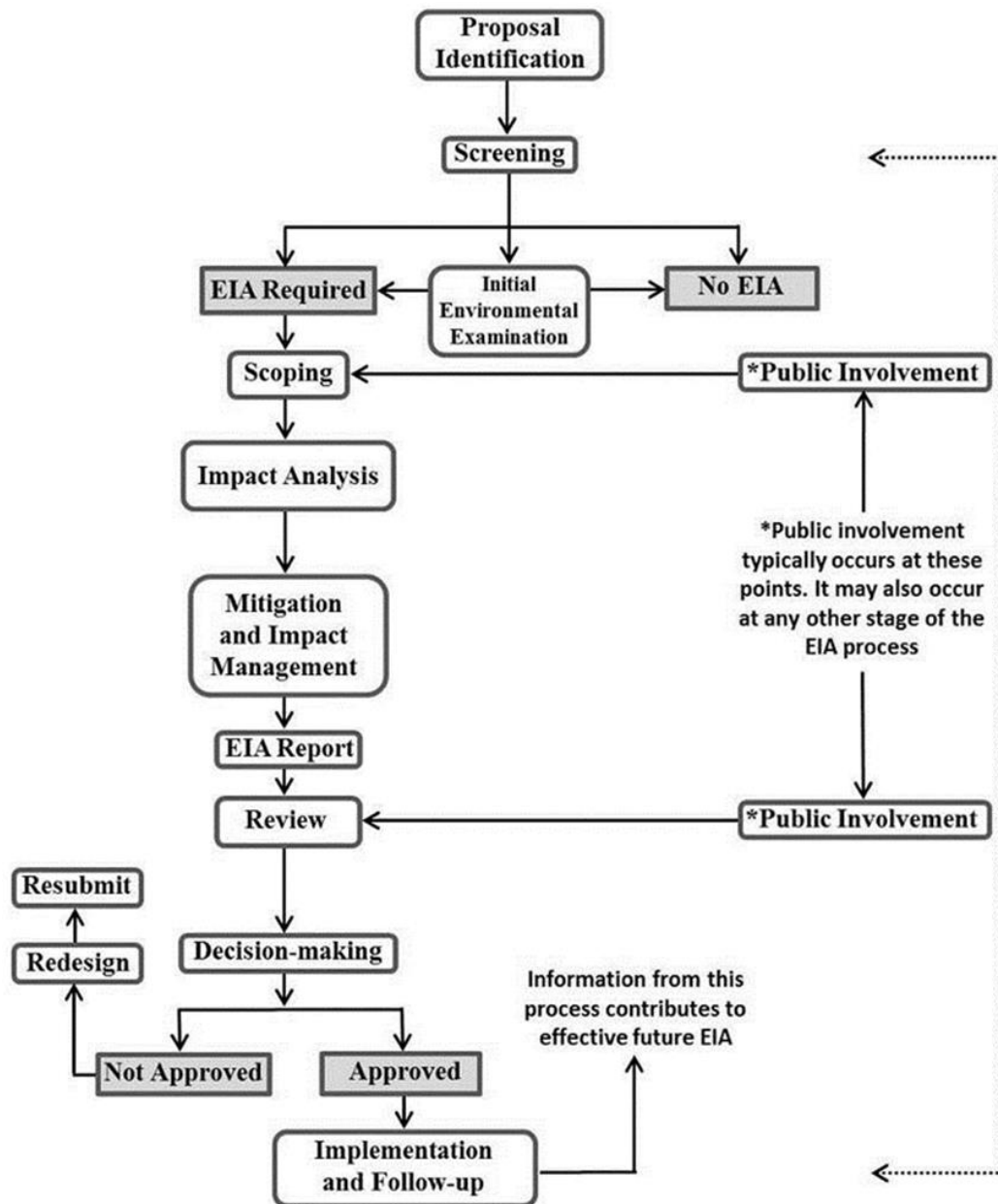


Figure 1-1: Schematic Presentation of the ESIA Process in Kenya



1.3.6 Literature Review

Various relevant documents were reviewed for a clear understanding of the terms of reference, environmental status of the project area (Tsavo East National Park), the target Galana river systems, Galana Kulalu ranches, data on demographic trends (for the communities lining downstream of Galana river such as Shakahola, Chakama and Bombi), land use practices in the affected areas (either as catchments, dam location or the beneficiary areas), development strategies and plans (local and national) as well as the policy, legal and institutional documents.

Some of the documents reviewed include:

- i. Detailed Design Report and associated documents developed for the proposed Athi Dam and Associated Irrigation Water Conveyance System
- ii. The feasibility Study Report;
- iii. Tsavo East National Park Management Plan 2021-2031
- iv. Relevant studies on Tsavo Conservancy area
- v. Relevant Legal, Policy and Regulatory documents;

1.3.7 Field Assessment

Field assessment was designed to address the physical and biological environment of the project impact area (i.e. sections to be covered by the 38km² reservoir, 40km open canal, Temporary Workers' Camp, Transport Infrastructure and related amenities and utilities as well as the project affected persons (PAPs) downstream of Galana Kulalu ranches in Kilifi County). Determination of the affected environmental and social features would not only be felt within the dam area but in the defined project impact area.

The fieldwork was, therefore, focused on establishing the anticipated positive and negative impacts in terms of physical (Natural Landscape alteration) and biological environment (habitat, biodiversity, climatic patterns, water and soil resources), social and economic trends, (Human wildlife conflict, risks of dam safety, population trends, settlement trends, economic patterns, cultural setting and linkages, etc.).

Specific objectives of the field assessment included:

- i. Obtaining available information and data from the Project proponent and stakeholders (NIA & KWS, and the project contractor CCCC)



- ii. Obtaining additional information on the study area from the key stakeholders i.e. Tsavo Trust, Wildlife Works, Team Tsavo, ADC, Voi Safari lodges, Sentrin Lodge, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Ranches, Save The Elephant, Wildlife Research & Training Institute.
- iii. Evaluating the environmental setting around the proposed site. General observations were focused on the topography, land use, surface water sources, public amenities, land cover, climate, settlements, forests, soils, etc.
- iv. Evaluate social, economic and cultural settings of the communities downstream
- v. Undertake comprehensive consultative public participation exercises with the project affected persons and stakeholders.

1.3.8 Detailed ESIA Study Activities

This assignment involved a series of activities carried out in liaison with the project proponents, project contractor, the key stakeholders, relevant government departments, local authorities, community groups and other organizations in the study area with a view of sharing information and documentations relevant to the proposed project. Effective evaluation of the social baseline status was achieved through consultative meetings and discussions and physical inspection of the entire project area.

The baseline conditions tied with the stakeholders input provided the starting point for the impact's predictions and benchmark for the mitigation measures. Details of the activities are listed under the terms of reference, and the outputs for each activity are outlined in the sub-sections below;

- i. Review of the proposed Athi Dam and Associated Irrigation Water Conveyance System to understand the project components and their specifications.
- ii. Establishment of the current baseline conditions to provide a documented foundation for the impact predictions and a benchmark for the development of adequate mitigation measures
- iii. Update of the legal, legislative and regulatory requirements as a basis for drawing a compliance monitoring protocol for the project cycle (preconstruction, construction, operation and monitoring and decommissioning phases)
- iv. Environmental and social impacts assessments for the identification of significant impacts to the protected area, and the communities living downstream, including cumulative and



induced impacts. Types and levels of impacts as well as criteria for developing suitable mitigation measures and an environmental management plan.

- v. Environmental and social management plan (ESMP) on mitigation measures, responsibilities, timeframes, environmental costs and a comprehensive environmental management plan.

1.3.9 Public Participation

Interaction with the project proponents and the contractor, key stakeholders and communities living downstream the project area was a continuous process at scoping and findings of detailed ESIA study was also presented to stakeholders for their feedback and validation. The role of public participation exercises during the ESIA process was to;

- i. Comply with Legal and Regulatory Framework
- ii. Enhance transparency and accountability
- iii. Identifying local concerns and knowledge
- iv. Improving the Quality and Effectiveness of the ESIA
- v. Building public support and reducing conflict

Various mechanisms such as Public Meetings, Public notices and announcements, Workshops and Focus Groups, questionnaires and written submissions were considered. Additionally, several meetings with different target groups were conducted on specified dates as follows:

a) Consultations with Key Stakeholders

i. Consultation with Kenya Wildlife Service

Initial consultations we conducted with Kenya Wild Service through meetings held with the Director General, Senior Assistant Director in charge of TCA and Assistant Director in charge of Tsavo East. The consultations made reference to Tsavo East Management Plan and how the proposed project fits in its implementation.

ii. Consultation with the NIA and CCCC

The team conducting the ESIA held series of consultative meetings with the NIA and China Communication Construction Company. The meetings resulted to sharing of information and materials of the proposed project including Project Technical Report, project components designs and drawing. The study process was discussed including the work plan, study process and protocols and eventually the work contract was signed.

**b) Meetings and Discussions with Wildlife Conservation Stakeholders****i. First consultative meeting with Conservation Stakeholders**

The meeting took place at Tsavo East Education centre on 16th May 2024 from 9.25am to 12.10pm. In attendance were 23 representatives from; KWS, NIA, Tsavo Trust, Wildlife Works, Team Tsavo, ADC, Voi Safari lodges, Sentrin Lodge, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Ranches, Save The Elephant, Wildlife Research & Training Institute and The ESIA consultants.

ii. Second Key Stakeholders' Meeting

The meeting took place at Tsavo East Education centre on 7th June 2024 from 9.45am to 12.32pm. In attendance were 22 representatives from; KWS, NIA, Tsavo Trust, Wildlife Works, Team Tsavo, ADC, Voi Safari lodges, Sentrin Lodge, Ashnil Aruba Lodge, African Wildlife Fund, Taita Taveta Wildlife Ranches, Save The Elephant, Wildlife Research and Training Institute and The ESIA consultants. The objective of the meeting was to deliberate the study findings and obtain additional information from the key stakeholders.

iii. Third Consultative Meeting with Conservation Stakeholders

The meeting took place at Tsavo East Education centre on 17th February 2026. In attendance were 28 representatives from; NIA, KWS, Tsavo Trust, Wildlife Works, Team Tsavo, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Conservancies Association, Wildlife Research and Training Institute, African Environmental Film Foundation, China Communications Construction Company, Sheldrick Wildlife Trust and The ESIA consultants.

c) Public Consultation Meetings/public barazas**i. Community Meeting at Shakahola Market Centre**

The meeting took place on 29th May, 2024 at Shakahola PEFA Church from 10.30am to 12.45pm. A total of 115 members were present including KWS, the area chief, assistant chief, the deputy county commissioner and the ESIA consultants.

ii. First Community Meeting at Bombi Market Centre

The meeting took place on 31st May, 2024 at Bombi PCEA Church from 11.00am to 1.00pm. A total of 44 members were present including KWS, the area chief, assistant chief, the deputy county commissioner and the ESIA consultants.



iii. Second Community Meeting at Bombi Market Centre

The meeting took place on 18th February, 2026 at Bombi PCEA Church from 10.30am to 2.30pm. A total of 69 members were present including KWS, NIA, China Communications Construction Company, Leaders of Orma community, village elders, area MP's representative, National Government Administration Officers, GBV officer and the ESIA consultants

1.3.10 Reporting

The reports (inception, draft final and final draft and final) were done within pre-agreed time frames such as to cover the requirements of the National Environmental Management Authority (NEMA) guidelines. The report schedule comprised a scoping report, draft final ESIA study report and final ESIA study report. The scoping report and the final study report will be submitted to NEMA for decision making. Besides continuous briefings to the Client and local NEMA office also undertaken.

1.4 ESIA Team of Experts

Names of persons involved in undertaking the Environmental and Social Impact Assessment for the Athi Dam and Associated Irrigation Water Conveyance System are given below.

Table 1-1: ESIA Team Members

NO.	NAME
1.	Eston N. Murithi (Team Leader)
2.	Cyrus M. Ogutu (Lead Expert/Physical Planner)
3.	Emmanuel Wathome (Physical Planner)
4.	Elizabeth W. Mutua (Lead Expert)
5.	Dr. Reuben Wambua (Sociologist)
6.	Nzisa Munyao (Wildlife Ecologist)
7.	Humphrey Kinyua (Hydrologist)
8.	Lydia Nancy Kihu (Health and Safety Expert)



CHAPTER TWO: PROJECT DESCRIPTION

2.1 Objective of the Project

The proposed project has the overall objective of developing a new reservoir for the water storage and an open canal for transporting the water. It serves as the water source for the Galana irrigation area by storing water of Galana river and then transporting water to the Galana-Kulalu Food Security Project. This is aimed at transforming Kenya from food importing country to food exporting country by helping to achieve an annual output of 2 million tons of staple food grains and other cash crops in the irrigation area so as to achieve two-thirds of the country's staple food grains localization. This will play a significant role in reducing the annual foreign exchange expenditure. In addition, the project will increase local employment, expand national tax revenue, promote economic development, play a significant role in environmental protection, improve the regional ecology and boost the development of local tourism.

2.2 Proposed Project Description

The proposed project is called Athi Dam and Associated Irrigation Water Conveyance System. Its main purpose is to store (from Galana River) and provide water for irrigation for the Galana-Kulalu Food Security Project. The project has four main components; the dam/reservoir, open canal, workers' camp and support transport infrastructure.

2.2.1 Dam/Reservoir

The dam/reservoir is for water storage for irrigation (Galana-Kulalu Food Security Project) and it covers an area of approximately 38km². The length and width of the reservoir area are about 13km and 6km. It has a storage capacity of 306.4MCM. The normal water level of the project is 232.0m and the check water level is 232.5m. The catchment area for the dam is 33610 km² with an average annual flow will be 76.2 m³/s and annual sediment discharge of 2.334 million tons. The design irrigation flow is 46 m³/s

The type of the dam is a mixed dam type whereby the riverbed adopts a concrete dam as structure for overflow, water intaking and sediment discharge and both banks of the concrete dam adopt local material dam.



The dam will have two main sections; concrete face rockfill dam section and concrete dam section. The concrete dam section which is to be located on the left bank of the original riverbed, comprises of the gate chamber of stoplog, intake section, flushing sluice section and main spillway (overflow section). The total length is approximately 164m. The concrete face rockfill dam section which acts as the banks of the dam will be approximately 3,308m in length of which the left bank will be approximately 1,300m while the right bank will be approximately 2008m. The maximum dam height will be 34.0m with a crest width of 10.0m. The gate chamber section will be 20.0m, intake section: 10.5m, flushing sluice section: 11.5m and main spillway: 122.0m.

The dam construction process will entail excavation of the dam shoulder, treatment of the dam foundation, filling of the dam body, upstream and downstream slope protection, dam crest road, and wave wall.

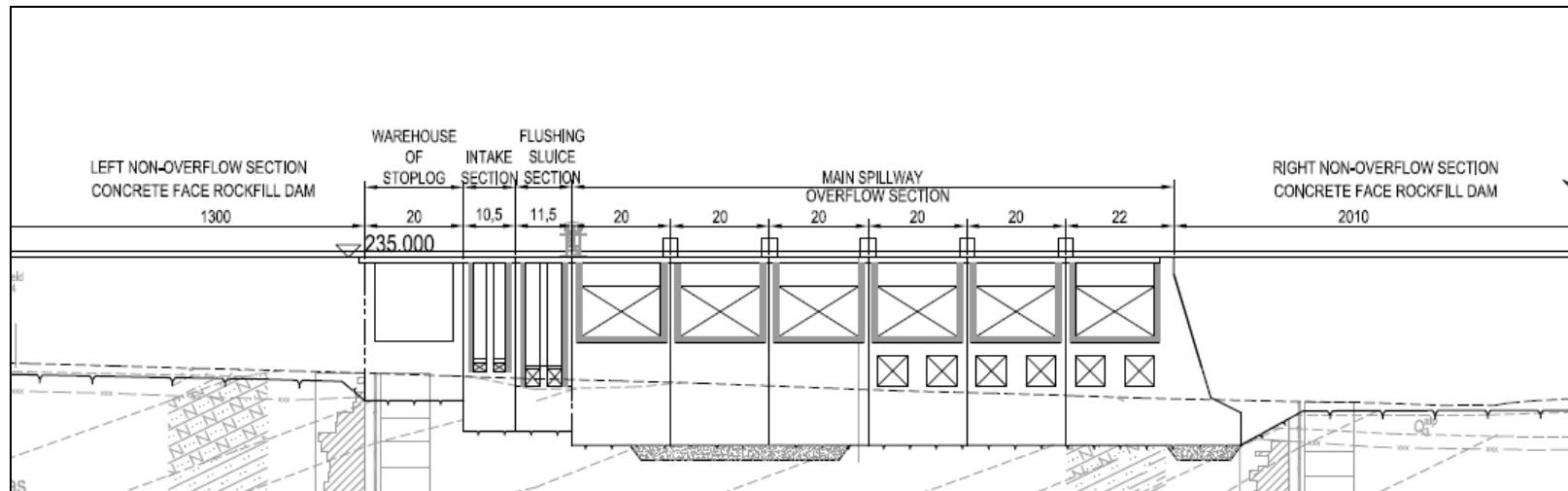


Figure 2-1: Upstream view of concrete section

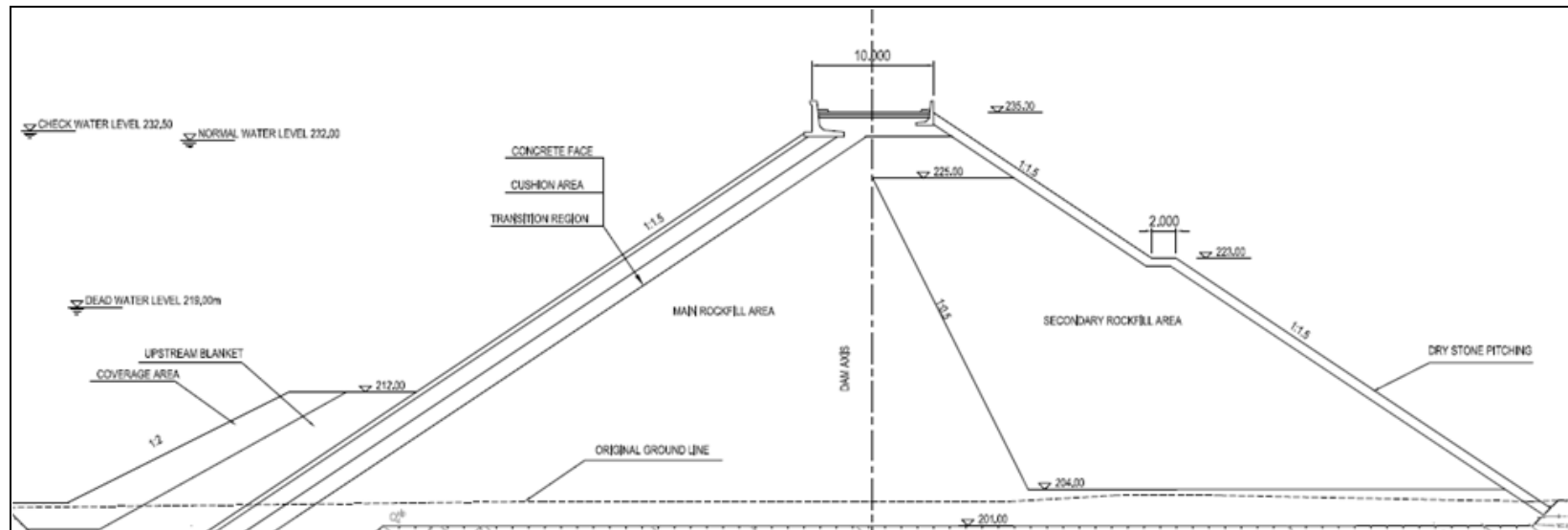


Figure 2-2: Typical section of Concrete faced rockfill dam



2.2.2 Open Canal

The open canal will be a water supply canal for transporting water from the reservoir to the Galana Kulalu irrigation area. The canal will be designed along the terrain and has a total length of approximately 40 kilometers. The irrigation design flow of the canal is 46 m³/s and the increased flow is 53 m³/s. The canal will have a total depth of 4.5 meters with the water level being at 3.6 meters. The total width of the canal at the top will be 13.7 meters with a base of 6 meters. Both banks of the canal will have 1.05 meters buffers accommodating quarry stone aggregate and a fence to restrict movement and access. The use of quarry stone aggregate or quarry chips as buffer along the canal in place of grass is to discourage wildlife from breaching the fence in search of foliage. The fence will be powered by solar energy. The canal will have a cement lining on the floor and both banks improve the channel's hydraulic efficiency, reduce seepage losses, minimize roughness, increase flow velocity, enhance water-carrying capacity and prevent erosion.

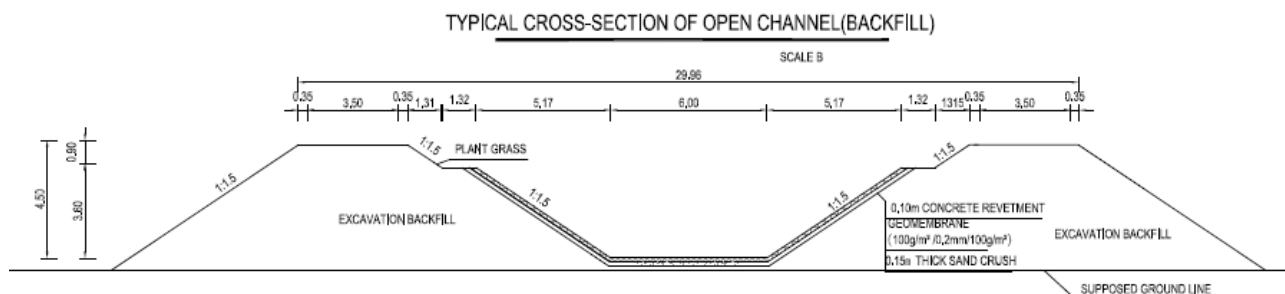


Figure 2-3: Layout of Open Canal

The open canal is located on the left bank of the Athi River with the upstream section connecting to the water intake and the start bottom elevation set at 208.0 meters. In order to better play the irrigation task of the project and increase the irrigable area of the project, the canal extends downstream to the southern boundary of the Galana Irrigation Area, with the tail bottom elevation set at 200.0 m.

The canal will have five overpasses at strategic locations along the wildlife migratory routes/wildlife corridors to allow free movement of the wildlife between different sections of the park. KWS will guide in the specific locations of the overpasses. The width of the overpasses/culverts will be 100 meters which will cater for all animals.



In addition to the overpasses, the canal will have two drinking pools for wildlife strategically located on the northern side of the canal (to be guided by KWS) as a way of discouraging wildlife from moving to the southern side towards the neighbouring communities in the Galana and Kulalu ranches. The small canal connecting the main open canal to the drinking pools will also be open and fenced just as the main canal.



Figure 2-5: Layout of Culverts/Overpasses and Drinking Pools



Figure 2-4: Overpass for Wildlife



Figure 2-6: Drinking Pool

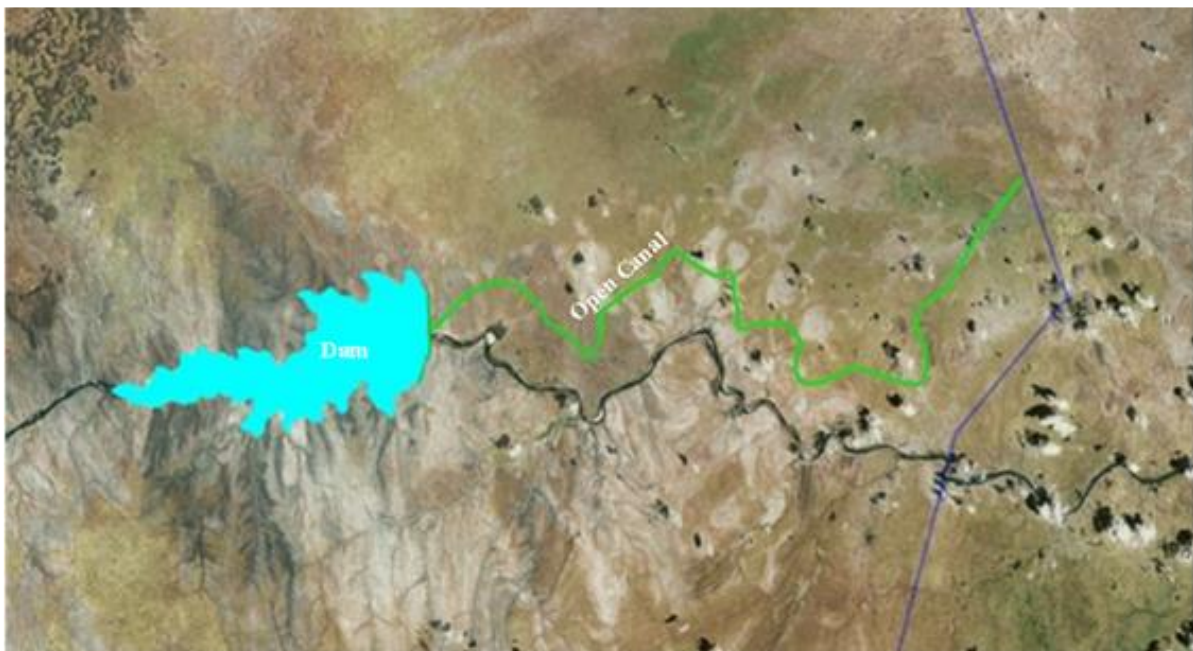


Figure 2-7: General Layout of the Dam and Canal

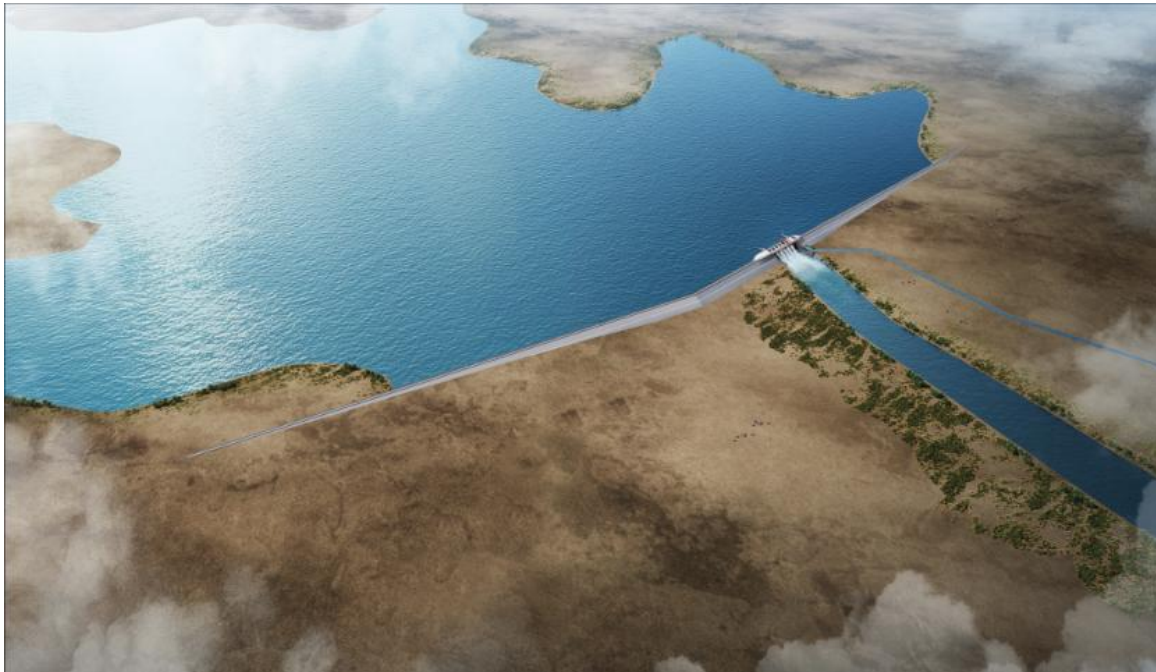


Figure 2-8: Depiction of the Dam and Canal

2.2.3 Workers' Camp

The workers' camp will be temporary with its ancillary facilities for purposes of supporting the development of the dam. It will be located 22 kilometers from Sala gate. The whole camp will cover a total area of 13.97Ha with dimensions of 605 meters by 231 meters. However, the built-up area will only be approximately 4Ha. The main components of the camp include;

1. Project department office area
2. Laboratory
3. Oil depot
4. KWS Accommodation area
5. Staff Accommodation area
6. Vegetable Garden and Leisure Hall
7. Equipment Parking area
8. Parts warehouse and Machine warehouse
9. Sand and Gravel Storage area
10. Concrete Mixing area



11. Prefabricated component storage area

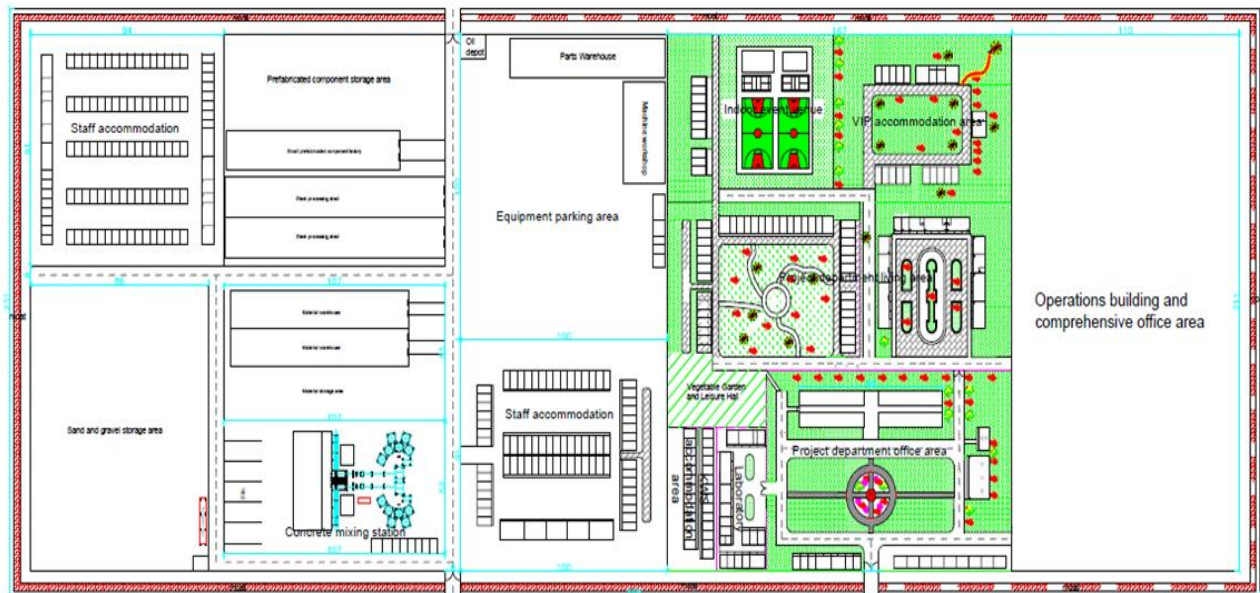


Figure 2-9: Workers' Camp Layout

2.2.4 Transport Infrastructure

The transport infrastructure will entail access roads and a bridge. As part of the project, there will be rerouting of a section of the C103 road (sections which will be flooded by the dam) which is approximately 13 kilometers in length.

Additionally, to ensure accessibility to both the left and right banks of the dam during construction, it is planned to build an access bridge with a total length of 150 meters and temporary access roads. The bridge will be located along Galana River at Koito area and it will be a Steel Trestle Bridge. It will be approximately 1 kilometer from the workers' camp.

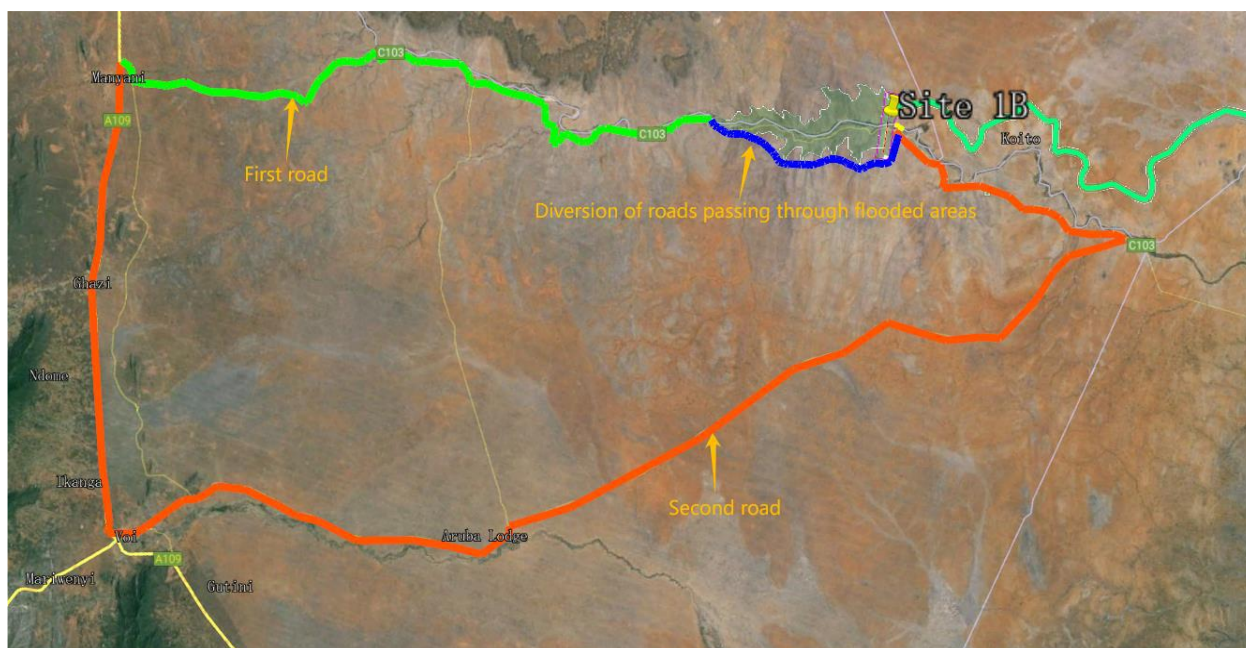


Figure 2-10: Access Roads Layout

2.3 Project Location and Site Description

Tsavo East National Park which is the oldest and largest national park in Kenya is situated in the semi-arid area of the famous Taru Desert. It is located near the Kenya Coast, a few kilometers from Voi Town. The park is in Taita-Taveta County and it borders Tsavo West National Park which was part of the Tsavo East National Park before the construction of the A109 road along the railway line that connects the interior of Kenya with the coastal area. The park is located in the South East of the Kenya's capital Nairobi approximately 250 kilometers.

The dam project is located within the Tsavo East National Park approximately 380 kilometers from Nairobi and about 220 kilometers from Mombasa along the Galana River downstream of Luggard Falls. It is about 75 kilometers West of the Mombasa-Nairobi railway and about 25 kilometers East of the Sala Gate at the eastern entrance of Tsavo East National Park. The project area is located approximately 105km Northwest of the coastal port city of Malindi, at a latitude of -3.021319°S and longitude of 39.021992°E.



The project site has three access points to the project site: Manyani Gate, Voi Town Gate and Sala Gate. From Mombasa-Nairobi Highway, the first route involves entering the park through the Manyani Gate and following the C103 highway to the project site covering a distance of about 75 kilometers while the second route is accessed via the Voi Town Gate and follows an indirect path from Manyani Gate to Voi Town, then continuing through the park to reach the project site, covering a distance of approximately 145 kilometers. The third route is from Mombasa to Malindi and then following the C103 highway to Sala Gate and continuing along the C103 highway for 25 kilometers to reach the project location.

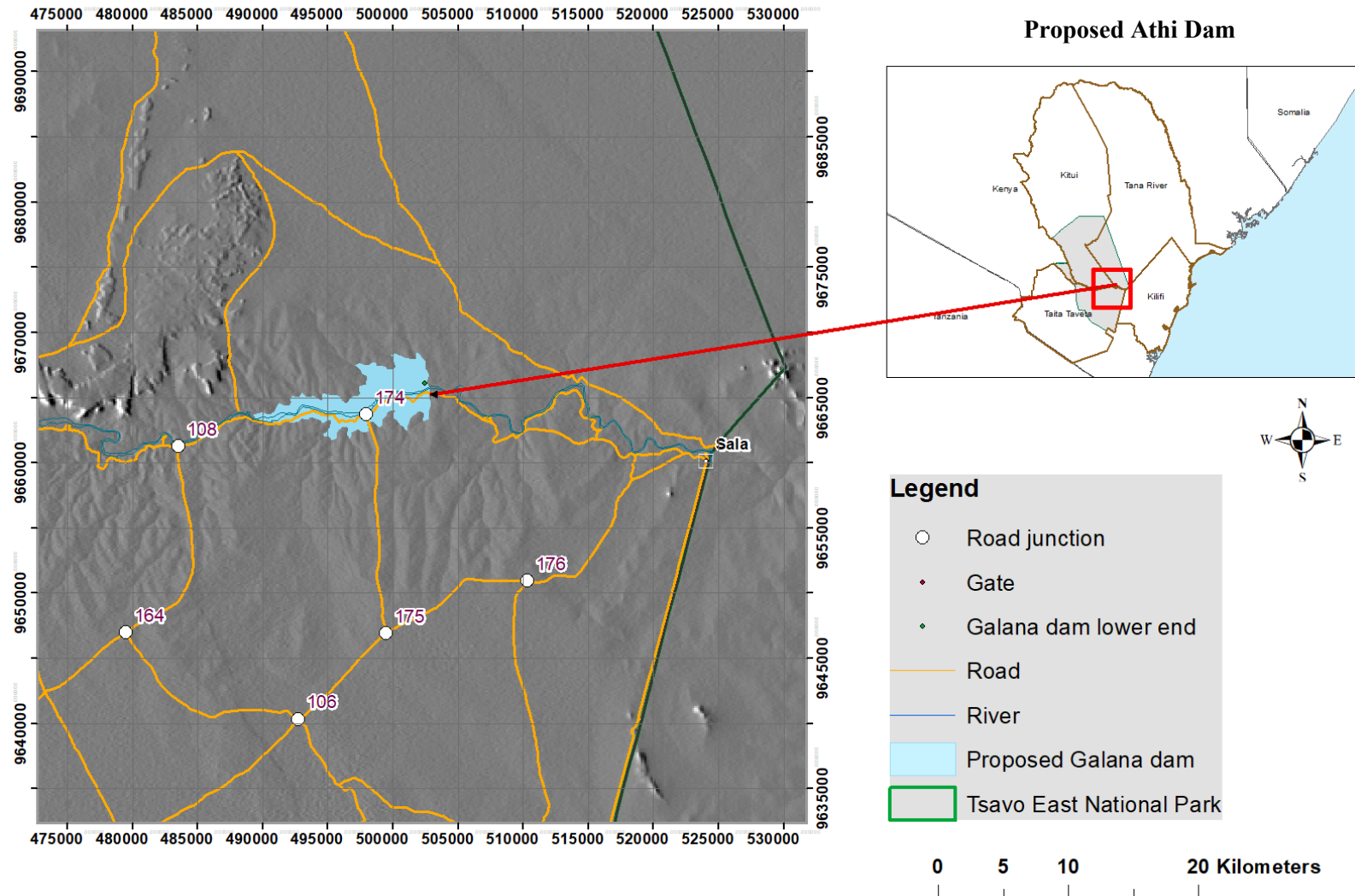


Figure 2-11: Location of the Project Site



2.3.1 Justification for location of the dam project within the park

The dam project is located within Tsavo East National Park which is a protected area and a wildlife conservation area. The justification of the selected location is as below:

- i. The project shall be as close to the irrigation area as possible to shorten the water delivery distance, reduce water losses and allow the water to be transportation by gravity hence reducing the overall project costs by avoiding pumping.
- ii. The identified location/site does not involve displacement of population and hence no disruptions to human settlements and the costs associated to relocation of population
- iii. The feasibility study undertaken by National Irrigation Authority (NIA) identified the selected site as the most suitability location
- iv. The park falls within an arid to very arid climate which is prone to drought receiving an annual rainfall of less than 250mm. The presence of the proposed dam project within the park will contribute drought mitigation by ensuring consistent water availability along the drinking pools and the reservoir.
- v. The reservoir will create new habitats for various species potentially increasing biodiversity
- vi. For sediment-laden rivers, the intake shall be located in areas with stable riverbed.
- vii. The headworks shall be selected on solid riverbanks at an appropriate elevation to avoid increasing the amount of earth and rock excavation in the canal.
- viii. The width of the river shall be appropriate.
- ix. The topographic and geological conditions near the dam site shall be favorable for the construction of water-retaining structures.
- x. There are topographic and geological conditions suitable for building water retaining structures near the dam site.
- xi. The reservoir area has a small inundation and submergence range, occupying less farmland and cultivated land, and requiring less resettlement.
- xii. There is large quantity of high-quality construction materials near the dam site that are easily transported.

The proposed project site falls within Land Reference LR No. 27743 which falls under public land gazetted as Tsavo East National Park by the Government of Kenya. The affected land area is registered in the name of Kenya Wildlife Service who are the custodian of wildlife conservation areas in the country.



Figure 2-12: The Dam Project Site along Galana River

2.4 Project Proponents and Key Stakeholders

The proposed project is to be implemented by National Irrigation Authority (NIA) in conjunction with Kenya Wildlife Services (KWS). The roles of National Irrigation Authority (NIA) are as follows;

- i. Coordinate undertaking of topographic survey and geological exploration
- ii. Preparation of site survey reports, concept design report and work arrangement, technical scheme of project, feasibility studies, detailed designs preparation
- iii. Tendering for construction

The roles of Kenya Wildlife Service (KWS) are as follows;

- i. Controlling access to the project site, issuance of consent/permission for any activity within the park
- ii. In conjunction with NIA oversee the construction of the dam project
- iii. Provide necessary support to the project contractor including provision of security in the workers' camp and construction sites
- iv. Undertake surveillance of the project site
- v. Sensitize the public and tourists on dam safety issues associated with the dam
- vi. Monitor post-construction ecological impacts

It is also appreciated that the value of the resource cuts through various other stakeholders. While most stakeholders may not be directly involved in the implementation of the project, there are key



players in addition to NIA and KWS who are expected to feature prominently during the development and operation of the facility. These include;

Table 2-1: Project's Key Stakeholders

No.	Stakeholder	Roles
1.	National Environment Management Authority	• Approves and licenses projects after reviewing ESIA reports, • Conducts environmental audits and inspections Enforces compliance with EMCA (1999) and related regulations, • Coordinates public participation processes
2.	Water Resources Authority	• Issues water abstraction and dam safety permits, • Monitors catchment hydrology and downstream flow requirements, • Ensures environmental flow and water allocation standards are met
3.	County Governments (Taita Taveta County, Kitui & Kilifi)	• Issues land use permits and development approvals, • Ensures local development aligns with County Integrated Development Plans (CIDPs), • Coordinates with national agencies on community welfare
4.	Mining Department	• Resource Assessment and Mapping, • Conduct or validate geological surveys to determine the presence, type, and quantity of minerals in the area, • Advise whether the dam site overlaps with a known or prospective mineral resource zone, • Help in identifying strategic minerals that may be affected or lost due to submersion or land use change. • Offer regulatory oversight.
5.	Civil Society and Environmental NGOs	• Provide independent oversight and advocacy, • Conduct biodiversity studies and social impact awareness, • Monitor compliance and advocate for community rights and conservation
6.	Development Partners and Financiers	• Provide project financing, • Require adherence to environmental and social safeguards (e.g., IFC Performance Standards), • Monitor project outcomes and sustainability indicators
7.	Contractors and Consultants	• Design and construct the dam, • Conduct feasibility studies and environmental assessments, • Implement mitigation and monitoring measures, • Report progress to the proponent and regulators



8.	Media and the Public	• Raise awareness and shape public opinion, • Hold stakeholders accountable, • Report on environmental concerns or project benefits
9.	Business community i.e. hotels. Lodges	• Act as Environmental Stewards by advocating conservation of the park's natural scenery, wildlife, and ecosystem, • Monitor and report on changes to the environment that may affect biodiversity or the visitor experience, • Collaborate in environmental protection initiatives, including waste management and anti-poaching campaigns. • Represent the tourism industry's economic interests which may be at risk from environmental degradation or loss of wildlife.
10.	Political class	• Policy and Legal Influence • Project Approval and Budgeting • Public Mobilization and Representation • Stakeholder Engagement and Oversight • Influencing Conservation vs. Development Debate • Facilitating Inter-Governmental Coordination
11.	Other interested stakeholders might include: • Ministry of Agriculture, Livestock and Fisheries • Ministry of Water, Sanitation and Irrigation • Water Resources Authority (WRA) • Kenya National Highways Authority (KeNHA) • Agricultural Development Corporation (ADC)	

2.5 Project Justification

The Dam Project is meant to support the Galana Kulalu Food Security Project which is one of the flagship projects under the Agriculture and Livestock economic pillars in Kenya's Vision 2023. The project aims at putting 10,000 acres of land under irrigation for food production. In light of this, the project is aimed at;

- i. Support the implementation of the Bottom-Up Economic Transformation Agenda by reducing imports and creation of estimated jobs.
- ii. Contribute to self-sufficiency of locally produced staples and potentially reduce the national maize deficit. Therefore, stabilize and lower the cost food for the vulnerable population segment.



- iii. The dam will regulate downstream flows by maintaining at least 80% exceedance flow. This will provide flood protection in lower reaches of the river while also controlling salt water intrusion from the Indian Ocean.

2.6 Dam Type and Site Selection of Project

In the preliminary tracking stage of the project, based on the data available at the time and communication with the Kenyan government, four dam site options were initially proposed and analyzed. These options from upstream to downstream are: Dam4, Dam2, Dam3, and Dam1. Based on the preliminary analysis of the four options the Privately Initiated Proposal (PIP) report was submitted for NIA's approval. As more data was collected and communication with the Kenyan government deepened, two additional options were proposed based on the original four options: Dam 5, and Dam 1B. After preliminary analysis and multiple communications with the Kenyan government, the Dam1B option was selected as the recommended dam site. The justification for site selection include:

- i. The topographic and geological conditions near the dam site is favorable for the construction of water-retaining structures.
- ii. There are topographic and geological conditions suitable for building water retaining structures near the dam site.
- iii. The reservoir area has a small inundation and submergence range occupying less land.
- iv. There is large quantity of high-quality construction materials near the dam site that are easily transported.
- v. The project will be as close to the irrigation area as possible (about 25 km away from the Galana irrigation area) to shorten the water delivery distance, reduce water losses, and lower overall project costs.
- vi. The width of the river is appropriate.
- vii. The stable riverbed is stable for construction of the intake

- viii. The riverbanks are solid and at an appropriate elevation to avoid increasing the amount of earth and rock excavation in the canal.

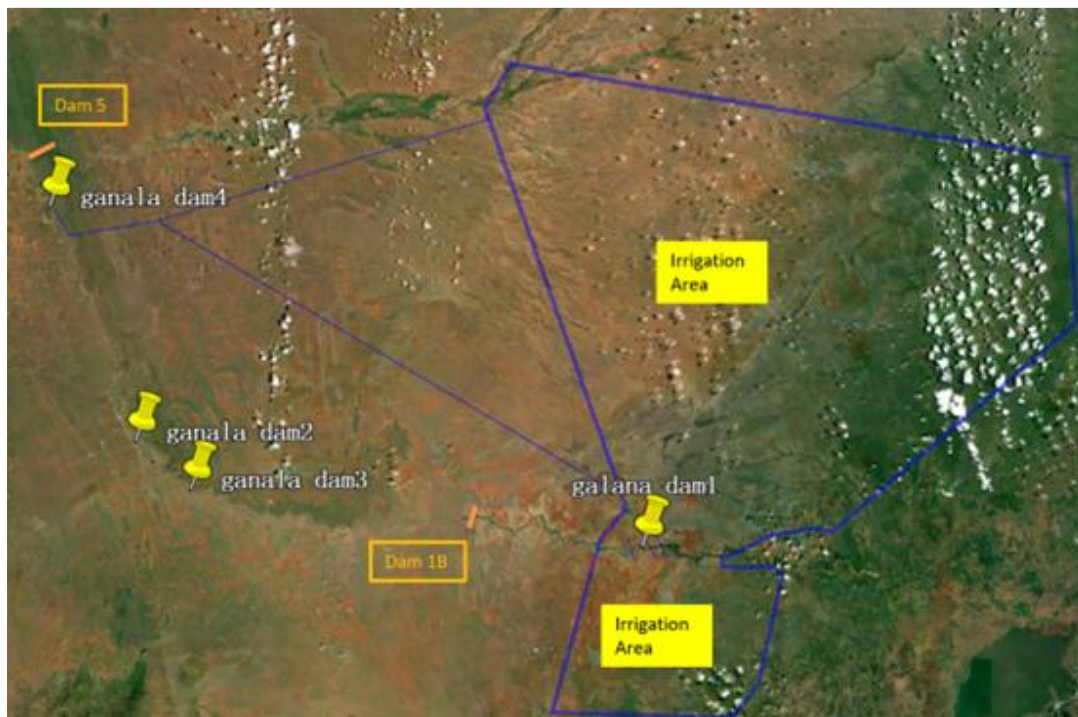


Figure 2-13: Distribution of the Dam Site Options

Based on the topographic features of the recommended dam site (Dam 1B site), it was determined that the project had a longer dam axis and lower dam height. Based on the experience of similar projects in the Africa, a mixed dam type was selected for the dam. The riverbed adopts a concrete dam as structure for overflow, water intaking and sediment discharge and both banks of the concrete dam adopt local material dam. Concrete faced rockfill dam has the characteristics of making full use of local materials, simple dam structure, good slope stability and excellent seismic performance. Hence, a concrete faced rockfill dam was selected as the local material dam.

For the open canal, the route was selected considering the geological and topographical conditions from the dam site to irrigation area, the topography on the left and right banks of the dam site from the dam site to the tail of the water conveyance line fluctuates little and due to the fact that the land is grassland with the elevation generally ranging from 190m to 230m. This made the route well-suited for constructing the open canal. The open canal is set on the left bank of the Galana River in order to minimize the length of the open canal and reduce the number of river-crossing aqueducts since the Galana Irrigation Area is mainly located on the left bank of the Galana River.



2.7 Major Activities of the Proposed Project

2.7.1 General Project Activities

The proposed project generally involves the following activities;

- a) Construction of the workers' camp
- b) Construction of a sedimentation tank and a reservoir in the construction camp for water supply
- c) Development of material and mechanical storage areas and concrete mixing plant
- d) Development of local access roads, parking and walkways
- e) Site preparation and clearance
- f) Excavation of the dam foundation
- g) Excavation of the dam shoulder
- h) Treatment of the dam foundation
- i) Construction of the dam surface
- j) Upstream and downstream slope protection
- k) Construction of the dam foundation and abutment
- l) Construction of overflow dam section
- m) Construction of a drainage system
- n) Construction of a power substation near the dam for power supply
- o) Construction of dam crest road

2.7.2 Main project construction (Dam Construction)

The dam construction involves the following main activities; excavation of the dam foundation, treatment of the dam foundation, filling of the dam body, concrete construction of toe board and panel and construction of overflow dam section.

2.7.2.1. Dam foundation and abutment construction

The excavation of the dam foundation and abutment will be carried out in a top-down order. The temporary slope which will form during the construction process will meet the stability requirements. The water wells, springs, tunnels, caves, geological survey holes, vertical shafts, adits and test pits within the dam area will be inspected one by one and treated according to design requirements and recorded for future reference. For the retained gravel dam foundation, compaction treatment will be carried out using a vibrating roller, ramming plate, etc. according to the determined



scope and thickness before filling the dam body and the treatment should meet the design requirements.

2.7.2.2 Dam foundation treatment

This phase includes consolidation grouting and curtain grouting. Consolidation grouting will adopt pressurized grouting, geological drilling will be used for drilling and the BW-200 grouting machine will be used for circulating and segmented grouting in the hole. The curtain grouting of the dam foundation will adopt a 150-type geological drilling rig for drilling with the orifice closed and segmented drilling and grouting from top to bottom.

2.7.2.3 Dam filling

The construction of the dam surface will be carried out using a flow process method consisting of four processes: paving, leveling, rolling and quality inspection.

For the cushion area, a 132kW bulldozer will be used for paving and the upstream part near the dam slope will be manually assisted for paving. The thickness of each layer of paving material will be less than 50cm. The horizontal width of the cushion filling will be 15cm~30cm more than the designed slope line and will be compacted using a 17t vibrating roller. The slope will be statically rolled with a 5t~8t slope roller for 3-4 times and then compacted with a vibrating roller. For the rockfill area, the thickness of the paving material will be 0.8-1.0m and will be transported to the dam using 3m³ loaders and a 20t dump trucks. The excavated materials or excavated materials from the material yard will be used to fill the dam. A 132kW bulldozer will be used to pave the materials and a 17t vibrating roller will be used for compaction.

2.7.2.4 Concrete construction of Toe Board and Panel

The concrete for the toe slab will be supplied by the concrete mixing system and the pouring carried out using a 6m³ concrete mixer truck and a chute. After manual leveling, the concrete will be vibrated using a vibrator. A peripheral joint water stop system should be installed during pouring the toe slab concrete. After the toe slab concrete pouring is completed, maintenance measures will be taken. In addition, after the formwork of the toe board is removed, the water stop system will be protected in a timely manner. The concrete panel will be constructed 3 to 5 months after the settlement of the dam body and will be arranged for construction during the dry season. The panel will be poured once to the elevation of the dam crest. The panel construction will adopt the trackless sliding formwork method and two winches will be installed at the top of the dam to pull the sliding



formwork. The concrete will be transported to the top of the dam by a 6m³ concrete mixer truck and then transported to the working face by a chute.

To avoid dry shrinkage cracks on the panel, maintenance measures should be taken immediately after concrete pouring, and the curing time should not be less than 90 days. When the climate is dry and hot, the curing time should be appropriately extended.

2.7.2.5 Construction of overflow dam section

During the concrete construction of the overflow dam section, the concrete clinker will be supplied by the mixing station and transported to the pouring warehouse surface by dump trucks. Depending on the site conditions, the concrete will be directly stored or transported through chutes. For the pouring of high parts, a hanging tank will be used and vertically transported to the warehouse location using a tower crane. The temperature difference and segregation issues will be strictly controlled during concrete pouring and the joint joints will be roughened. Before pouring, a mortar layer will be laid, the concrete will be vibrated and compacted and timely watering and curing carried out. For metal structure installation, metal structural components such as hoists and gates will be lifted into position using gantry cranes lift with manual assembly, welding and other detailed work being carried out. The installation of mechanical and electrical equipment and metal structures will comply with the Construction Quality Acceptance and Evaluation Standards for Hydraulic Metal Structure Installation Engineering (SL635-2012) and Construction Quality Acceptance and Evaluation Standards for Water Conservancy and Hydroelectric Engineering Unit Engineering (SL 638-2013).



2.8 Equipment to be used during Construction

No.	Plant/Equipment	Quantity
1.	Excavator 180hp	10
2.	14-ton tipper	25
3.	Tower Crane maximum lift 100-250m.t	2
4.	Concrete mixer Capacity 90 m3/ day	2
5.	Sheep foot roller	2
6.	Concrete Mixer	2
7.	Dewatering pumps at least 10 kW	4
8.	Smooth Drum Vibrating RollerVibrating Roller	2
9.	Concrete Mixer Truck capacity 6-14m3	10
10.	Industrial air Compressor 100-450kw	2
11.	Pick up Double cabin	6
12.	Bulldozer 80-750HP	4
13.	Wheel loader 150-450HP	4
14.	Coated macadam paving machine (crawler or wheeled)	1
15.	Hydraulic vibrating hammer/extractor including power pack 50 – 200 tonnes	1
16.	Cement silo 200 and 500 tons	2
17.	Grouting machine including pump and hopper 50 - 450 litres /sec	2

2.9 Project Budget

The estimated project cost for the proposed Athi Dam and Associated Irrigation Water Conveyance System based on the prevailing construction market rates amounts to 300 Million USD (Kes 38.841 Billion using conversion rate of 128.50 of USD to Kenya Shillings).



CHAPTER THREE: ANALYSIS OF PROJECT ALTERNATIVES

3.1 Introduction

This section analyses the project alternatives in terms of site/location and project design. The following paragraphs describe the alternatives studied during the design life of the project.

3.2 Alternatives on Location of the Dam Project

Regarding the location of the dam, there were two main categories; inside the national park and outside the park alternative sites.

3.2.1 Alternative Dam Sites Outside the Park

The site for the location of the dam considered the distance from the reservoir to the Galana-Kulalu irrigation area, the average annual water flows of the river at specific points, the project cost estimates, topography and geology and engineering layout. Given these parameter, the only suitable site outside the park that qualified the said criteria was at the southern part of Makueni and Kitui counties where the Athi River flows before entering the Tsavo East National Park. This option was not prioritized for the dam construction due to the following reasons;

- i. That section of the river before entering the park already has another ongoing dam project (Thwake Multipurpose Dam) which is designed to provide water, irrigation and hydroelectric power to the region around Makueni and Kitui counties and not the Galana Kulalu area.
- ii. Tsavo River drains into Athi River inside the park to form the Galana River. If the dam is located outside the park on Athi River, it would not benefit from the large Tsavo River catchment that contributes to average annual water flow of Athi River. The dam outside the park would therefore take long to fill.
- iii. Location of the dam upstream outside the park would lengthen the water delivery distance to the irrigation area and hence result to increased water losses and increase the overall project costs due to the additional construction costs associated with the additional length of the water conveyance canal from the reservoir to the irrigation area.
- iv. Location of the dam outside the park would result to displacement of population and disruptions to human settlements and increase the project cost and project timelines significantly due to the costs associated to relocation of population and compensations to the land owners.



- v. Several opportunities to the wildlife inside the park would be missed such as the opportunity of drought mitigation within the park since there would not be a consistent water availability that would come with the reservoir being inside the park and along the drinking pools since the park falls within an arid to very arid climate which is prone to drought receiving an annual rainfall of less than 250mm. The opportunity for potential increase in biodiversity within the park would also be missed due to the potential new habitats the reservoir would create.

3.2.2 Alternative Dam Sites Inside the Park

The selection of the dam axis mainly depends on environmental conditions, topographic and geological conditions and combined with considerations such as project layout, technical and economic conditions, distribution, reserves and quality of construction materials, construction conditions and external transportation conditions. And other factors. The selection adheres to the following principles of environmental, technical, economic, and safety considerations:

- i. For sediment-laden rivers, the intake shall be located in areas with stable riverbed.
- ii. The headworks shall be selected on solid riverbanks at an appropriate elevation to avoid increasing the amount of earth and rock excavation in the canal.
- iii. The width of the river shall be appropriate.
- iv. The topographic and geological conditions near the dam site shall be favorable for the construction of water-retaining structures.
- v. There are topographic and geological conditions suitable for building water retaining structures near the dam site.
- vi. The reservoir area has a small inundation and submergence range, occupying less farmland and cultivated land, and requiring less resettlement.
- vii. There is large quantity of high-quality construction materials near the dam site that are easily transported.
- viii. The project shall be as close to the irrigation area as possible to shorten the water delivery distance, reduce water losses, and lower overall project costs.

In the preliminary tracking stage of the project, based on the data available at the time and communication with the Kenyan government, four dam site options were initially proposed and analyzed. These options, from upstream to downstream, are Dam4, Dam2, Dam3, and Dam1. Based on the preliminary analysis of these four options, the Privately Initiated Proposal (PIP) report was

submitted for NIA's approval. As more data was collected, and communication with the Kenyan government deepened, two additional options were proposed based on the original four options: Dam 5, and Dam 1B.

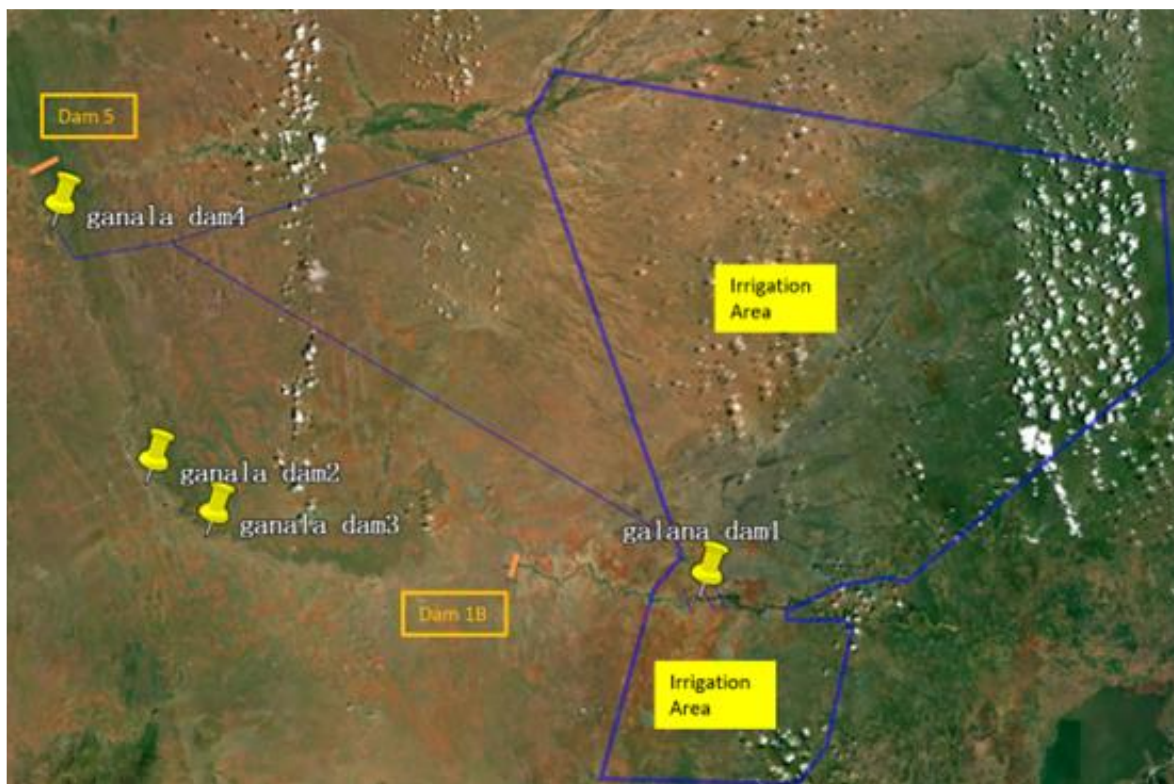


Figure 3-1: Distribution of the dam options

The dam site selection scheme was compared and analyzed from the aspects of dam site location, topography and geology, engineering layout, etc. Combined with the opinions of relevant departments in Kenya, the DAM1B dam site (proposed/recommended dam site) is selected as the recommended dam site at this stage.

3.3 Alternatives on project design

3.3.1 Alternatives designs of the dam/reservoir

Based on the topographic features of the Dam 1B site (proposed dam site), it was preliminarily determined that the project has a longer dam axis and lower dam height. Based on the experience of similar projects in Africa, a mixed dam type was initially selected for the dam. The riverbed adopts a concrete dam as structure for overflow, water intaking and sediment discharge, and both banks of the concrete dam adopt local material dam. Concrete faced rockfill dam has the characteristics of



making full use of local materials, simple dam structure, good slope stability, excellent seismic performance, etc. So concrete faced rockfill dam was selected as the local material dam.

3.3.2 Alternative design of the canal

Irrigation water will be conveyed to the farmlands using a canal. The alternative designs for the water conveyance canal were considered, as discussed below.

- i. **Open Canal:** Open water conveyance canals convey huge water volumes mainly required for large-scale irrigation, they are easier to design, build, and maintain using locally available materials and technical skills, they can be constructed in various sizes and shapes to adapt to the terrain and compared to pressurized pipeline systems. Open canals generally have lower initial construction and capital costs. The disadvantages of this alternative include susceptibility to significant water losses through evaporation, safety risk especially for wildlife (drowning of wildlife) and interference with animals' free movement. Wildlife animals such as Hippos may inhabit the canal and causal cause blockage of water flow.
- ii. **Closed Canal Alternative:** This option considered using high-density polyethylene pipes or precast concrete flumes to transport water. The advantages of this alternative include; elimination of water loss through evaporation and reduces seepage to near zero, minimizes interference with animal movement within the park, no fragmentation of the park, natural habitat is restored gradually, minimal safety hazards and reduced pollution as the water quality is protected from external contaminants. The disadvantages of this alternative include extremely high initial cost since the construction materials and installation are very expensive, difficult maintenance since in cases where repairs are needed, they are difficult and require specialized equipment and requires precise pressure management and cannot easily handle sudden excess, requiring robust safety valves or tanks. Within the Tsavo East National Park there is a high population of elephants and are able sense water flowing in underground installations, meaning that closed canal systems face undisputed risks of being destroyed by elephants as they search for water, especially during the dry season. This will considerably increase the cost of surveillance and repair of the canal.
- iii. **Intermittent Open and Closed Canal:** This alternative combines the use of open canal and closed canal being an attempt to minimize the negative impacts of the canal to the wildlife animals. It presents adequate routes for animals to move freely, but the areas with open



canal will still have the full disadvantages of the open canal systems, therefore not an appropriate compromise of the drawbacks presented by the open canal system.

- iv. **Open Canal with crossing points for animals:** This alternative incorporates animal crossing points on the open canal to mitigate habitat fragmentation and make a provision for animals to move from one side of the canal to the other. The disadvantages of this alternative include water loss through evaporation, wildlife and human safety hazards due to the significant risk of drowning and habitat fragmentation. To minimize negative impacts, the project involves using electric fencing alongside the canal to prevent animals from entering the waterway directly and hence address the wildlife safety hazard concerns. The crossing points facilitate safe passage of wildlife which is crucial for maintaining movement of animals and mitigate on habitat fragmentation. In addition, the crossing points will have to be strategically located along the wildlife movement and migratory routes with constant surveillance to ensure they remain effective and are not bypassed by animals. The crossing points are design to provide for all animal species to cross with ease and will be located at points predetermined by existing animal movement routes. This canal design alternative was selected and recommended due to its lower initial construction and capital costs, its potential to easily transport the massive volumes of water and its mitigative measures to wildlife safety hazard and habitat fragmentation.

3.3.3 Alternatives for open canal type and route selection

In accordance with the Design Standard for Irrigation and Drainage Engineering (GB 50288-2018), the selection of longitudinal and cross-sectional designs for channels should meet the following criteria:

- i. Ensure stable riverbed conditions and sediment equilibrium. Channel section with a fill height exceeding 4 meters may consider comparison with the aqueduct section.
- ii. Provide adequate water-carrying capacity to reduce leakage losses.
- iii. Enable smooth connection of water surface profiles between channels of different levels and upstream and downstream of important structures;
- iv. Facilitate construction management and reduce construction costs.

Comparison of Wide and Shallow vs. Narrow and Deep Cross-Sections



Both wide and shallow open canals and narrow and deep open canals have their own advantages and disadvantages. The characteristics are as follows:

- a) Generally, wide and shallow open canals have relatively wide cross-sectional openings and occupy a large area; while narrow and deep open canals have narrow cross-sectional openings, so they occupy a small area and require less compensation for land acquisition. However, as the depth of the narrow and deep section increases, the safe slope ratio increases and the area occupied increases.
- b) Narrow and deep open canals are deeper than wide and shallow open canals, making construction more difficult. Moreover, the length of the channel section that encounters groundwater and rock foundation at the bottom of the narrow and deep open canal increases, increasing construction difficulty and investment.

Under the same conditions of flow rate, slope, roughness, and slope ratios, the optimal hydraulic cross-section reduces the quantity of channel works. However, the optimal hydraulic cross-section for trapezoidal channels is often narrow and deep, which is disadvantageous for water distribution and construction. Furthermore, due to the shallow groundwater depth along the alignment, deep channel sections exhibit poorer slope stability, which is not conducive to the safe operation of the project. Consequently, the open canal section is designed as a trapezoidal concrete lining plate section at this stage.

The selected Dam site is about 25 km away from the Galana irrigation area in a straight line. In order to better play the irrigation task of the project and increase the irrigable area of the project, the elevation of the tail point (falling point) of the open canal is set at 200 m. Considering the geological and topographical conditions from the dam site to irrigation area, the topography on the left and right banks of the dam site from the dam site to the tail of the water conveyance line fluctuates little, and most of the land is grassland, with the elevation generally ranging from 190m to 230m. It is well-suited for constructing the open canal.

As the Galana Irrigation Area is mainly located on the left bank of the Athi River, in order to minimize the length of the open canal and reduce the number of river-crossing aqueducts, the open canal is set on the left bank of the Athi River.



3.4 The “No Project Alternative” Option

The Athi Dam project is a significant infrastructure initiative in Kenya, aimed at enhancing water supply and irrigation capabilities for the Galana-Kulalu Irrigation project. A “no project alternative” means the status quo remains, thus inadequate water supply continues to persist in the irrigation project, the benefits of the dam to wildlife in Tsavo East National Park will not be realized and the social economic benefits accruing from the project will also not be realized. Taking this option may also imply that there would be no environmental and social impacts to address since no project would be implemented. On the other hand, the Kenyan Government is keen to address issues of food insecurity through irrigation, hence the project is a top priority project. On the foregoing basis the “no project alternative” is rejected.



CHAPTER FOUR: BASELINE INFORMATION FOR THE STUDY AREA

4.1 The Tsavo Conservation Area

The Tsavo Conservation Area (TCA) cover an approximated area of about 49,000km². The conservation area has three national parks that is: Tsavo East, Tsavo West, and Chyulu Hills on the Kenyan side. Mkomazi national park in Tanzania is an important component of the Tsavo ecosystem as wildlife from the Kenyan side freely move in and out of this park. Tsavo East and Tsavo West National Parks cover over 21,000 km². The Tsavo Conservation Area is the largest protected area complex in Kenya, and covers over 4% of the entire country's land mass. Owing to the size of this protected area system and the connectedness diverse ecosystems and habitats are supported. According to Douglas-Hamilton et al. (2005) and Leuthold (1977) this ecosystem sustains the seasonal movement of elephants. The elephant population in this ecosystem is also Kenya's largest and provides much impetus internationally for conservation awareness and action. The ecosystem vast conservation areas and unique habitats host diverse wildlife species. The ecosystem is a known elephant stronghold, hosting about a 33% of elephants in Kenya (Ngene et al., 2013) and about 3% of Africa's population.

Land use practices vary across the ecosystem, with the major type being conservation, agriculture, livestock ranching, mining, rural and urban settlements (County Government of Taita Taveta, 2018). Agriculture is the main source of livelihood, contributing to approximately 95% of household income and 80% of employment in the ecosystem (Ministry of Agriculture, Livestock and Fisheries, 2016). Agriculture is mainly rain-fed, except in parts of Taveta sub-county and Galana-Kulalu, where irrigation farming is practised. Both small- and large-scale intensive crop farming is practised in this ecosystem. Increase in human population and demand for food has led to increase in area under agriculture especially in the lowlands on the cost of bushlands, which are the natural habitats for elephants.

These changes in land use have led to construction of elephant proof fences (wildlife barriers) where human activities are incompatible with wildlife conservation with plans to extent and cover more areas (Kenya Wildlife Service, 2008). In addition, the landscape is also crossed by two major roads, the Mombasa-Nairobi highway and the Voi-Taveta Road. Two railway lines from Mombasa to Nairobi run next to the Mombasa-Nairobi highway. Other public utility infrastructure include the oil pipeline, Mzima water pipeline and several high-voltage power lines.

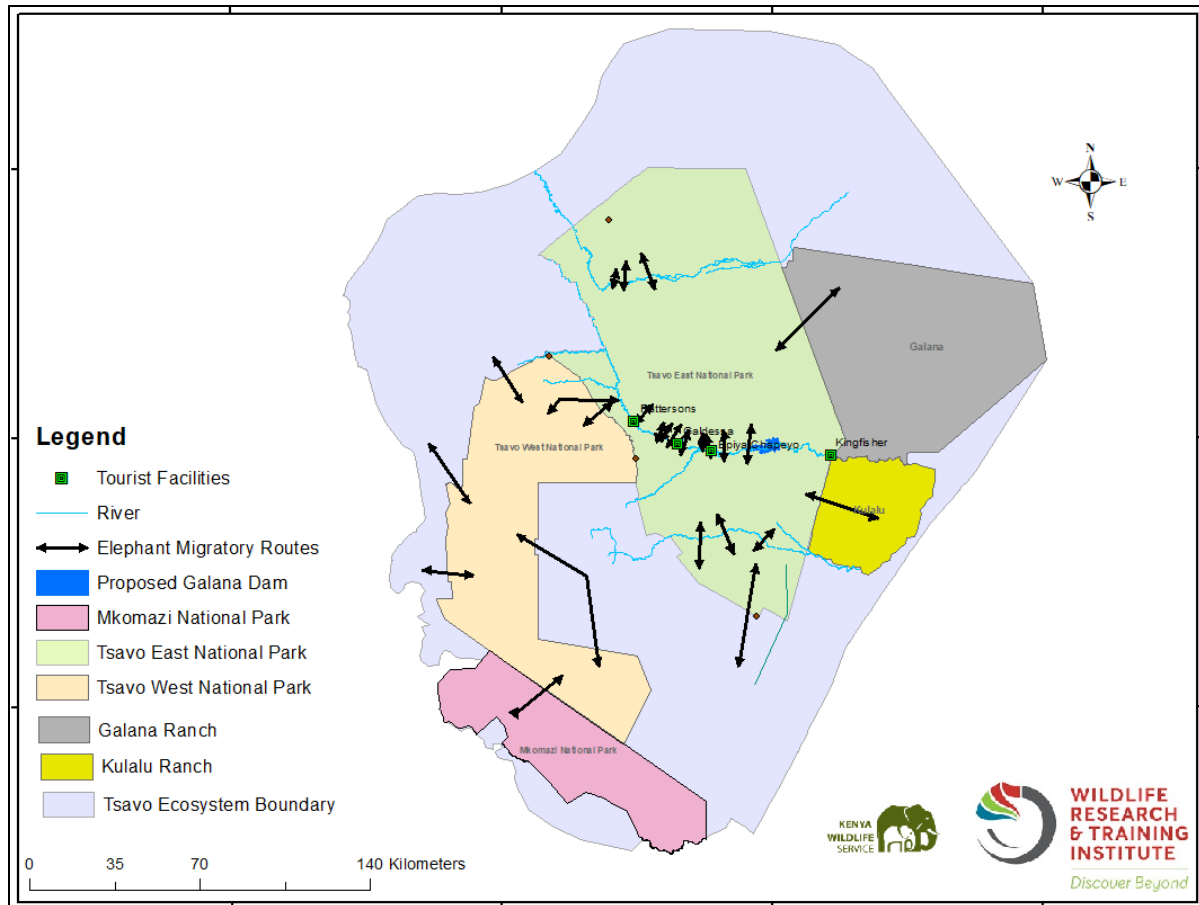


Figure 4-1: Tsavo Ecosystem Map

4.2. Climate

The climate of Tsavo ecosystem is classified as arid to very arid, with fairly hot to very hot temperatures. The average annual rainfall decreases towards the north-north east, decreasing from 550mm to 200mm. The average annual evapo-transpiration ranges from 1900mm to 2500mm. The climate is characterized by alternating dry and rainy seasons; a long dry season from June to October; short rains in November/December; a short dry season from January to March and long rains in April/May. The lowlands are prone to drought with annual rainfall less than 250mm and drought occurring at least once every 10 years. The Taita hills however, are much cooler and receive higher rainfall than the lowlands.

4.3 Water

Lake Jipe and Challa are some of the two important water points in the Tsavo ecosystem. Permanent rivers in the County are the Tsavo River whose main source is the Mzima springs, Lumi whose source is Mt. Kilimanjaro and the Galana river. Other seasonal rivers include the Voi,

Mwatate, Mbololo, and Bura among others. In addition to these natural water sources, several water pans, boreholes, and water troughs have been constructed in different parts of the ecosystem to provide water for wildlife.



Figure 4-2: Galana River

4.4 Soils

The dominant soils in the Tsavo ecosystem are cambisols. They originate from weathered gneiss and are often gravely to sandy-loamy and shallow. They are well drained and moderately fertile. Many cambisols are in a transitional stage of development from a young soil to a mature one. On steep slopes and transitional zones, the dominant soil types are regosols, which are shallow soils, with high permeability and low water holding capacity occur. The drier foothills are characterized by luvisols, acrisols and arenosols soils. They are moderate to low in fertility. In valley bottoms, alluvial soils (fluvisols) are apparently noticed. These are young soils with fertility being moderate to high. They receive fresh sediments and nutrients during regular floods and occur in all larger river basins of Bura, Lumi, Mbololo, Mwatate and Voi Rivers. Deeply weathered soils are widespread in Taveta sub-county. Saline and sodic soils occur around Lake Jipe while in the western part of the sub-district are soils developed from the basement rock system with some influence of volcanic ashes. The lowlands are characterized by reddish, very deep, acid sandy-clayey soil (Ferralsols). The ferrelsols are found in most of the Tsavo National Park and the ranches. These soils are vulnerable to soil erosion, have a low water holding capacity and low soil fertility.



4.5 Tsavo Ecosystem Human Population Outlook

Human population outlook and human activities around the Tsavo National Parks cannot be discussed in isolation without focusing on the ecosystem at large. The Tsavo ecosystem borders seven Counties. The entire of the Tsavo West National Park is within the Taita Taveta County, while the Southern Sector of Tsavo East National and which is the most wildlife dense area of the park is also within this County. In Taita Taveta County where the proposed water pan will be implemented the human population has grown from 284,657 in 1999 (Kenya National Bureau of Statistics, 2009) to 340, 671 in 2019 (Kenya National Bureau of Statistics, 2019). Based on the 2019 national census Voi, Mwatate and Taveta sub-counties have the highest human population. The Taita highlands have higher population density per kilometer square, while in the lowlands high population densities are in the urban centers enclaves of Voi, Mwatate, Taveta and Maungu. Mtito Andei town is also expanding although its growth does not have direct impacts on conservation. Mackinon town in Kwale County is growing fast. Human population growth and expansion of settlements in Bachuma and Miasenyi areas is also notable.

4.6 Land Use

4.6.1 Wildlife conservation

The Tsavo ecosystem provides a habitat for diverse wildlife including birds, reptiles, amphibians, large ungulates and many herbivores. The ecosystem is host to many endangered species e.g. the African elephant (*Loxodonta africana*), Grevy's zebra (*Equus grevyi*), and the African wild dog (*Lycan pictus*). Over 60% of the area of Taita Taveta County is protected area, community conservancies or private sanctuaries. The County which is part of the Tsavo ecosystem hosts the single largest elephant population. The latest figures indicate that the ecosystem has 12,843 elephants (Ngene et al., 2017) hence the County is very important for the conservation of elephants. Water is an important aspect of the wildlife habitat health, and elephants among other wildlife depend on it as part of their diet and healthy living.

Figure 4-3: Wildlife within TCA

Buffalos within TENP



Girrafe within TENP



Ostrich within TENP



Elephants within TENP

4.6.2 Forestry

Forestry is an important land use in the ecosystem. The Chyulu hills National Park and Chyulu Forest Reserve are dryland forests. Other important forests are in the Taita hills, with a total of 78 forest parcels, of which 25 are gazetted forests (County Government of Taita Taveta, 2018). In the high-altitude areas, high productive forests of indigenous trees and isolated portions of forest plantations are found. The main highland forests are Chawia, Iyale, and Ngangao. Dryland forests in the Taita Taveta County are mainly found in Bura, Ronge, and Mwandongo areas.

4.6.3 Tourism

The Tsavo ecosystem is a popular tourist destination due to the rich wildlife diversity, scenic landscapes, wilderness value, and the rich cultural history of the Taita people. In addition, the Taita Taveta County was a battlefield during the First and Second World War and the evidence of this war still remains a big part of the history of the area and is currently being promoted as a tourism

product. The Tsavo ecosystem has some of the best tourist accommodation facilities with major hoteliers having branches here. Infrastructural development to support tourism exists and continues to be upgraded to meet the international standards. Some of the infrastructure include roads, Standard Gauge Railway, and internet services.

Tourism is practised in Tsavo National Parks and also in the Community and Private ranches. Ngutuni ranch and Taita Hills Wildlife Sanctuary are some of the successful private owned tourism ventures. TENP is the largest national park in Kenya and it is classified a premier park in terms of tourism use. The park is zoned into three classes based on limits of acceptable tourism use. The three zones include: high use, low use, and the wilderness zone. In the high use zone, big lodges that have a high bed capacity are permitted. The high use zone also has a high road density to facility wildlife viewing. In the Low use zone high-end low bed capacity facilities are permitted and the road density is also low. In the wilderness zone visitor accommodation facilities are not permitted. The wilderness zone is conserved for its wilderness value and limited road network mainly for patrol is permitted.

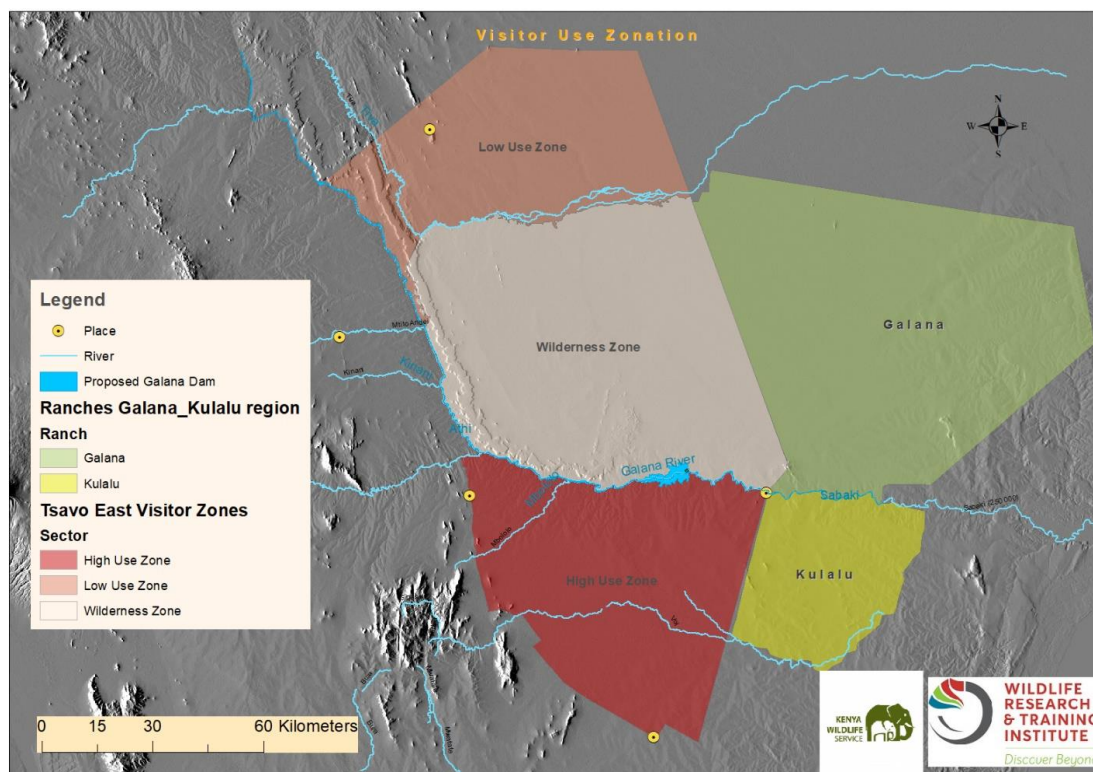


Figure 4-4: Tsavo East National Park Visitor Use Zones



Figure 4-5: Tsavo East National Park



Figure 4-6: Roads within the wilderness zone of TENP

4.6.4 Agriculture

Agriculture is a key land use in the Tsavo ecosystem. Both small and large-scale farming is practiced. Some of the commercial farming include sisal plantations in the lowlands, horticulture in the Taita Hills and Taveta. Increased water abstraction for irrigating crops has led to reduced water volume in rivers downstream thus threatening livelihoods and wildlife downstream. Other impacts related to this farming include increased siltation and eutrophication of water points hence affecting the quantity and quality of water for people and wildlife. Taita Taveta County has the world's largest sisal plantation. Galana Kulalu Irrigation is another important large-scale farming project by the Government of Kenya. Galana Kulalu project is aimed at addressing the food security concerns in the Country.



4.6.5 Ranching

The Taita Taveta County has over 28 ranches. About 24% of the County area is suitable for ranching and dryland agriculture (County Government of Taita Taveta, 2018). The County is one of the disease-free zones in Kenya that are aimed at boosting livestock production in the country. For many years the County has been used by pastoral communities as a fattening ground before livestock is sold for beef production both within the country and for export. Other ranches are the Kulalu and Galana ranches that border the Tsavo East National Park. All these ranches, they are actively used for commercial rearing of livestock.

4.6.6 Mining

Mining is an important land use and a commercial activity in Taita Taveta County. Taita Taveta County lying geologically within the Mozambique Belt is rich most rich County in precious stones in the Kenya (Mwakesi et al., 2020). In most areas within the Taita Ranches, both artisanal and commercial mining takes place, employment a large number of people. The common gemstones mined in Taita include green garnets, yellow garnets, ruby, Tsavorite, green tourmalines, and sapphires among others.

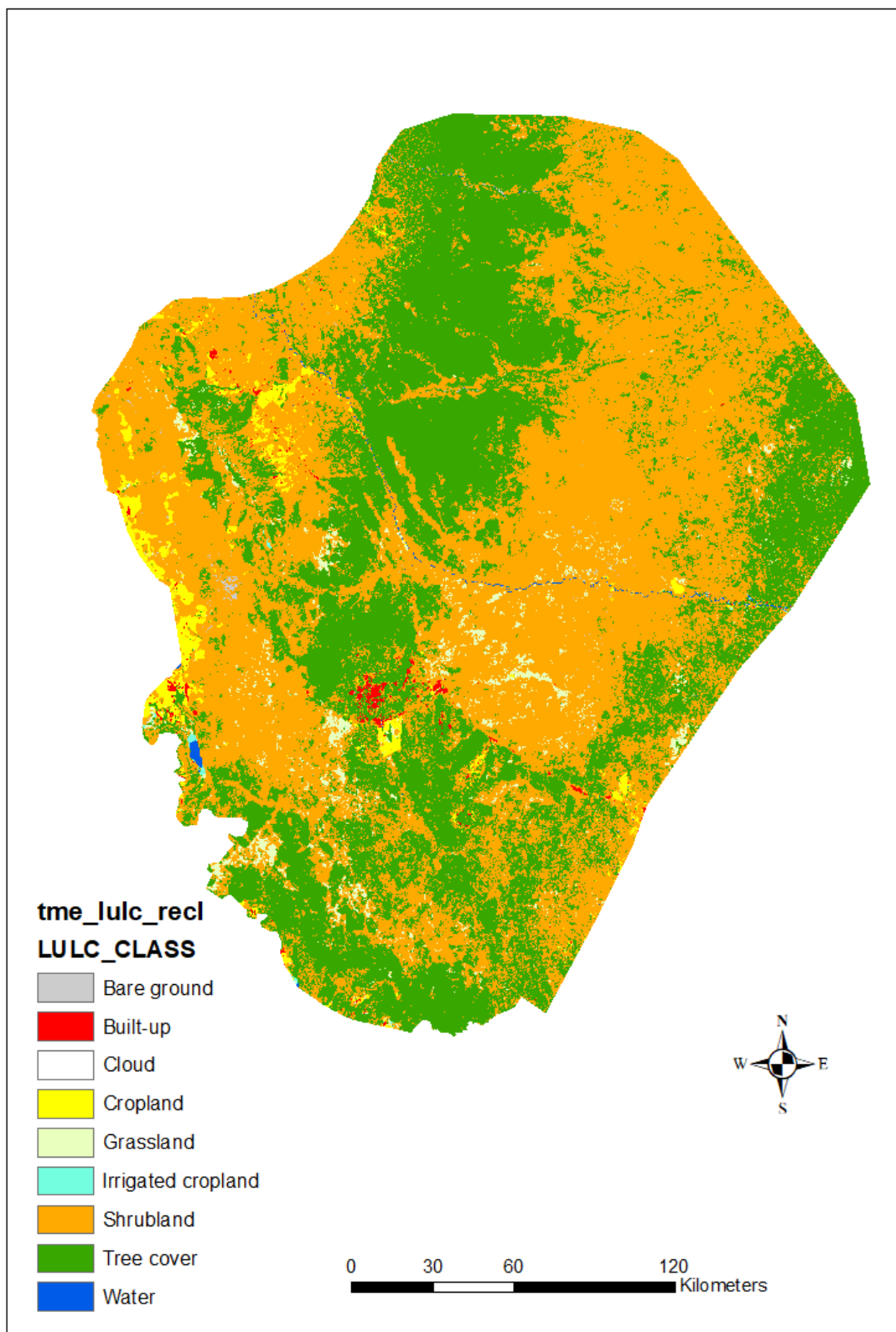


Figure 4-7: Landcover Map of the Tsavo Conservation Area



4.7 Ecological Characteristics

4.7.1 Flora

The vegetation communities and structure in Taita Taveta County differ widely. Altitude and soil type have a big influence on the type of plant species that thrive in different areas of the County. The lowlands have large areas dominated by deciduous woodlands of *Commiphora* and *Acacia* species. Over the years, both human activities and elephants have altered vegetation communities and structure. This vegetation alteration is thought to have been due to over utilization of trees by elephants and fires caused by natural or anthropogenic factors. The common shrubs in the lowlands include *Premna resinosa*, *Premna hildebrandtii*, and *Cassia longiracemosa*. The dominant species of the undifferentiated grasses include; *Setaria nervosum*, *Digitaria macroblephara*, and *Eragrostis superba*. The granitic hills are dominated by undifferentiated semi deciduous montane forest.

Surveys conducted in the project area by KWS and KWRTI in the year 2025 in the project site identified the tree, shrubs and grass species. Sampling was done using a combination of transects walks and quadrat methods.

A total of 41 tree species, belonging to 14 plant families were recorded in the project site. Shrub species were 49 belonging to 23 different families, thus a higher diversity than the tree species. Grass species were 11 in number all belong to the Gramineae Family. The numbers indicate high diversity of tree and shrub species and average level diversity of grass species. The proposed project area is dominated by five herbaceous plant families including Rubiaceae, Acanthaceae, Amaranthaceae, Labiatae and Sterculiaceae, which are important in providing browse for the wildlife animals.

Table 4-1: Trees Species Recorded in the Project Area

Species Name	Family Name
1. <i>Lannea rivae</i>	Anacardiaceae
2. <i>Lannea triphylla</i>	Anacardiaceae
3. <i>Hyphaene compressa</i>	Arecaceae (Palmae)
4. <i>Balanites aegyptiaca</i>	Balanitaceae
5. <i>Ebretia amoena</i>	Boraginaceae
6. <i>Boswellia neglecta</i>	Burseraceae
7. <i>Commiphora africana</i>	Burseraceae



8. <i>Commiphora baluensis</i>	Burseraceae
9. <i>Commiphora campestris</i>	Burseraceae
10. <i>Commiphora edulis</i>	Burseraceae
11. <i>Commiphora schimperi</i>	Burseraceae
12. <i>Cassia abbreviata</i>	Caesalpinaceae
13. <i>Delonix elata</i>	Caesalpinaceae
14. <i>Boscia angustifolia</i>	Capparaceae
15. <i>Boscia coriacea</i>	Capparaceae
16. <i>Boscia salicifolia</i>	Capparaceae
17. <i>Maerua kirkii</i>	Capparaceae
18. <i>Combretum apiculatum</i>	Combretaceae
19. <i>Terminalia prunioides</i>	Combretaceae
20. <i>Terminalia spinosa</i>	Combretaceae
21. <i>Strychnos madagascariensis</i>	Loganiaceae
22. <i>Melia volkensii</i>	Meliaceae
23. <i>Vachellia mellifera</i>	Mimosaceae
24. <i>Vachellia nilotica</i>	Mimosaceae
25. <i>Vachellia reficiens</i>	Mimosaceae
26. <i>Vachellia robusta</i>	Mimosaceae
27. <i>Vachellia senegal</i>	Mimosaceae
28. <i>Acacia tortilis</i>	Mimosaceae
29. <i>Albizia amara</i>	Mimosaceae
30. <i>Albizia anthelminitica</i>	Mimosaceae
31. <i>Dichrostachys cinerea</i>	Mimosaceae
32. <i>Newtonia hildebrandtii</i>	Mimosaceae
33. <i>Dalbergia melanoxylon</i>	Papilionaceae
34. <i>Erythrina burtii</i>	Papilionaceae
35. <i>Sesbania sesban</i>	Papilionaceae
36. <i>Sesamothamnus rivae</i>	Pedaliaceae
37. <i>Ziziphus mucronata</i>	Rhamnaceae
38. <i>Zanthoxylum chalybeum</i>	Rutaceae



39. <i>Dobera glabra</i>	Salvadoraceae
40. <i>Haplocoelum foliosum</i>	Sapindaceae
41. <i>Sterculia africana</i>	Sterculiaceae

Table 4-2: Shrub Species Recorded in the Project Area

Species Name	Family Name
1. <i>Anisotes pervifolia</i>	Acanthaceae
2. <i>Barleria taitensis</i>	Acanthaceae
3. <i>Blepharis hildebrandtii</i>	Acanthaceae
4. <i>Sericocomopsis pallida</i>	Amaranthaceae
5. <i>Lannea alata</i>	Anacardiaceae
6. <i>Adenium obesum</i>	Apocynaceae
7. <i>Carissa tetramera</i>	Apocynaceae
8. <i>Carrisa edulis</i>	Apocynaceae
9. <i>Boussieria teintensis</i>	Boraginaceae
10. <i>Cordia gotzei</i>	Boraginaceae
11. <i>Cordia monoica</i>	Boraginaceae
12. <i>Cordia sinensis</i>	Boraginaceae
13. <i>Entada leptostachya</i>	Caesalpinaceae
14. <i>Bauhinia taitensis</i>	Caesalpiniaceae
15. <i>Capparis tormentosa</i>	Capparaceae
16. <i>Maerua decumbens</i>	Capparaceae
17. <i>Thylacium thomasii</i>	Capparaceae
18. <i>Salacia stuhlmanniana</i>	Celastraceae
19. <i>Cyclocheilon erianthemum</i>	Crassulaceae
20. <i>Acalypha fruticosa</i>	Euphorbiaceae
21. <i>Croton dichogamus</i>	Euphorbiaceae
22. <i>Erythrococca bongensis</i>	Euphorbiaceae
23. <i>Euphorbia cuneata</i>	Euphorbiaceae
24. <i>Phyllanthus reticulatus</i>	Euphorbiaceae



25. <i>Senna longiracemosa</i>	Fabaceae
26. <i>Erythroclamys spectabilis</i>	Labiatae
27. <i>Hoslundia opposita</i>	Labiatae
28. <i>Ocimum hadiense</i>	Labiatae
29. <i>Lawsonia inermis</i>	Lythraceae
30. <i>Abutilon hirtum</i>	Malvaceae
31. <i>Sida ovata</i>	Malvaceae
32. <i>Ochna innermis</i>	Ochnaceae
33. <i>Phoenix reclinata</i>	Palmae
34. <i>Crotalaria axillaris</i>	Papilionaceae
35. <i>Ormocarpum kenienne</i>	Papilionaceae
36. <i>Carphalea glaucescens</i>	Rubiaceae
37. <i>Tennantia sennii</i>	Rubiaceae
38. <i>Tricalysia ovalifolia</i>	Rubiaceae
39. <i>Salvadora persica</i>	Salvadoraceae
40. <i>Dousperma kilimandscharica</i>	Sapindaceae
41. <i>Solanum incanum</i>	Solanaceae
42. <i>Sterculia stenocarpa</i>	Sterculiaceae
43. <i>Grewia bicolor</i>	Tiliaceae
44. <i>Grewia forbesii</i>	Tiliaceae
45. <i>Grewia similis</i>	Tiliaceae
46. <i>Grewia tembensis</i>	Tiliaceae
47. <i>Grewia villosa</i>	Tiliaceae
48. <i>Premna hostii</i>	Verbenaceae
49. <i>Premna resinosa</i>	Verbenaceae

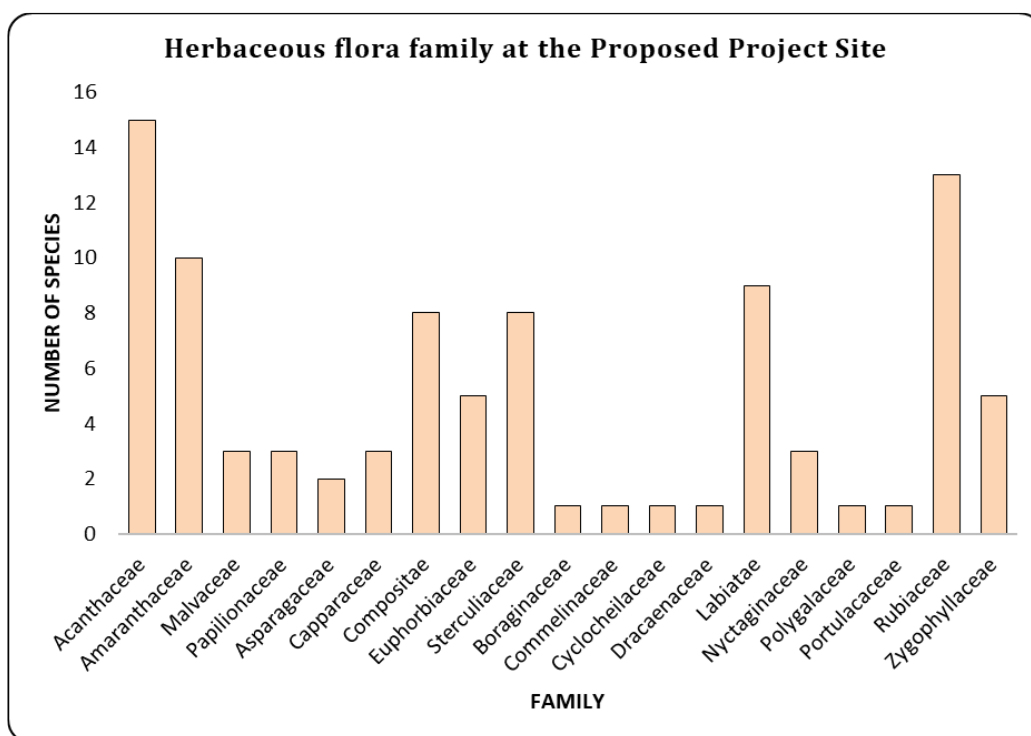


Figure 4-8: Herbaceous Flora Families at the Proposed Project Site

Table 4-3: Grass Species Recorded in the Project Area

Species Name	Family Name
1. <i>Cenchrus ciliaris</i>	Gramineae
2. <i>Chloris roxburghiana</i>	Gramineae
3. <i>Dactyloctenium aegyptium</i>	Gramineae
4. <i>Dichanthium annulatum</i>	Gramineae
5. <i>Digitaria milaniana</i>	Gramineae
6. <i>Eragrostis ciliaris</i>	Gramineae
7. <i>Heteropogon contortus</i>	Gramineae
8. <i>Panicum maximum</i>	Gramineae
9. <i>Tragus berteronianus</i>	Gramineae
10. <i>Sporobolus festinus</i>	Gramineae
11. <i>Panicum deustum</i>	Gramineae



Figure 4-9: Shrubs within TENP



Figure 4-10: Shrubs found in the project area; *Cordia senesis* (left) and *Grewia bicolor* (right)

4.7.2 Fauna

Taita Taveta County is rich wildlife with over 60% of the land under the protected area system. The common wildlife species in the County include Grants gazelle, Cokes hartebeest, Eland, Impala, Oryx, Zebra, Lesser kudu, Giraffe, Gerenuk, Dikdik, Duiker, Elephant, Warthog, Waterbuck, Buffalo, and Ostrich. The large carnivores found here mainly include the Cheetah, Lion, and Wild dogs. Importantly, the Taita hills within the County form the northern most edge of the eastern arc mountains and thus the area has several identified endangered and endemic species of both plants and animals. Among the endemic animal species are the Taita apallis and Taita thrush.

In the year 2025, WRTI and KWS conducted aerial animal census in Tsavo Ecosystem including the area where the proposed Athi dam and canal will be developed. A total of 36 different species of mammals were recorded and their conservation status according to IUCN determined. Of all the



species, 2, Black rhinoceros and Hirola are critically endangered, the Oryx is endangered, the lesser kundu and Gerenuk are near threatened and 7 species including Elephant, Giraffe, leopard, Eland, lion and cheetah are vulnerable.

Table 4-4: Mammals in Recorded in the Proposed Project Area in Tsavo East National Park

Species	Scientific Names	IUCN Status
1. Black rhinoceros	<i>Diceros bicornis</i>	Critically Endangered
2. Elephant	<i>Loxodonta africana</i>	Vulnerable
3. Hirola	<i>Beatragus hunteri</i>	Critically Endangered
4. Buffalo	<i>Syncerus caffer</i>	Least Concern
5. Common zebra	<i>Equus burchelli</i>	Least Concern
6. Giraffe	<i>Giraffa camelopardalis</i>	Vulnerable
7. Water buck	<i>Kobus ellipsiprymnus</i>	Least Concern
8. Kongoni	<i>Alcelaphus buselaphus cokii</i>	Least Concern
9. Kirk's dikdik	<i>Madoqua kirkii</i>	Least Concern
10. Common duiker	<i>Sylviaapra grimmia</i>	Least Concern
11. Lesser kudu	<i>Tragelaphus imberbis</i>	Near Threatened
12. Leopard	<i>Panthera pardus</i>	Vulnerable
13. Lion	<i>Panthera leo</i>	Vulnerable
14. Cheetah	<i>Acinonyx jubatus</i>	Vulnerable
15. Spotted hyena	<i>Crocuta crocuta</i>	Least Concern
16. Impala	<i>Aepyceros melampus</i>	Least Concern
17. Thomson's gazelle	<i>Eudorcas thomsonii</i>	Least Concern
18. Gerenuk	<i>Litocranius walleri</i>	Near Threatened
19. Yellow Baboons	<i>Papio cynocephalus</i>	Least Concern
20. Vervet monkey	<i>Cercopithecus aethiops</i>	Least Concern
21. Oryx	<i>Oryx beisa callotis</i>	Endangered
22. Yellow rock hyrax	<i>Heterohyrax brucei</i>	Least Concern
23. Common warthogs	<i>Paecothernus africanus</i>	Least Concern
24. Honey badger	<i>Mellivora capensis</i>	Least Concern
25. Unstriped ground squirrel	<i>Xerus rutilus</i>	Least Concern



26. Bush squirrel	<i>Paraxerus</i>	Least Concern
27. Crested porcupine	<i>Hystrix cristata</i>	Least Concern
28. Sliver backed jackal	<i>Canis mesomelas</i>	Least Concern
29. Cape hare	<i>Lepus capensis</i>	Least Concern
30. Eland	<i>Taurotragus oryx</i>	Vulnerable
31. White tailed mongoose	<i>Ichneumia albicauda</i>	Least Concern
32. Dwarf mongoose	<i>Helogale parvula</i>	Least Concern
33. Banded mongoose	<i>Mungos mungo</i>	Least Concern
34. African civet	<i>Civettictis civetta</i>	Least Concern
35. Bushbuck	<i>Tragelaphus sylvaticus</i>	Least Concern
36. Aardwolf	<i>Proteles cristata</i>	Least Concern

The two species, Hirola and Black rhinoceros that are critically endangered and the vulnerable elephants that are an icon of the ecosystem, are discussed in more details below.

a) Hirola

The hirola (*Beatragus hunteri*), also known as the Hunter's antelope or the four-eyed antelope, is one of the world's most endangered antelope species, native to the arid and semi-arid regions of Kenya and Somalia. The current population of hirola is reported to be decreasing, and is listed as critically endangered in the IUCN Red List (IUCN, 2023). Currently, the global population is estimated to be less than 250 individuals. Hirola inhabit semi-arid thorn bush, open bush grassland, to light woodland, and lush savanna grassland (Butynski, 2000). The conservation of the species in Kenya is affected by various factors (Andanje, 2002), which include:

- i. **Habitat loss and degradation:** Encroachment by human activities and overgrazing by livestock competes with hirola for food resources. Activities such as agriculture and settlement expansion are encroaching on the hirola's natural habitat, reducing the available space for these antelopes to live and graze.
- ii. **Poaching and hunting:** Poaching for bushmeat and trophies continues to threaten hirola populations. Despite legal protections, enforcement is often inadequate, and illegal hunting persists.



- iii. **Human-wildlife conflict:** In some areas, hirola are hunted by local communities in retaliation for competition with livestock or due to cultural practices.
- iv. **Predation:** The decline in other prey species and changes in predator-prey dynamics have led to increased predation pressure on hirola from lions, hyenas, and wild dogs.
- v. **Lack of safe havens:** Degradation of habitat and loss of traditional safe zones where predators are less active have made hirola more vulnerable to predation.
- vi. **Livestock disease transmission:** Hirola are susceptible to diseases transmitted by domestic livestock, such as rinderpest and bovine tuberculosis. Disease outbreaks can have devastating effects on small, isolated populations.
- vii. **Parasites:** Infestation by parasites, including ticks and gastrointestinal worms, weakens hirola, making them more vulnerable to other threats.
- viii. **Genetic diversity:** The small population size has led to a genetic bottleneck, reducing genetic diversity and increasing the risk of inbreeding. This can result in reduced fertility and higher susceptibility to diseases.
- ix. **Reproductive challenges:** Hirola have low reproductive rates, which hampers population recovery. Factors such as environmental stress, predation, and disease contribute to low calf survival rates.
- x. **Climate change:** Drought is a major threat to the conservation of the species. Increasing frequency and severity of droughts affect the availability of water and food, leading to malnutrition and higher mortality rates among hirola.

b) Black Rhino

Conservation efforts for black rhinos (*Diceros bicornis michaeli*) in Kenya have shown promising progress, characterized by significant milestones and innovative strategies. Historically, black rhino populations in Kenya faced severe declines due to poaching, with numbers dropping to fewer than 400 in the mid-1980s from about 20,000 in 1970. However, concerted conservation efforts have reversed this trend. As of 2023, Kenya's black rhino population has surpassed 1,000, marking a significant recovery. The government, alongside various conservation organizations, has developed species conservation action plans aimed at increasing the population to 2,000 by 2026, maintaining a growth rate of over 5% annually. The IUCN Red List has categorized the black rhino as critically

endangered (Emslie, 2020). Tsavo East National Park hosts a small number of the critically endangered black rhino. Rhino poaching remains to be one of the main threats to the conservation of the species.

c) Savanna Elephant

The savanna elephant (*Loxodonta africana*) is a keystone species in many landscapes within its range. The species is a mixed feeder and can thus survive in different habitats. The Tsavo ecosystem hosts the single largest elephant population in Kenya with over 14,000 individuals as of 2021 census. Poaching, habitat loss and human-elephant conflict are some of the challenges facing the conservation of the species. Tsavo ecosystem represents approximately 2.0% of remaining African elephant range. The elephant is a keystone species that is a focus of conservation in Tsavo. In parts of the ecosystem, large elephant densities have transformed bushlands into grasslands for example in the Aruba area of Tsavo East National Park and in the Taita Hills Wildlife Sanctuary.



Figure 4-11: Savanna Elephant

4.7.2.1 Animal Species Distribution in the Project Area

Aerial surveys conducted in the project area shows the distribution of animals in that area. As an illustration and for the purpose of report, the distribution of selected animal species in the project area is provided below. The animal species distribution maps indicate that the proposed project area has high diversity of animal species spread in the entire area with some like Zebra, Giraffe and Elephants having high concentration in the area.

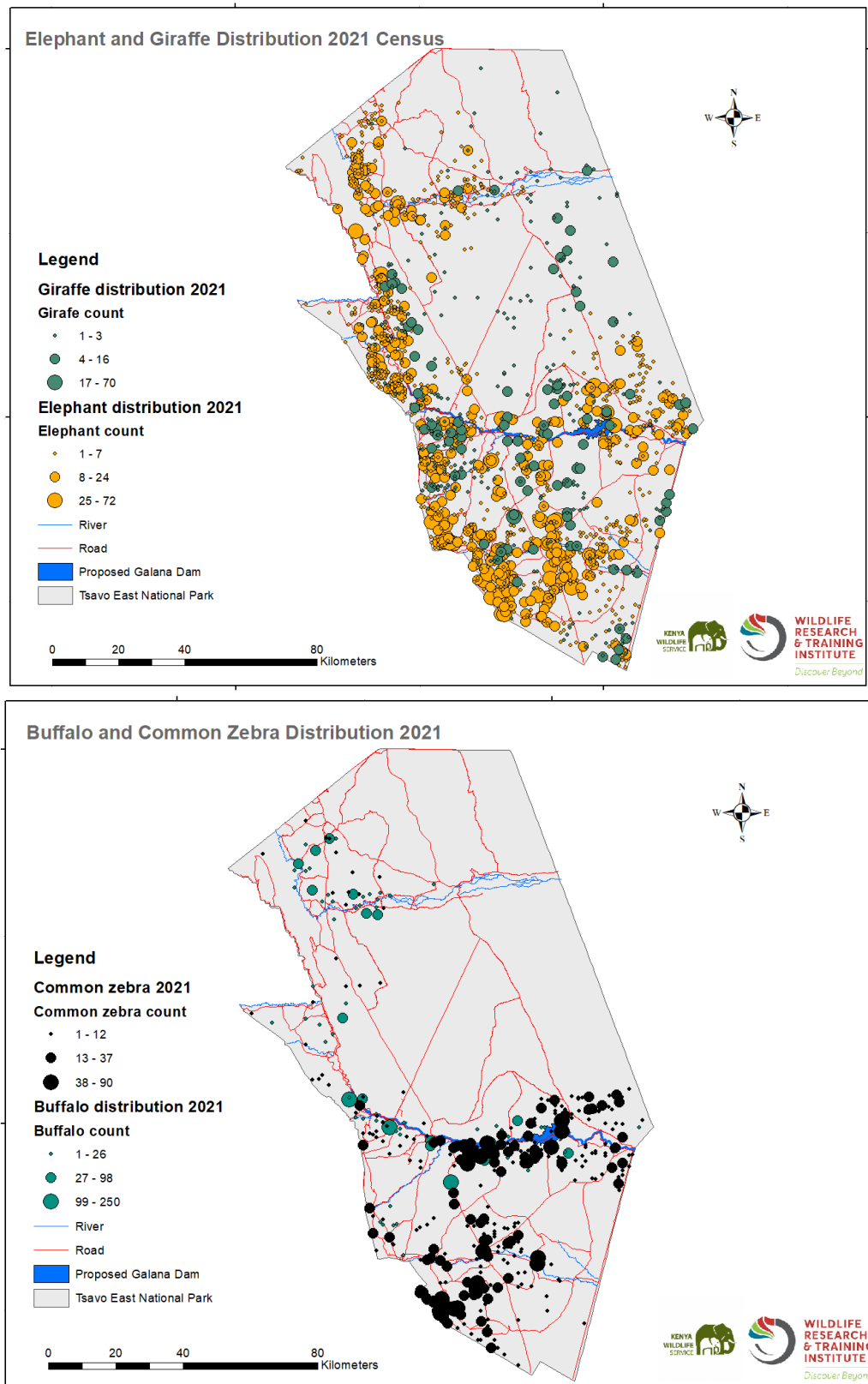
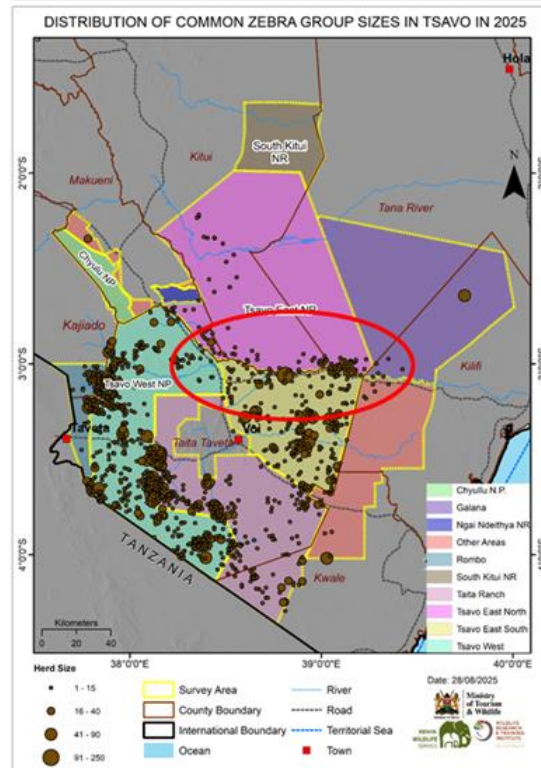
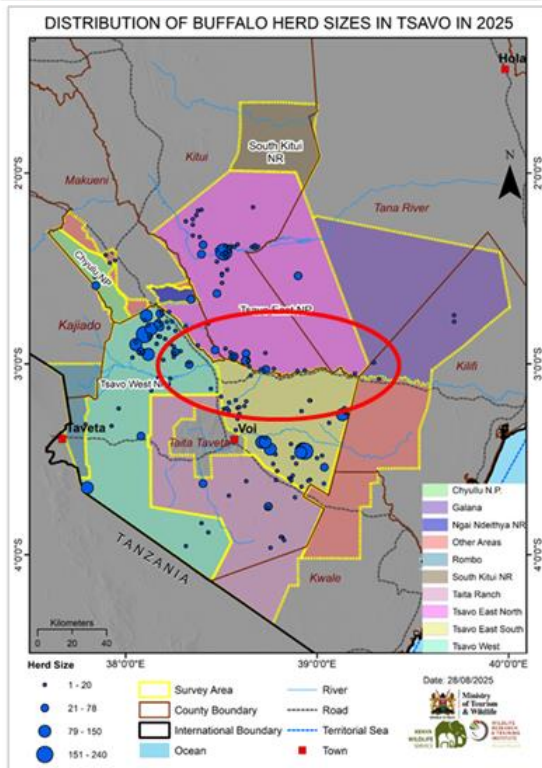
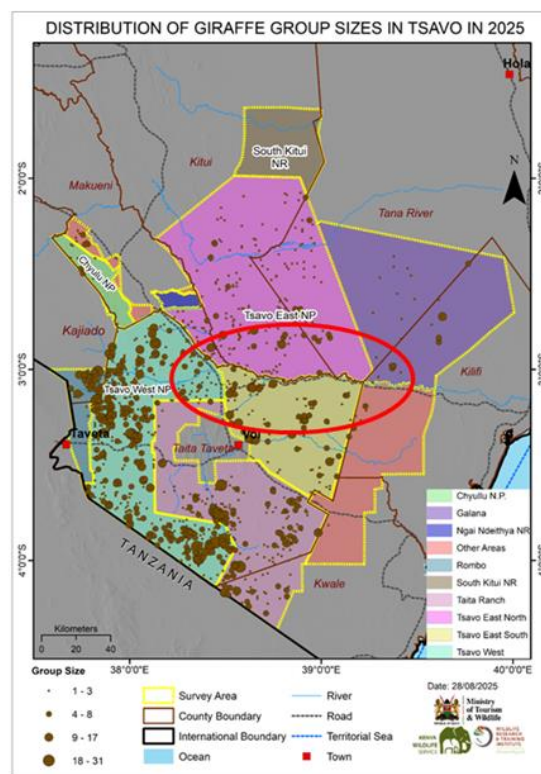
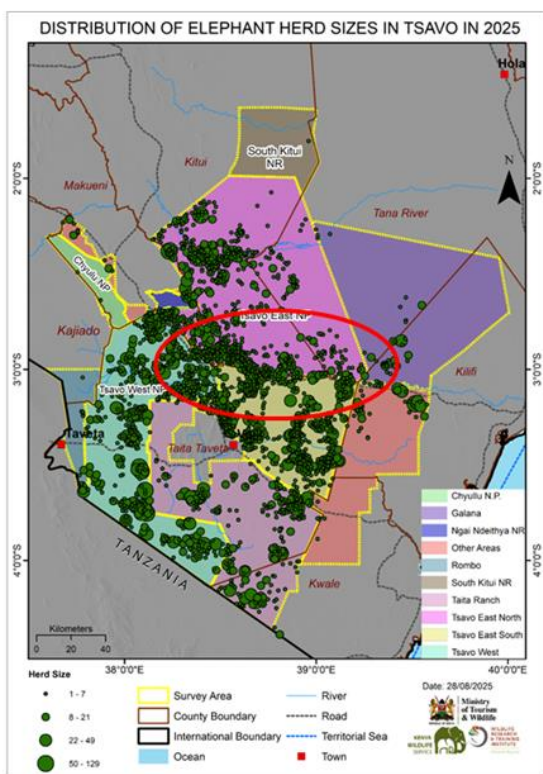


Figure 4-12: Elephant Distribution within TENP



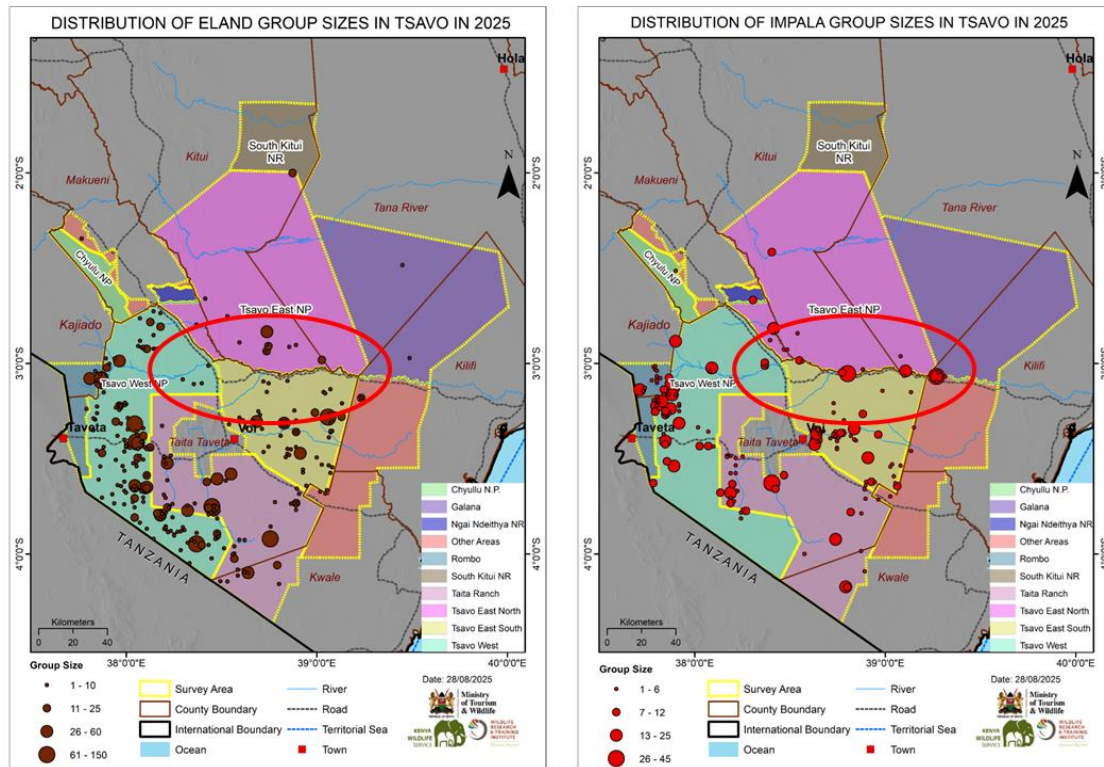


Figure 4-13: Distribution of Wildlife in the project site

4.7.3 Human –Wildlife conflict

Human–wildlife conflicts (HWC) occurs when people and wildlife interact negatively. Taita Taveta County is highly rated as a HWC hotspot (County Government of Taita Taveta, 2018). HWC in this County involves different wildlife species, with the most notorious being elephants, lions, hyenas, buffaloes, and primates among others. Of these species, elephants, baboons, and lions are associated with most HWC incidents in the Taita Taveta County (Long et al., 2020). HWC has detrimental effects to both people and wildlife.

4.7.4 Siltation in Water Bodies

Poor farming practices and environmental degradation is associated with siltation of water bodies. Siltation of water bodies affect the volume of water they can hold and thus compromises the water resource availability for wildlife and people especially during the dry seasons. For instance, siltation in Aruba dam in Tsavo East National Park has negatively impacted wildlife. Lake Jipe has also in the past recorded high levels of siltation due to poor farming practices in the catchment areas.



4.7.5 Invasive Species

This include the *Datura stramonium*, *Prosopis juliflora*, and *Opuntia sp.* that are fast invading parts of the Tsavo ecosystem. Invasive species degrade rangeland condition, replacing good plants with less palatable plants that are of less value to animals and people. Some of these invasive species have invaded disturbed areas, such as road and water pans construction sites. It is therefore important to ensure that the spread of invasive species is minimized during the proposed water pan construction.

4.7.6 Drought

The Tsavo ecosystem is within a semi-arid area that is prone to frequent droughts. During the peak of the dry season in the July to October reliable water supplies are few. This limited water availability highly affects wildlife that have to congregate in the few water points and thus causing vegetation degradation in those areas. Water supplementation particularly for water dependent species like elephant, zebras, and buffaloes among others is necessary as part of habitat enhancement. Studies indicate that elephants for instance have knowledge on location of water points (Wato et al., 2018). Thus, providing water for wildlife is positive step in reducing human–wildlife conflict and thus ensuring a peaceful coexistence between the two. In the project site, there are not water pans since the already existing water pans are located to the southern parts of the Tsavo East National Park.

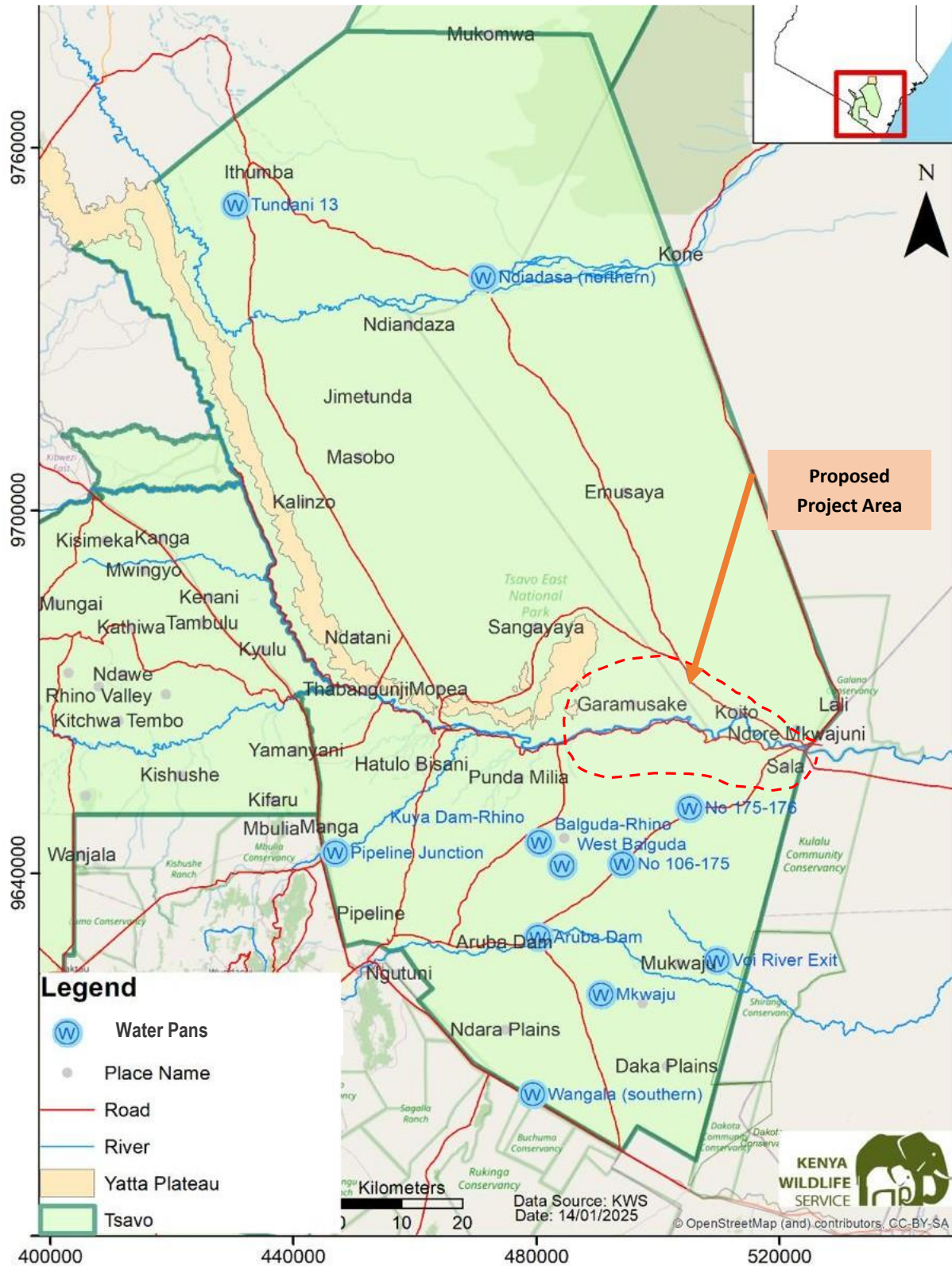


Figure 4-14: Existing Water Pans in Tsavo National Park



CHAPTER FIVE: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

5.1 Introduction

This chapter reviews and analyzes the relevant policies, laws, regulations and institutions that affect the implementation of the proposed Athi Dam and Associated Irrigation Water Conveyance System. The proposed dam project ought to adhere to the relevant policies and laws that govern environmental management matters in Kenya. The chapter is organized based on existing policy environment for key environmental resources presented in the baseline and also the institutions for their management.

5.2 Relevant Policies, Conventions and Treaties

5.2.1 Convention on International Trade in Endangered Species (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement to ensure that trade in wild animals and plants does not threaten their survival. It was established to regulate or ban international trade in species that are at risk of extinction. The agreement is voluntary, and countries that join are called Parties, legally committing to implement national laws that enforce CITES regulations. Kenya is a signatory to CITES, having ratified the convention in December 1978. Kenya implements CITES through the Kenya Wildlife Service (KWS), which is responsible for regulating the international trade of certain species listed in the Appendices of the Convention to ensure their survival in the wild. The proposed project is being implemented in a wildlife conservation area, where some animal species including Black rhinoceros and Hirola are critically endangered and the Oryx is endangered. It is postulated that the dam project may open up the area to humans increasing the risk of poaching of the critically endangered animals, thus threatening their survival. Kenya Wildlife Service will be tasked to put in place monitoring and protection plan for specific animal and plant species that may be affected by poaching and trade, especially in areas made more accessible to human due to the proposed project.

5.2.2 Ramsar Convention

The Ramsar Convention, formally known as the Convention on Wetlands of International Importance, is an international environmental treaty signed in 1971 in Ramsar, Iran, and it came into force in 1975 under UNESCO's auspices. Its primary goal is to halt the worldwide loss of wetlands



and promote their wise use and sustainable management, ensuring that these ecosystems continue to provide ecological, hydrological, and biological benefits. The proposed Athi Dam will create a massive wetland with Tsavo East National Park. In future, the wetland may be recognized as Ramsar site thus gaining another level of conservation status. This will require that as the project is being implemented both short- and long-term biodiversity management plans are put in place, to ensure protection and sustainable use of the dam as a wetland serving the objectives of biodiversity conservation, climate regulation, and human survival.

5.2.3 United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty established to address global climate change by preventing dangerous human interference with the climate system. Kenya is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and is committed to various climate change agreements, including the Kyoto Protocol and the Paris Agreement. Kenya's participation in UNFCCC activities and negotiations further solidifies its commitment to addressing climate change. The proposed project will have some influence on climate change, given its magnitude and location. Mitigation measures must therefore be designed and implemented to ensure that the project doesn't increase greenhouse gas concentrations in the atmosphere but also should allow ecosystems to adapt to the new environments created as a result of the dam and the water conveyance system.

5.2.4 Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) is a multilateral treaty aimed at the conservation of biological diversity, the sustainable use of its components, and the equitable sharing of benefits arising from the utilization of genetic resources. The CBD has two supplementary agreements: the Cartagena Protocol on Biosafety and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. The CBD seeks to address all threats to biodiversity and ecosystem services, including climate change, through scientific assessments, the development of tools, incentives, and processes, and the full and active involvement of relevant stakeholders. It is important that the proposed project ensures that ecosystems, species, and genetic diversity are protected and that there is no long term decline of biological resources. That will call for development of a comprehensive biological diversity strategy for conservation and management of biodiversity, not only in the project area but bringing the



project into the context of the entire Tsavo Conservation Area. Its components should be integrated into the Tsavo East Management Plan.

5.2.5 Convention on Migratory Species (CMS)

The Convention on Migratory Species (CMS) is a global treaty under the United Nations Environment Programme aimed at conserving migratory animals and their habitats across international borders. It is the only global, UN-based intergovernmental organization dedicated exclusively to the conservation and management of terrestrial, aquatic, and avian migratory species. Tsavo East National Park where the proposed project is located, is home to various migratory bird species, particularly during the breeding season from November to April. Some examples are; European Roller from Europe, Barn Swallow, Steppe Eagle, European Bee-eater. The CMS aims to conserve migratory species and their habitats by encouraging cooperation among countries that share these species. The proposed project should focus on ensuring that migratory animal species ecosystem within the project area are not degraded to the extent of affecting their short- and long-term conservation status.

5.2.6 World Bank Environmental and Social Safeguards

World Bank safeguards in Kenya, primarily managed under the Environmental and Social Framework comprise 10 Environmental and Social Standards. These standards ensure projects prevent harm to people and the environment, focusing on sustainable development, stakeholder engagement, involuntary resettlement management and labor protections in Kenya-funded projects. The Safeguards are critical to the Athi dam project focusing on managing risks linked to large-scale irrigation and water storage, such as loss of biodiversity and impacts on local communities. These policies ensure sustainable watershed management, dam safety and equitable community participation. Stakeholders' engagements and public consultation will be undertaken continuously from the design stage up to operation phase.

As the project includes building a large dam to expand irrigation, World Bank policies prioritize strict safety measures, environmental assessment, and monitoring to mitigate structural risks and downstream impacts. Ecological management of the Tsavo East National Park together with policies ensuring the protection of natural habitats and biodiversity will hence have to be undertaken during dam construction and operation. Adherence to these standards is intended to make the project environmentally sustainable and socially responsible, improving long-term success, according



to this World Bank document. The bank helps build local capacity at national and county levels for better management of environmental and social risks.

5.2.7 Irrigation policy

This policy is primarily driven by the National Irrigation Sector Investment Plan (NISIP) 2025–2035 and NISS 2022–2026, focuses on transitioning from subsistence to commercial, climate-resilient agriculture. It targets expanding irrigated land to over one million acres in four years, enhancing food security through public-private partnerships, implementing water tariffs, and utilizing climate finance to support small-scale farmers. The government plans to increase irrigated land from approximately 711,993 acres in 2022/23 to over 1.28 million acres by 2027/28, adopt Public-Private Partnerships (PPPs) to close funding gaps, introduce of a water tariff, funding small-scale irrigation, including facilitating 50% financing for equipment to aid smallholders and focus on commercial agribusiness.

This policy is highly relevant to the Athi dam project since it provides the framework to shift from rain-fed to irrigated agriculture, enhancing food security and drought resilience in the region. The policy encourages building dams and irrigation infrastructure, which supports the Athi-Galana dam's objective to boost agricultural productivity through water storage. By aligning with the National Irrigation Sector Investment Plan (NISIP), the dam supports the national goal of increasing land under irrigation, reducing post-harvest losses, and boosting value addition for economic transformation. The policy prioritizes irrigation to mitigate the effects of erratic rainfall and climate change, which is vital for the sustainability of agricultural projects in the Athi River basin area.

On capacity building, the policy prioritizes irrigation to mitigate the effects of erratic rainfall and climate change, which is vital for the sustainability of agricultural projects in the Athi River basin area. The Athi dam project serves as a cornerstone for Kenya's agricultural transformation directly implementing national policy goals.

5.2.8 National Environment Action Plan (NEAP)

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from economic and social development programmes that disregarded environmental sustainability. In this regard, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been



accomplished and/or are in the process of development. Under the NEAP process, EIA was introduced.

5.2.9 National Policy on Water Resources Management and Development

The National Policy on Water Resources Management and Development which is framed within the Sessional Paper No. 1 of 2021 and the Water Act 2016 was established to address current challenges like climate change, rapid urbanisation and right-to-water requirements. It also desires to supply water of good quality and in sufficient quantities to meet the various water needs while ensuring safe disposal of wastewater and environmental protection. The policy focuses on integrated management to increase water supply, sanitation access and food security in alignment with Kenya's Vision 2030 and Sustainable Development Goals (SDGs). Key priorities include strengthening water catchment conservation, improving irrigation efficiency and enhancing drought mitigation.

The policy emphasizes regulation of Athi River flows for flood management and to provide water for domestical, agricultural and industrial use specifically benefiting Kitui, Makueni and the coastal region. It aims to enhance community resilience in the Upper Athi River Catchment through watershed protection, rehabilitation of water storage facilities, and development of multi-purpose infrastructure. Together with Thwake Multi-purpose Water Development Program (TMWDP), the Athi dam project will be one of the key infrastructure development projects prioritizing building high-capacity dams for water supply and irrigation to support rural communities and industrial growth.

5.2.10 Water Policy

The Ministry of Water Resources in 1999, the precursor of the Ministry of Water & Irrigation developed a Water Policy Paper with the aim of providing an elaborate and efficient mechanism for the development of water resources and water use. This is known as the Sessional Paper Number 1 of 1999 on National Policy on Water Resources Management and Development. The Policy Paper set out to tackle issues pertaining to Water Resources Management, Water and Sewerage Development, Institutional Framework and Financing of the Water sector. It necessitated the overhauling of the existing Water Act (Cap 372) to the current Water Act 2002, which established the water provision and service institutions as they exist today. The Policy Paper stipulates that, the long-term objective of the Government of Kenya is to ensure that all residents in the country are entitled to clean and potable water by protecting the water resources: Section 2.6.2 proposes that the



water abstraction and disposal permits be dynamic and economic instruments for the water quality control. Section 2.6.3, states that ‘a process of water quality monitoring of all water bodies and pollution control inspection of existing and potential polluting sources will be put in place. Section 2.7.1, the policy paper stresses that there should be continuous water resources assessments for the determination of sources, extent, dependability and quality of water resources and further states that, monitoring of water quality parameters provides baseline data for the purpose of pollution control. Section 2.7.4 calls for the establishment of fully fledged hydrologic, hydrogeologic, water quality, water permits and socio-economic databases at all water resources management levels for the purpose of establishing comprehensive water resources databases. Section 3.3.1 mandates the Ministry of Water & Irrigation to facilitate formulation of policy framework to guide water sector activities. The proposed Athi Dam and Associated Irrigation Water Conveyance System shall adhere to the water policy requirements to ensure sustainable utilization of the same.

5.2.11 Environmental Policy

The Kenya Government’s environmental policy is geared towards sound environmental management for sustainable development. The Kenya Government’s environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

Optimal use of natural land and water resources in improving the quality of human environment; Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations; Integration of environmental conservation and economic activities into the process of sustainable development; and meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth. At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also local and international NGOs involved in environmental issues in the country. The object and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. NEMA mandate is designated to the several committees including the County Environment



Committees in respect of every County. They are responsible for the proper management of the environment within the County in respect of which they are appointed. The decisions of these committees are legal and it is an offence not to implement them.

5.2.12 The Land Policy

To restore the environmental integrity the government shall introduce incentives and encourage use of technology and scientific methods for soil conservation and maintain beaches at high and low water marks and put in place measures to control beach erosion. Fragile ecosystems shall be managed and protected by developing a comprehensive land use policy bearing in mind the needs of the surrounding communities. Zoning of catchment areas to protect them from further degradation and establishing participatory mechanisms for sustainable management of fragile ecosystems will also be done. It will also develop procedures for co-management and rehabilitation of forest resources while recognizing traditional management systems and sharing of benefits with contiguous communities and individuals. Lastly all the national parks, game reserves, islands, front row beaches and all areas hosting fragile biodiversity are declared as fragile ecosystems. Conservation and sustainable management of land based natural resources. The sustainable management of land-based natural resources depends largely on the governance system that defines the relationships between people, and between people and resources. To achieve an integrated approach to management of land based natural resources, all policies, regulations and laws dealing with these resources shall be harmonized with the framework established by the Environmental Management and Coordination Act (EMCA1999).

5.2.13 The Kenya Vision 2030

Kenya Vision 2030 is the current national development blueprint for period 2008 to 2030 and was developed following on the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation which saw the country's economy back on the path to rapid growth since 2002. Both the Vision 2030 and the First Medium Term Plan (MTP) recognize the important role that irrigation is expected to play in improving agricultural productivity and meeting Kenya's food security needs. The MTP estimates that irrigation can increase agricultural productivity four-fold and depending on crops multiply incomes by up to 10 times. The Government targets to exploit agricultural potential in Arid and Semi-arid Lands (ASALs) areas by putting an additional 600,000 hectares under irrigation. Specifically, the MTP aims to establishing an additional 25 small-scale irrigation schemes throughout the country and several irrigation schemes mainly in Tana River,



Athi River, Mwea, Yatta, Nyando, Nzoia Basin, Turkwell and Kerio river Basins. The implementation will be carried out jointly by the National Irrigation Board and the Agricultural Development Corporation (ADC).

5.2.14 National Climate Change Response Strategy

In 2020, the Ministry of Environment and Forestry coordinated the development of the National Climate Change Response Strategy (NCCRS). The purpose of this NCCRS “is to put in place robust measures needed to address most, if not all, of the challenges posed by climate variability and change”. To-date, this Strategy is the key Government climate change agenda guide in the Country and, it informs nationwide climate change programmes and development activities, including the formulation of documents such as the National Climate Change Policy and efforts towards the attainment of *Vision 2030*. Following all present and future climate change programmes and projects are and are to be developed in line with provisions of this Response Strategy.

Vis-à-vis, on mitigation interventions, the Response Strategy recommends “efforts that seek to prevent or slow down the increase of atmospheric greenhouse gas (GHG) concentrations by limiting current and future GHG emission and enhancing potential sinks for GHGs”. These efforts include:

- a) Restoring the country’s forest cover by growing about 7.6 billion trees on 4.1 million hectares of land during the next 20 years: The efforts are targeted to not only gazetted forests, but private forests, on-farm trees and any other areas in which trees can be grown.
- b) Pursuing an energy mix that greatly relies on carbon-neutral energy sources such as geothermal and other renewables (wind, solar and renewable biomass), in order to achieve the goal of low-carbon developed society: At present, Kenya’s power generation capacity is grossly inadequate to meet demand. Her main source of electricity is hydropower generation which is vulnerable to climate variability. Other sources are wind, geothermal and, recently, solar. To bridge the electricity generation shortfall from these, the Country occasional rents leases thermal generation units. These are expensive, require large subsidies, and are major contributor of GHG emissions. To counter these and other potential threats to the energy sector, two of the measures the Country has taken are:



- (i) Accelerating development of green energy including wind, solar and renewable biomass. With respect, the Country: 1) has reviewed and gazetted regulations for mandatory installation of solar hot water systems in residential and commercial houses; and, 2) is encouraging development of waste-to-energy projects, where municipal solid waste is converted to energy for domestic supply. This has the additional benefits including improving health and lowering demand for both landfilling waste and fossil fuels; and,
- (ii) Promoting embracement of energy efficiency, i.e. use of less energy to provide the same service without compromising the quality of service. With respect, the Country has enacted The Energy Management Regulations (2012), which enforces mandatory energy audits on large consumers of energy - commercial, industrial and other large institutions. And in 2009, the Country reviewed its building codes. The revised building code, “Planning and Building Regulations (2009)”, incorporate modern measures on ‘climate-proofing’ and the construction of energy-efficient buildings.

The relevance of the National Climate Change Response Strategy to the proposed project is ensuring restricting clearance of vegetation to the project affected area only, creation of green buffer zones, encouraging use of renewable energy within project and promoting energy efficiency in the construction and operation phases of the proposed dam project.

5.2.15 Kenya National Adaptation Plan (NAP) 2015-2030

This NAP builds on the foundation laid by the NCCRS and the National Climate Change Action Plan (NCCAP) 2013-2017. Additionally, it is the basis for the adaptation component of Kenya’s Intended Nationally Determined Contribution (INDC) that has been submitted to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. The aim of the NAP is to consolidate the Country’s vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and country level vulnerabilities to enhance long-term resilience and adaptive capacity. The NAP presents adaptation actions that cover the time frame 2015-2030.

With respect, the adaptation actions the NAP describes and are relevant to the proposed project include those related to:

- a) Enhancing climate proofing of infrastructure (through use of appropriate designs and building materials);



- b) Mainstreaming climate change adaptation in the environment sector. On this, relevance is the adaptation sub-action “Review and update existing Environmental Impacts Assessment (ESIA) regulations with climate change adaptation considerations”;
- c) Mainstreaming of climate change adaptation in the water sector, as Kenya requires adequate water management strategies that take into account the sector’s vulnerability to climate change. The strategies and plans are to manage, among others, water supply and wastewater. As regards, of relevance to the project is adaptation sub-action that promotes water conservation (recycling, wastewater management) and efficient water use.
- d) Enhancing the adaptive capacity of the population, urbanisation, and housing sector. This is toward “ensuring that continued population growth is matched with climate resilient urban development and green housing programmes”. This is “critical for Kenya’s sustainable development and providing a foundation for improving health and safety”. Respecting, of relevance to the project are the following two sub-actions: 1) strengthening enforcement of building codes by national and county governments; and, 2) integrating adaptation into relevant building and urban planning.
- e) Enhancing the resilience of the tourism value chain; and,

Creating enabling environment for the resilience of private sector investment. This is in recognition of the private sector being of “critical importance in eradicating poverty and hunger, and developing global partnerships for development. In addition, the sector can help build climate change resilience through its products and services, whilst robust national and international trade will become a crucial instrument to alleviate weather-induced food supply shortages. Climate change has the potential to curtail the success of private sector development (which is crucial to the Kenyan economy and underpins *Vision 2030*), through, for instance, supply chain disruptions, leading to the need of specific adaptation actions.

5.2.16 National Climate Change Action Plan (NCCAP 2023–2027)

This is a five-year iterative tool for the integration of low carbon climate resilient initiatives across different socio-economic sectors. It builds on the foundation laid during the implementation of the National Climate Change Action Plan (NCCAP) 2013-2017, and the Climate Change Act (No. 11 of 2016). And, it sets out bold measures to ensure that the Country’s development remains sustainable in the event of any adverse climate change impacts. Recognised in the Action Plan is that collective contributions by all (the National and County Governments, private sector, civil society, faith-based



organisations, other non-state actors, and individual citizens) will help deliver the expected transformational outcomes as relates to climate change. Thus, from this plan, the key priority climate change actions of relevance to the project, and which it is advisable the project complies with prior to commencement and completion of construction, are as follows:

- a) Priority 3: Water and the Blue Economy. Kenya is a water scarce Country, and this is one of the Country's largest challenges. This water situation has been exacerbated by among others, climate change, deforestation and a growing demand for water. The consequence of this is decreased access to quality water. This priority climate change action seeks to increase annual per capita water availability by June 30th 2023. To achieve this target, among the actions proposed under it, and are relevant to the Project are:
 - (i) Promoting water efficiency (monitor, reduce, re-use, recycle and modelling); and,
 - (ii) Enabling actions (policies and regulations). Those proposed are: 1) zero rate taxes on water harvesting and storage equipment; 2) development of a water harvesting policy for institutions and households; 3) reviewing by-laws that prohibit water harvesting in urban areas such as Nairobi; and, 4) formulating a policy for recycled water pricing and beneficiary sectors such as construction, watering flower beds and car washes.
- b) Priority 4: Forests, Wildlife and Tourism. At present, the Country's tree cover is less than 10% of the total land area; and, Chapter 5 of the Constitution of Kenya (2010) stipulates that this ten-percentage cover should be attained. This Action Plan commits to contribute to the restoration, preservation, and sustainable management of forests and other ecosystems that play an essential role in Kenya's economy. With respect to the Project, bordering the Project site on one side is a river (River Thigiri) and an urban forest (Karura Forest). The forest is one of three gazetted as state forests and are located in Nairobi City County. It is the largest of the three. According to the Nairobi City County Integrated Plan, it covers an estimated area of 1,041 hectares. About 632 hectares of this is covered with exotic tree plantations, while indigenous trees cover 260 hectares. The rest is shrubs and other plants. This Forest and the River are important national and county assets, thus presenting a case for the Project to comply with this Priority 4, as well as Priority 3 above.



- c) Priority 5: Health, Sanitation and Human Settlements. The rate of solid waste generated across urban centres has been faster than its management. Additionally, solid waste dumping sites are open in Kenya, making them exposed to runoff during heavy rains. And, further compounding the solid waste challenge in Kenya is inappropriate disposal and wastewater. The consequences are adverse environmental and human health impacts, including GHG emissions. In seeking to protect the human and environmental challenges posed by solid waste, the main guiding approach the Government of Kenya has taken is the “zero waste principle” as set out in the National Solid Waste Management Strategy (NSWMS). Recycling, composting, waste minimisation, and industrial symbiosis are important elements of this strategy. As regards to this Climate Change Action Priority 5, among the actions under it is “Promoting recycling to divert collected waste away from disposal sites”.
- d) Priority 7: Energy and Transport. This priority is with regard to reducing GHG emissions in energy and transport; and among the actions it promotes, that are relevant to the Project are:
- i) improved energy efficiency and energy conservation; ii) uptake of clean cooking, whereby clean fuels such as LPG, and ethanol are promoted and used; and, iii) enabling actions (technology) whereby uptake of climate change resilient technologies, such as modern coolers and scrubbers, are promoted.

5.3 Legal Framework

National statutes and regulations are applied on environmental conservation to ensure that proposed dam project is carried out without compromising the status of the natural resources in the area, environment resources, social and cultural setting as well as the economic potential of the local communities' health and safety. This position enhances the importance of this environmental impact assessment for the proposed site to provide a benchmark for its sustainable operation. The key national laws that govern the management of environmental resources in the country have been briefly discussed below.

5.3.1 The Constitution of Kenya, 2010

Constitution of Kenya provides that land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable. In this regard, land within the project area ought to be used and managed equitably, efficiently, productively and sustainable by conservation of the environment and optimal use of land and land resources. The proponent ought to ensure that the



project is ecologically, economically and socially sustainable as well as ensure that all the applicable provisions of the Constitution are observed at all times.

5.3.2 The Environmental Management and Co-ordination Act (EMCA), 1999

The Environmental Management and Co-ordination Act (EMCA) of 1999 provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for the matters connected therewith and incidental thereto. It provides for establishment of National environment management authority (NEMA) a body charged with the responsibility of ensuring a clean and healthy environment. The act provides various standards and regulations in regards to different developments or land uses with a provision for environmental impact assessment for selected developments. Its emphasis is on clean and healthy environment for all people in Kenya. It has several Regulations outlined below.

5.3.2.1 Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 (Legal Notice No. 31 & 32)

The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 specify and categorize projects in respect to the magnitude of the impacts to the environment; low risk, medium risk and high risk. It requires every proponent undertaking a project specified in the Second Schedule of EMCA to prepare and submit a project report of the likely environmental effects of the project and the project report to be prepared by a registered environmental impact assessment expert. The relevance of this regulation to the project includes the acquisition of a NEMA license before the commencement of the project and provision of procedures and modalities for preparation of comprehensive project report.

5.3.2.2 Water Quality Regulations (Legal Notice No. 120 of 2006)

Water quality regulations were gazetted as a legislative supplement mainly to address the challenges of pollution of water sources and conservation. The regulation provides guides for water use and conservation as well as effluent standards for discharge. The relevance of the regulation to the proposed project includes ensuring that the effluent from the premise meets the standards set out under Schedule V.

5.3.2.3 Waste Management Regulations (Legal Notice No.121 of 2006)

In pursuit of the provisions of EMCA 1999, the Minister for Environment in 2006 gazetted the waste management regulations focusing on management of solid, industrial and hazardous wastes,



pesticides, toxic and radioactive substances. The relevance of the regulation to the proposed project includes provision of litter bins that foster separation of wastes at source and disposal of solid waste in the prescribed manner.

5.3.2.4 Noise Regulations (Legal Notice No. 61 of 2009)

These Regulations were gazetted to manage noise pollution to levels that do not cause a disturbance/nuisance to the public. Generally, construction sites generate noise that is above 85 dB (A). The proposed construction activities will have a potential for the production of noise above the acceptable limits. The relevance of the regulation to the proposed project include compliance with the set noise level limits for the site especially during construction and occupational phases.

5.3.3 The Water Act of 2016

The Act provides a framework for the regulation, management, and development of water resources and services, aligning the sector with the 2010 Constitution. It decentralizes water services to county governments, establishes key national institutions like the Water Resources Authority (WRA) and Water Services Regulatory Board (WASREB), and emphasizes sustainable management, catchment conservation, and equitable water access.

The relevance of the act to the proposed project include compliance to the act in regards to water usage in all phases of the project cycle and provision of a permit from Water Resources Authority (WRA) for the dam's water abstraction and the involvement of local communities in the planning phase, ensuring the project's sustainability and social.

5.3.4 Energy Act No. 1 of 2019

The Energy Act 2019 (Kenya) consolidates laws on energy, aiming to provide affordable, sustainable energy by regulating electricity, renewable energy, and petroleum. It established the Energy and Petroleum Regulatory Authority (EPRA) as the primary regulator, replacing the ERC, and created the Rural Electrification and Renewable Energy Corporation (REREC) and Nuclear Power and Energy Agency (NuPEA).

The relevance of the act to the proposed project includes developing of renewable energy master plans, which are being used to replace diesel pumps with reliable, cheaper grid power, the use of clean energy sources aligned with the project's aim to reduce the carbon footprint of large-scale agriculture and the licensing of the power infrastructure at the dam by EPRA.



5.3.5 Occupational Health and Safety Act No. 15 of 2007

The Act applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to: Secure the safety, health and welfare of persons at work and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work. In regards to safety, hoarding of the project site should be done and workers must be trained on personal safety. Adequate fire Extinguishers should be installed at the facility and an assembly point provided and marked. In regards to health, the premises must be kept clean; dusting done daily and washrooms kept clean and in good working conditions and necessary facilities provided.

5.3.6 The Public Health Act, Chapter 242

The public health Act regulates activities detrimental to human health. The Act prohibits activities that may be injurious to health. It then becomes the responsibility of the local authority to maintain clean and sanitary conditions around the proposed development. The relevance of the act to the proposed project entails adequate provision of clean and safe drinking water, proper waste disposal, prevention of all activities that would be a nuisance to the public and strict adherence to COVID 19 regulations.

5.3.7 The Physical and Land Use Planning Act (PLUPA)

This Act provides for the purposes of the Local Physical Development Plans to be for the purposes of zoning, urban renewal or redevelopment, guiding and coordinating the development of infrastructure, regulating land use and land development and giving effect to any Integrated City or Urban Development Plan. The relevance of this Act to the proposed project is to ensure that the proposed development is in compliance with the set zoning guidelines for the project area.

5.3.8 Wildlife Conservation and Management Act, 2013

This Act provides for protection, conservation and management of wildlife in Kenya and related matters. The Act shall apply to all wildlife resources on public, community and private land, and Kenya territorial waters. The Act provides for conservation, protection and management of wildlife, establishment of the Wildlife Research and Training Institute and how to mitigate Human wildlife conflict. The relevance of this Act to the proposed project is to ensure that the proposed dam project enhances wildlife conservation.



5.3.9 Health Act, 2017

Part IX section 115 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 and include nuisances caused by accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

5.3.10 The Forest Conservation and Management Act (FCMA) of 2016

provides a framework for the sustainable management, conservation, and utilization of forest resources, aiming to achieve at least 10% forest cover. It establishes the Kenya Forest Service (KFS) to manage public forests, fosters community participation, and regulates forest-related industries and trade.

Under Section 32, the Kenya Forest Service is responsible for managing water catchment areas, crucial for the dam's long-term viability, and for supporting sustainable water management to prevent degradation in arid regions. Section 7 requires licenses for accessing forest resources, which may apply if construction materials are sourced from nearby forest areas.

5.3.11 The Agriculture and Food Authority (AFA) Act No. 13 of 2013

The Act aims to promote the production, processing, marketing, and distribution of crops and fish, aiming to boost efficiency and reduce the bureaucratic burden of multiple independent boards. The Act provides for establishment of Agriculture and Food Authority (AFA) which is responsible for collecting agricultural data, setting research priorities, promoting best practices, and advising national/county governments on agricultural levies.

The Galana-Kulalu irrigation project involves the construction of a 305MCM dam aimed at irrigating up to 300,000 acres to increase food production, particularly maize, rice, and animal feed. The AFA Act is relevant because as the project scales up production of cereals and potential export crops, the authority ensures compliance with standards for food security and export standards and by managing the supply chain, the AFA acts to stabilize food prices, a major goal of the dam project.



5.3.12 Kenya Roads Act, No 2 of 2007

This act provides for establishment of Kenya National Highways Authority (KeNHA) which is responsible for the management, development, rehabilitation and maintenance of national roads. With the dam project expected to lead to rerouting of section of C103 highway within the park, KeNHA will be engaged in the rerouting activities.

5.3.13 Climate Act, 2016

This is an Act of parliament to provide a regulatory framework for enhanced response to climate change at both the National and County Government levels, to provide for mechanisms and measures to achieve low carbon climate development and for connected purposes. The Act was promulgated in line with Kenya's responsibility to mitigate the effects of climate change, and in keeping with the objective of the *Paris Agreement*. Consequently, climate change is now recognised as a crosscutting thematic area in the Country's planning process. The proposed dam project is a climate change mitigation measure as a drought mitigation measure through storage and provision of water for both wildlife and irrigation purposes.

5.3.14 Employment Act, 2007

This act declares and defines fundamental rights of employees, to provide basic condition of employment of employees, regulate employment of children and to provide for matters connected to employment in the country. The proposed project is expected to provide employment for both skilled and unskilled labour with the rights and basic conditions of employment being covered in the project.

5.3.15 National Construction Act (NCA)

The act provides for establishment, powers and functions of National Construction Authority and the connected purposes and the chief regulator of the construction and building sector in Kenya. The NCA regulates contractors involved in building and construction works and roads work and proceeds to classify contractors based on their capacity to carry out the works. The construction works of the proposed dam project will be regulated by NCA and will be in strict adherence to the act.

5.3.16 Work Injury Benefits Act, 2007

Section 7. (1) Require that the proponent to obtain and maintain an insurance policy, in respect of any liability that the employer may incur under this Act to any of his employees. Section 10 (1) of



the Act entitles an employee involved in an accident resulting in the employee's disablement or death is subject to the provisions of this Act, to the benefits provided for under this Act. (2) An employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work. This was earlier stated under Workmen's Compensation Act, Cap 236. The proponent will ensure the engagement of a qualified, registered and licensed personnel. Through the EMP the proponent has defined the measures to be undertaken to prevent or reduce injuries that may occur during the specified work activities. All activities will be closely monitored in consultation with relevant authorities such as National Environment Management Authority, Kenya Wildlife Service, and the Ministry of Irrigation and Sanitation to enforce compliance to the ESMP.

5.3.17 Lands Act, No. 6 of 2012

This is an act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land-based resources, and connected purposes. The proposed project falls under ecologically sensitive public land (Tsavo East National Park).

Part II Section 8 provides guidelines on the management of public land by the National Land Commission on behalf of both National and County Governments. This law in Section 8(b) stipulates that the Commission shall evaluate all parcels of public land based on land capability classification, land resources mapping consideration, overall potential for use, and resource evaluation data for land use planning. Section 8(d) stipulates that The Commission may require the land to be used for specified purposes subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument.

In managing public land, the Commission is further required in Section 10(1) to prescribe guidelines for the management of public land by all public agencies, statutory bodies and state corporations in actual occupation or use. In these guidelines management priorities and operational principles for the management of public land resources for identified uses shall be stated. This in essence means that the Commission shall take appropriate action to maintain public land that has endangered or endemic species of flora and fauna, critical habitats or protected areas. As well the Commission shall identify ecologically sensitive areas that are within public lands and demarcate or take any other justified action on those areas and act to prevent environmental degradation and climate change.



This act ensures that the ecological use of the protected area (Tsavo East National Park)) is not affected by the implementation of the proposed project. Further, the protected area is managed by the Kenya Wildlife Service according to the Wildlife Management and Conservation Act 2013.

5.3.18 Land Registration Act, 2012

This is an act of Parliament to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.

The proposed project shall be implemented in close coordination with the National Irrigation Authority and Kenya Wildlife Service, both government entities, and may therefore not trigger separate land registration processes.

5.3.19 County Government Act, 2012

An Act of Parliament to give effect to Chapter Eleven of the Constitution; to provide for county governments' powers, functions, and responsibilities to deliver services and for connected purposes. Part VIII of the Act outlines the principles of citizen participation in counties as;

- (a) Timely access to information, data, documents, and other information relevant or related to policy formulation and implementation;
- (b) Reasonable access to the process of formulating and implementing policies, laws, and regulations, including the approval of development proposals, sub-projects, and budgets, the granting of permits and the establishment of specific performance standards;
- (c) Protection and promotion of the interest and rights of minorities, marginalized groups and communities and their access to relevant information;
- (d) Legal standing to interested or affected persons, organizations, and where pertinent, communities, to appeal from or, review decisions, or redress grievances, with particular emphasis on persons and traditionally marginalized communities, including women, the youth, and disadvantaged communities;
- (e) Reasonable balance in the roles and obligations of county governments and non-state actors in decision-making processes to promote shared responsibility and partnership, and to provide complementary authority and oversight;

Section 163 allows counties to control or prohibit all businesses, factories and workshops which, by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhood, and to prescribe the



conditions subject to which such businesses, factories and workshops shall be carried on. The same section allows counties to prohibit, control and regulate trade and trading activities within their jurisdiction.

The project proponents i.e. National Irrigation Authority in coordination with Kenya Wildlife Service should ensure smooth coordination of the protected areas. Further, a well-structured forum for engaging the citizens and relevant stakeholders on matters related to the project has been established.

5.3.20 Community Land Act, 2016

The Community Land Act, 2016 (no.27 of 2016) is a Kenyan law that provides for the recognition, protection and registration of community land rights. The act also covers the management and administration of community land, including the environment and natural resources. The Act states that customary land rights, including those held in common, shall have equal force and effect in law with freehold or leasehold rights acquired through allocation, registration or transfer. Community land may be compulsorily acquired by the State only in accordance with the law and for a public purpose. The act requires that every person dealing with community land be guided by the principles and values set out in the constitution.

The project is proposed within the Tsavo East National Park but some of the likely impacts are expected in community lands downstream of the project area. The Project proponent will work closely with the affected communities, local leadership and partners to address the impacts.

5.3.21 National Land Commission Act, 2012

The act creates the National Land Commission, providing for the functions and powers of the commission and proceeds to give effect to the objects and principles of devolved government in land management and administration.

Under Section 5, the law empowers the commission to manage public land on behalf of the national and county governments and to monitor and have oversight responsibilities over land use planning throughout the country. The Land Act further elaborates on the coordination mechanism between the Commission and public agencies, statutory bodies and state corporations in the management of public lands.



The Proposed Project is situated within public lands and the proponents, Kenya Wildlife Service and National Irrigation Authority, will work closely with the National Land Commission to address relevant processes triggered by the proposed project.

5.3.22 Irrigation Act, No. 14 of 2019

It provides a legal framework for developing, managing, and regulating irrigation in Kenya to ensure food security. It established the National Irrigation Authority (NIA) as the successor to the National Irrigation Board, focusing on sustainable water use, infrastructure development and managing public schemes.

The proposed dam project which is an irrigation infrastructure and a critical component of Galana Kulalu irrigation scheme shall be implemented by the National Irrigation Authority (NIA) which is responsible for developing and managing irrigation infrastructure including dams.

5.3.22.1 Irrigation (General) Regulations, 2020

The Irrigation (General) Regulations in Kenya emphasize on water harvesting and storage to ensure reliable water supply for irrigation, especially where natural water resources are scarce or unreliable. These regulations mandate that irrigation users implement water harvesting and storage measures, including flood water harvesting, and may also consider the use of recycled wastewater. In addition, the regulations outline the process for obtaining water use rights and paying for water from storage structure.

The relevance of these regulations to the project is ensuring that NIA (which is an entity engaged in irrigation) implements water harvesting and storage measures through storage of enough floodwater capable of meeting the irrigation demands through implementation of the dam project. In addition, the implementation of the dam ought to be undertaken within the context of a national irrigation master plan, county irrigation master plan, investment plan and respective strategic plans to support sustainable food security and socio-economic development of the country and ought to be compliant with all relevant statutory requirements and for NIA to source for funds finance implementation of the dam project through appropriate modality including private investments, financial institutions, loans and grants from government and development partners, public-private partnerships or cost-sharing.



5.4 Institutional Framework

The institutional framework entails Institutional Structure of the Water Sector, Wildlife Resource, Land Resource and Project Institutional Management Structure.

5.4.1 Institutional Structure of the Water Sector

The National Policy on Water Resources Management and Development and the Water Act 2002, presently guides water resources management. The overall goal of the national water development policy is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance to meet all competing uses in a sustainable, rational and economical way. Under the policy, the Ministry of Environment, Water and Natural Resources is responsible for policy development, sector co-ordination, monitoring and supervision to ensure effective Water and Sewerage Services in the Country, sustainability of Water Resources and development of Water resources for irrigation, commercial, industrial, power generation and other uses. It executes its mandate through the following sector institutions:

5.4.1.1 Water Services Regulatory Board (WASREB)

The regulatory Board is responsible for the regulation of the water and sewerage services in partnership with the people of Kenya. The mandate of the regulator covers the following key areas;

- i. Regulating the provision of water and sewerage services including licensing, quality assurance, and issuance of guidelines for tariffs, prices and disputes resolution.
- ii. Overseeing the implementation of policies and strategies relating to provision of water services licensing of Water Services Boards and approving their appointed Water Services Providers,
- iii. Monitoring the performance of the Water Services Boards and Water Services Providers,
- iv. Establish the procedure of customer complaints,
- v. Inform the public on the sector performance,
- vi. Gives advice to the Minister in charge of water affairs.

5.4.1.2 Water Resources Authority (WRA)

The authority is responsible for sustainable management of the Nations Water Resources;

- i. Implementation of policies and strategies relating to management of Water resources
- ii. Develop principles, guidelines and procedures for the allocation of water,



- iii. Development of Catchments level management strategies including appointment of catchments area advisory committees,
- iv. Regulate and protect water resources quality from adverse

5.4.1.3 Water Services Trust Fund (WSTF)

This body assists in the financing of the provision of Water Services to areas of Kenya, which are without adequate water services. This shall include providing financing support to improved water services towards;

- i. Capital investment to community water schemes in underserved areas
- ii. Capacity building activities and initiative among communities
- iii. Water services activities outlined in the Water Services Strategic Plan as prioritized by the Government
- iv. Awareness creation and information dissemination regarding community management of water services

5.4.2 Institutional Structure of the Wildlife Resource

The dam project site is located within a national park and the proposed project is expected to affect wildlife and hence the importance of the institutions which are mandated to management and conservation of wildlife.

5.4.2.1 Kenya Wildlife Service (KWS)

KWS was created under the Wildlife Conservation and Management Act Number 47 of 2013 with its mandated being to conserve and manage wildlife in Kenya and to enforce related laws and regulations. The relevant roles and responsibility of KWS to the proposed projects include:

- i. Conserve and manage national parks, wildlife conservation areas and sanctuaries
- ii. Provide security for wildlife and visitors in national parks, wildlife conservation areas and sanctuaries;
- iii. Coordinate the preparation and implementation of ecosystem plans;
- iv. Prepare and implement national park management plans;
- v. Undertake and conduct enforcement activities such as anti- poaching operations, wildlife protection, intelligence gathering, investigations and other enforcement activities for the effective carrying out of the provisions of this Act;



- vi. Conduct and co-ordinate, all research activities in the field of wildlife conservation and management and ensure application of research findings in conservation planning, implementation and decision making;
- vii. Promote and undertake extension service programmes intended to enhance wildlife conservation, education and training;
- viii. Grant permits

5.4.2.2 Wildlife Research and Training Institute

The Wildlife Research and Training Institute (WRTI) is a State Corporation established under Section 50 of the Wildlife Conservation and Management Act No. 47 of 2013 with its headquarters in Naivasha, Kenya. WRTI has established field centres and subcentres in key wildlife conservation areas across the country to address specific agro-climatic research thematic areas. The Institute is empowered under section 52 of the Act to collect and analyze wildlife data and information to support planning and decision-making by different stakeholders, relating to inventory and status of wildlife resources countrywide; trends in wildlife conservation and management approaches and practices, processes or activities likely to impact on sustainable wildlife conservation and management and also to provide wildlife statistics. Further, the Institute is empowered by law to provide training and capacity development programmes, give information on early warning, disaster management, impacts and mitigation and adaptive strategies to climate change in wildlife conservation areas. Importantly, the Institute assesses information that is the basis of ecosystem-based management plans for all wildlife conservation areas.

5.4.3 Institutional Structure of Land Resources

5.4.3.1 Coast Development Authority

Coast Development Authority (CDA) was established by the Coast Development Authority Act, CAP 449 of the Laws of Kenya, to plan for the development of a “Development Area”, meaning the part of the Coast Province as previously demarcated as Lamu, Mombasa, Kilifi, Tana River, Kwale and Taita Taveta, and including the southern half of Garissa district and the exclusive economic zone.

CDA was created to plan for the development of the Development Area and initiate project activities identified from such planning in the development and through the government generally. Other tasks include; developing an up-to-date long-range development plan for the area,



coordinating the various studies of schemes within the area such that human, water, animal, land and other resources are utilized to the best advantage and monitoring the design and execution of planned projects within the area, to coordinate the present abstraction and use of natural resources, especially water, within the area and to set up effective monitoring of abstraction and usage. Further, the CDA is to ensure that landowners in the area undertake all the measures specified by the Coast Development Authority to protect the water and soils of the area and to implement development projects and programmes whose primary objective is to promote the socio-economic development of the Coast Province in particular and Kenya in general.

5.4.3.2 County Governments

The county governments of Kilifi, Taita Taveta, Tana River, and Kitui are relevant in the management of the Tsavo Conservation Area and in the context of the proposed project. The County Government Act provides for the establishment of the County Government and together with the constitution, provides for the delimitation of functions between the two levels of government and the coordination mechanisms across the shared mandates through the Intergovernmental Relations Act.

The proposed project triggers coordination mechanisms across these governments around the protection and conservation of water catchment areas upstream of the project area and the mitigation plans for downstream impacts.

5.4.3.3 National Land Commission

The law empowers the commission to manage public land on behalf of the national and county governments and to monitor and have oversight responsibilities over land use planning throughout the country. The Land Act further elaborates on the coordination mechanism between the Commission and public agencies, statutory bodies and state corporations in the management of public lands.

5.4.4 Project Institutional Management Structure

The implementation of the project will involve various institutions including KWS, NIA and the Project Contractor (China Communication Construction Company).



5.4.4.1 National Irrigation Authority (NIA)

The main role of NIA in the proposed dam project includes undertaking topographic survey and geological exploration and preparation of site survey reports, concept design report and work arrangement, technical scheme of project, feasibility studies, detailed designs preparation and tendering for construction.

5.4.4.2 Kenya Wildlife Services (KWS)

KWS being the custodians of the Tsavo East National Park has the responsibility of controlling access to the project site, issuance of consent/permission for any activity within the park, oversee the construction of the dam project, supporting NIA in undertaking topographic survey and geological exploration, provide necessary support to the project contractor including provision of security in the workers' camp and construction sites, undertake surveillance of the project site, sensitize the public and tourists on dam safety issues associated with the dam and prepare vegetation restoration plans and programmes in collaboration with the project contractor.

5.4.4.3 The Project Contractor (CCCC)

The roles of project contractor in the proposed project include undertaking topographic survey and geological exploration, feasibility studies, detailed designs preparation and preparation of the project technical report on behalf of NIA. In addition, CCCC is responsible for construction of all the dam project components, recruitment and training of workers as well as establishment of an environmental office to continuously advise on environmental components of the project implementation. Elements in the environmental and social management plan are expected to be integrated in the project with appropriate consultations with KWS and NIA through the supervising environmental expert.



CHAPTER SIX: PUBLIC CONSULTATION AND PARTICIPATION

6.1 Introduction

Stakeholders are all those people and institutions who have an interest in the successful design, implementation and sustainability of a project. This includes those positively and negatively affected by the project. Stakeholder participation involves processes whereby all those with a stake in the outcome of a project can actively participate in decisions on planning and management. They share information and knowledge, and may contribute to the project, so as to enhance the success of the project and hence ultimately their own interests'. Different types of stakeholders can contribute to the ESIA process in different ways and, in most cases; inputs from a broad variety of stakeholders will complement the ESIA process. Stakeholder interests exist at different levels.

Participation in this case is not just through elected representatives but also through direct action. The Environmental Management and Coordination Act (EMCA, 1999) and its subsequent Environmental (Impact Assessment and Audit) Regulations, 2003 underscore the need for stakeholder participation in the ESIA process. Neighbours of a proposed project have to live with the project if implemented. They have the most to gain if the project impacts are beneficial to them. Conversely, they have the most at stake if the project goes awry. Not just neighbours but for projects whose impacts have a wide geographical spread, distant communities need to be involved. Stakeholder input is thus vital at the earliest stage possible in project development and should continue throughout the project cycle.

6.2 Role of public consultation and participation in ESIA process

The main purpose of carrying out consultations with project affected persons and key stakeholders was to obtain views and concerns from the project affected people regarding the proposed Athi Dam and Associated Irrigation Water Conveyance System so as to incorporate their contribution into the proposed project to safeguard the Tsavo Conservancy Area and the interests of key stakeholders particularly the NIA & KWS, Tsavo Trust, Wildlife works, Team Tsavo, ADC, Voi Safari lodges, Sentrin Lodge, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Ranches, Save The Elephant, Wildlife Research & Training Institute, local communities downstream and agencies directly or indirectly affected by the proposed project.



Stakeholder consultation was conducted to disclose the details of the proposed project, to inform the stakeholders of anticipated positive aspects and the anticipated negative impacts so that informed decisions are made by the stakeholders.

The public consultation and participation exercise was aimed at achieving the following specific objectives:

- i. Disclosing details of the proposed project to the stakeholders and the local communities
- ii. Provide the project area communities and stakeholders with an opportunity to directly interact with the project proponents, project contractor and the EIA Consultants and ask questions, raise issues and concerns pertaining to the proposed project and contribute to the identification of project impacts, mitigation measures and project alternatives.
- iii. Collection of additional baseline data/ information on the project area community
- iv. Facilitate consideration of project alternatives, mitigation measures and trade-offs;
- v. Ensure that important impacts are not overlooked and benefits are maximized;
- vi. Reduce conflict through early identification of contentious issues;
- vii. Provide an opportunity for the public to influence project activities in a positive manner;
- viii. Improve transparency and accountability of decision-making; and increase public confidence in the Environmental Impact Assessment process and the proposed project's undertaking.

6.3 Stakeholders Analysis

The Athi Dam project involves a complex multi-stakeholder environment focused on enhancing food security in Kenya. For the purpose of this project the stakeholders are categorized into two, primary stakeholders and secondary stakeholders.

6.3.1 Primary Stakeholders

These are the key decision makers and implementers mainly representing the Government Agencies and the contractors in the project, which is Public-Private Partnership Project. The key stakeholders under this category include;

- **National Irrigation Authority;** Government agency responsible for developing, coordinating and managing sustainable irrigation services to support food security and socio-economic development in the country. National Irrigation Authority is the lead implementing agency responsible for project management, overseeing the dam construction and the irrigation scheme.
- **Kenya Wildlife Service;** has the overall mandate to conserve and manage Kenya's wildlife and its habitats, ensuring sustainable use and protection for future generations. KWS will oversee the



construction of the dam project in conjunction with NIA. They will be controlling access to the project site, providing necessary support to the project contractor including provision of security in the construction sites, undertaking surveillance of the project site and monitoring post-construction ecological impacts.

- **Wildlife Research and Training Institute;** state corporation with the mandate to coordinate and conduct wildlife research and training in Kenya. The corporation will provide data and information necessary for decision making before, during and after dam construction.
- **Agricultural Development Corporation;** State Corporation established to promote agricultural development through commercial farming, agricultural advisory services and land development. The corporation is the custodian of the land to be irrigated by the water from the dam.
- **China Communication Construction Company;** a private company with extensive portfolio in infrastructure projects development. The company will undertake the design and construction work of the project.
- **Kenya Rural Roads Authority;** state corporation mandate with developing and managing rural roads, improving connectivity and ensuring rural roads meet safety standards. They will be involved in improving logistics and access, such as constructing of access road where necessary.
- **Rural Electrification and Renewable Energy Corporation;** state corporation mandate with expanding electricity access, promoting renewable energy and implementing energy projects. They will ensure that electricity is supplied to the various points of the project where it will be needed.
- **County Governments (Taita Taveta, Kilifi & Tana River);** devolved administrative units governing a specific region in the country. They are the local governments that will provide crucial social and administrative support especially those that concern the secondary stakeholders.

In overall, this category of stakeholders plays a crucial role in implementing government policies by translating policies into actionable plans and programs, overseeing compliance with laws and standards, providing public services and tracking policy implementation impacts. In the content of the Athi Dam Project, the stakeholders will ensure the project will be undertaken as required by policy, without damaging the environment or adversely affecting the communities and other stakeholders.



6.3.2 Secondary Stakeholders

These are organizations directly or indirectly involved in wildlife and environmental conservation within the Tsavo Ecosystem and the communities living adjacent to the conservation areas. They are grouped into two as follows;

- **Wildlife and Environmental Conservation Groups and Non-Governmental Organizations;** this category of stakeholders' supplement government work in wildlife conservation and environmental conservation. They play a crucial role in bridging the gaps in knowledge and resources that are important in wildlife and environmental conservation. In this project, they will provide data, information and other support necessary for designing and implementing the dam project while ensuring minimal negative impacts to the environment and wildlife. They include; Tsavo Trust, Wildlife Works, Team Tsavo, World Wildlife Fund, African Wildlife Fund, Taita Taveta Wildlife Ranches and Save The Elephant.
- **Communities and community-based organizations;** the communities living in Kilifi and Tana River Counties have a huge stake in the project because they derive their livelihoods from Galana River where the project is located. They have a big role in stipulating how the said project will affect their livelihoods and hence give opinions of how adverse impacts could be appropriately mitigated. Community based organizations working with these communities have a role in guiding and explaining the details of the project to the communities they serve.

6.4 Consultation Methodology

The following methods were used during the stakeholders' consultations;

- i. The team undertaking the ESIA held one-on-one consultation meetings with KWS, NIA and CCCC in their designated offices in Nairobi and Tsavo East. These were pre-arranged meetings that helped to discuss project details, share project documents and make plans and agreements for undertaking the ESIA. After discussions during the meetings, consultation continued through various modes of communication including emails, telephone calls and virtual online meetings.
- ii. Meetings and discussions with Wildlife Conservation Stakeholders were organized with the assistance of KWS because they have adequate knowledge of this category of stakeholders. The meetings were conducted at Tsavo East National Park, KWS Education Centre. They were conducted in English because all the participants understood the language, many being researchers and project officers in their various



- organizations. Power Point presentations were made, to clearly illustrate the project details. Minutes of the meeting were well written and later endorsed by the lead organizers. During the meetings the stakeholders were also issued with questionnaires to fill their concerns and comments on the project. A timeframe of two weeks was given to return the filled questionnaires to KWS offices at the National Park.
- iii. Public Consultation Meetings/public barazas were organized with the assistance of the National Government Officers under the leadership of the Deputy County Commissioners (DCC) for Kilifi and Tana River counties in conjunction with KWS officers. During the meetings, the discussions were moderated by officers from the National Government including the Chiefs and Assistance Chiefs and KWS officers because of their familiarity with the members of the community. The participants, one after the other were given a chance to give their concerns and opinions after the project details were presented. In the meeting a mix of different languages including Kiswahili and local communities' vernacular were used. When vernacular was used, an interpreter was used to help those who don't understand the local dialect to enable them follow the proceedings. The proceedings of the meeting were well written and endorsed by the lead organizers.

That notwithstanding, it is worth noting that consultation is an on-going process throughout the ESIA study. After publication of the report in local dailies and Kenya Gazette, the public will have another opportunity to give comments on the proposed project. Consultation goes on even after license issuance to the implementation phase, operation and decommissioning phases.

6.5 Consultations with Key Stakeholders

Consultations were held with various key stakeholders as outlined below;

6.5.1 Consultation with Kenya Wildlife Service

Initial consultations we conducted with Kenya Wild Service through meetings held with the Director General, Senior Assistant Director in charge of TCA and Assistant Director in charge of Tsavo East. The consultations made reference to Tsavo East Management Plan and how the proposed project fits in its implementation. In summary the following was highlighted;

- Water provision has been explicitly recognized in the current management plan for Tsavo East National Park as a key ecological and management intervention. The northern sector of Tsavo East, where the proposed project will be located, is



characterized by relatively good vegetation productivity and forage availability, yet it remains underutilized by elephants largely due to the scarcity and seasonality of reliable water sources. This imbalance has contributed to a concentration of elephants in the southern and central areas where perennial water is available, leading to localized habitat degradation and increased elephant movements beyond park boundaries into adjacent community lands, particularly the Taita Ranches.

- Improving water reticulation infrastructure in the northern part of Tsavo East—through strategic development such as having piped access or otherwise from the proposed dam and canal northwards of the Galana River would enhance spatial access to water and make these well-vegetated areas more suitable for sustained elephant and other wildlife use. Such redistribution would have multiple ecological and management benefits. Ecologically, it would reduce over-browsing and vegetation pressure in currently water-rich areas, allowing for habitat recovery and improved ecosystem resilience. From a management perspective, dispersing elephant concentrations away from the southern boundary is likely to decrease the frequency and intensity of elephant incursions into the Taita Ranches, where competition for resources and crop-raiding often occur. Consequently, this would contribute to a measurable reduction in human–wildlife conflict incidents, enhance coexistence with neighboring communities, and support broader landscape-level conservation objectives outlined in the Tsavo East Management Plan.
- During the consultation meetings, the KWS officers clearly stated the service had given consent NIA and the contractors to undertake surveys and assessments (hydrogeological surveys, ESIA) that are legally required. Kenya Wildlife Service indicated that they support the project, due to its benefits to the wildlife, but will be keen to ensure that adverse impacts are adequately, efficiently and effectively mitigated so that they don't cause harm to the Tsavo National Park and the communities living in the vicinity of the park.

6.5.2 Consultation with the NIA and CCCC

The team conducting the ESIA held series of consultative meetings with the NIA and China Communication Construction Company. The meetings resulted to sharing of information and materials of the proposed project including Project Technical Report, project components designs

and drawing. The study process was discussed including the work plan, study process and protocols and eventually the work contract was signed.

6.5.3 Meetings and Discussions with Wildlife Conservation Stakeholders

a. First Consultative Meeting with Key Stakeholders

The meeting took place at Tsavo East Education centre on 16th May 2024 from 9.25am to 12.10pm. In attendance were 23 representatives from; NIA, KWS, Tsavo Trust, Wildlife Works, Team Tsavo, ADC, Voi Safari lodges, Sentrin Lodge, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Ranches, Save The Elephant, Wildlife Research & Training Institute and The ESIA consultants.



Figure 6-1: First consultative meeting with Key stakeholders

b. Second Key Stakeholders' Meeting

The meeting took place at Tsavo East Education centre on 7th June 2024 from 9.45am to 12.32pm. In attendance were 22 representatives from; KWS, NIA, Tsavo Trust, Wildlife Works, Team Tsavo, ADC, Voi Safari lodges, Sentrin Lodge, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Ranches, Save The Elephant, Wildlife Research & Training Institute and The ESIA consultants. The objective of the meeting was to validate the study findings and obtain additional information from the key stakeholders.



Figure 6-2: Second Key Stakeholders' Meeting

c. Third Consultative Meeting with Conservation Stakeholders

The meeting took place at Tsavo East Education centre on 17th February 2026. In attendance were 28 representatives from; NIA, KWS, Tsavo Trust, Wildlife Works, Team Tsavo, Ashnil Aruba, African Wildlife Fund, Taita Taveta Wildlife Conservancies Association, Wildlife Research and Training Institute, African Environmental Film Foundation, China Communications Construction Company, Sheldrick Wildlife Trust and The ESIA consultants.



Figure 6-3: Third Key Stakeholders' Meeting


Table 6-1: Summary of Key Issues of Concern Raised by the Conservation Stakeholders

Key Issues and Concerns Raised	Responses and Strategies to Addressed the Concerns
Location of the dam inside the park as opposed to outside the park	- Thorough assessments were done and various options for the location of the outside the park and inside the park were analyzed. - It was found to be more viable for the dam to be located inside the park.
Counties affected by the project and if they were included for public participation.	- Two counties (Kilifi and Tana River) are the main ones affected by the project and have been involved in the public participation. - Public participation is an ongoing process and other counties may join as the process goes on through various forums and channels.
Safety hazard associated with open canal	- At this preliminary stage, the contractor has been given various options for the design of the water conveyance canal - The contractor will consider the most appropriate design while doing the final detailed designs based on the options given and the concerns raised during the public participation meetings.
Negative impacts on the flora and fauna within the project area	- Before the start of the project different plans will be made to counter any identified negative impact on the flora and fauna at the project site and beyond. The plans will be included in the ecological monitoring plans and procedures. - The ecological plans and procedures will be implemented to ensure the foreseen negative impacts are adequately mitigated.
Provision of water for wildlife in the areas where the canal passes	- The design of the water conveyance canal has provided for establishment of drinking points for animals. - The contractor has been given the option of using solar power to pump water to different parts of the park, in order for animals to access the water.
Risks of dam failure and collapse due to climate change	- The contractor has given assurance that the design and construction work will be in accordance to internationally acceptable standards, therefore very low risk of dam collapse. - Adequate consideration and provision has been made in the designs of the dam in case of climate change, such as heavier than normal rainfall.
Is the dam provided for in Tsavo East Management Plan?	Tsavo East Management plan provides for establishments that will enhance provision of water to the wildlife animals, of which the earth dam is one.



	• The plan guides that such projects should have minimal negative impacts on the ecosystem.
Long term impacts on downstream communities	• The dam targets to harvest over flow water especially during the rainy seasons without affecting the normal flow of water downstream. • The law does not allow blockage of river flow to deny water to downstream water users.
Increased traffic volume and conflicts on the access road	• A transport management plan will be developed before the construction phase of the project. • The plan will ensure that there are not conflicts or adverse impacts results from the use of access roads.
Environmental degradation resulting from building material storage yards	• Pollution prevention and waste management plans will be developed before the construction phase of the project. • The plans will give guidelines on how the construction materials and equipment will be handled.
Will there be adequate number of animal overpasses along the canal?	• The contractor will liaise with KWS and KWRTI to map out the animal movement routes in the project area to ensure that the overpasses are appropriately located and adequate in number for the animal crossing.
Control of water pollution coming from upstream, especially from industries.	• The National Government is putting in measures and initiatives to control directing industrial effluents into Athi River upstream. • NEMA has also increased surveillance on water pollution, not only into Athi River but also other rivers.
Prevention of animals from entering the canal	• The contractor has provided for a fence in the design of the canal to prevent animals from entering the water conveyance canal.

6.5.4 Public Consultation Meetings/Public Barazas

a. Community Meeting at Shakahola Market Centre

The meeting took place on 29th May, 2024 at Shakahola PEFA Church from 10.30 am to 12.45pm. A total of 115 members were present including KWS, the area chief, assistant chief, the deputy county commissioner and the ESIA consultants.



Figure 6-4: Community Meeting at Shakahola Market Centre

b. First Community Meeting at Bombi Market Centre

The meeting took place on 31st May, 2024 at Bombi PCEA Church from 11.00am to 1.00pm. A total of 44 members were present including KWS, the area chief, assistant chief, the deputy county commissioner and the ESIA consultants.



Figure 6-5: First Community Meeting at Bombi Market Centre

c. Second Community Meeting at Bombi Market Centre

The meeting took place on 18th February, 2026 at Bombi PCEA Church from 10.30am to 2.30pm. A total of 69 members were present including KWS, NIA, China Communications Construction Company, Leaders of Orma community, village elders, area MP's representative, National Government Administration Officers, GBV officer and the ESIA consultants.



Figure 6-6: Second Community Meeting at Bombi Market Centre

Table 6-2: Summary of Key Issues of Concern Raised During Community Public Meetings

Key Issues and concerns raised	Responses and Strategies to Addressed the Concerns
Reduced water levels downstream	- The dam targets to harvest over flow water especially during the rainy seasons without affecting the normal flow of water downstream. - The law does not allow blockage of river flow to deny water to downstream water users - The dam will be beneficial to the communities downstream because it will control flooding during the rainy seasons.
Risk of overflow and collapse of the dam	- The contractor has given assurance that the design and construction work will be in accordance to internationally acceptable standards, therefore very low risk of dam collapse. - Adequate consideration and provision has been made in the designs of the dam in case of climate change, such as heavier than normal rainfall.
Water supply of water to local communities	The contractor has been guided to consider the proposal of providing domestic water to the local communities.
Corporate social responsibility projects (schools and health facilities)	The community will work together with their leaders to identify priority projects for consideration by the contract as part of corporate social responsibility.
Increase of human wildlife conflicts due to construction machinery	- Kenya Wildlife Service will continually monitor animal movements during the project implementation and measures are taken to ensure elephants don't stray into farmlands. - Operational plans and guidelines will be developed to ensure minimal disruptions of wildlife animals.
Employment of community members in the project	- The contractor is committed to using local communities to offer unskilled labour and skilled labour if available with the local communities. - The community leaders will oversee the process of recruitment of community members for employment during the construction phase.



6.5 Grievance Redress Mechanism

The Grievance Redress Mechanism (GRM) for dam-related issues involves a structured process to identify, track, and manage grievances raised by stakeholders in relation to the dam during the various phases of construction and operation. The GRM aims to ensure that grievances are addressed fairly and transparently, providing a platform for individuals to express their concerns and seek resolution. A comprehensive GRM will be developed for Athi Dam with will give consideration to the following key aspects.

- i. **Intake and Initial Processing of Grievances:** robust intake procedures with multiple submission channels, including digital platforms, telephone systems, and in-person collection points through community liaison officers will be established. The multi-channel approach will ensure comprehensive accessibility while maintaining systematic documentation protocols. It is proposed that the key stakeholders including Kenya Wildlife Service, National Irrigation Authority and National Government Administration Office are involved in the initial intake and processing of grievances.
- ii. **Analysis of Grievances and Response;** after collecting the grievances systematic evaluations are done through a well-defined assessment protocol. It will be important to have a grievance evaluation team that will determine the validity, urgency, and required response levels. For the project, the team is proposed to comprise of NIA, KWS and the Contractor. Valid submissions may require comprehensive investigation, incorporating field assessments, stakeholder interviews, and technical analysis as required before arriving at the response to the grievance. Stakeholders may be involved to develop sustainable, mutually acceptable resolutions to the grievance.
- iii. **Resolution Implementation;** Resolution implementation requires clear communication protocols and defined execution parameters. The National Irrigation Authority should take leadership in providing detailed written documentation of proposed solutions, including implementation timelines and expected outcomes for the grievances. The communication must maintain accessibility while ensuring comprehensive understanding among all parties.
- iv. **Performance Assessment;** The National Irrigation Authority should institute a continuous mechanism for tracking the performance GRM that will look at resolution timeframes, submission volumes, stakeholder satisfaction among other parameters. This will inform strategic adjustments, ensuring continued system relevance and effectiveness through adaptive management practices.



CHAPTER SEVEN: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS IDENTIFICATION/ASSESSMENT AND ANALYSIS

This chapter identifies and assesses the probable anticipated impacts of the project and their analysis. Implementation of the Athi Dam and Associated Irrigation Water Conveyance System will have both positive and negative impacts resulting from activities carried out during Pre-construction and Construction, Operation and Decommissioning phases of the proposed project. The impacts are divided into two:

- i. Existing key Environmental and Social Impacts
- ii. Anticipated key Environmental and Social Impacts

7.1 Existing key Environmental and Social Impacts

Under the existing environmental and social impacts, there are both positive and negative impacts.

7.1.1 Existing Positive Impacts

Tsavo East National Park in Kenya is one of the oldest and largest parks in the country. It offers numerous positive impacts, both environmentally and socio-economically which include:

Environmental Benefits:

Biodiversity conservation: Tsavo East is home to a diverse range of flora and fauna, including the 'Big Five' (elephant, lion, buffalo, leopard, and rhinoceros) and many endangered species. The park plays a crucial role in protecting these species and their habitats.

Ecosystem services: The park contributes to ecosystem services such as water purification, soil erosion control, and carbon sequestration. These services are essential for maintaining environmental balance and mitigating climate change effects.

Habitat preservation: It protects vast tracts of savannah, forests and riverine habitats, ensuring the survival of various plant and animal species that depend on these environments.

Economic Benefits:

Tourism revenue: As a major tourist destination, Tsavo East attracts thousands of visitors annually, generating significant revenue for Kenya through park entry fees, lodging, and related tourism activities. This income supports the national economy and local communities.



Job creation: The tourism industry linked to the park creates numerous job opportunities for local residents, ranging from park rangers and guides to hospitality workers and artisans.

Infrastructure development: The presence of the park has led to improved infrastructure including better roads and communication networks benefiting both tourists and local communities. Of importance to note, is the connectivity that will come with the completion of the C103 Road linking Malindi to Manyani and eventually Namanga border Town. This will significantly reduce the transport time and cost of produce from the Galana Kulalu Food Security project to other parts of the country.

Social and Cultural Benefits:

Community empowerment: Initiatives around the park often involve local communities in conservation and tourism efforts, empowering them with skills, education and financial benefits. This inclusion helps foster a sense of ownership and responsibility towards wildlife conservation.

Cultural preservation: The park supports the preservation of local cultures and traditions by promoting cultural tourism. Visitors often engage with local communities, learn about their customs and purchase handmade crafts, thus preserving cultural heritage.

Public private partnership in park management: There is already an existing working relationship between KWS and conservation groups and hotel and lodges within the park playing key roles in rehabilitation and maintenance of the park infrastructure, conservation activities. These conservation groups include Taita Taveta Wildlife Conservancies Association (TTWCA), Tsavo Trust, Sheldrick Wildlife Trust, Wildlife Works, Sentrim Hotels and Lodges, Voi Wildlife Lodge, AShnil Aruba Lodge etc.

Educational and Research Benefits:

Research opportunities: Tsavo East provides a natural laboratory for scientists and researchers studying wildlife behavior, ecology and conservation strategies. The data collected helps in making informed conservation decisions.

Environmental education: The park offers educational programs and opportunities for schools, universities and the general public to learn about wildlife conservation and the importance of protecting natural habitats.

**Global Conservation Impact:**

Wildlife corridors: Tsavo East, in conjunction with Tsavo West National Park and other conservation areas, forms part of a larger network of protected areas that facilitate wildlife movement and genetic diversity.

International collaboration: The park engages in international conservation efforts and partnerships contributing to global biodiversity goals and raising awareness about wildlife conservation issues worldwide.

7.1.2 Existing Negative Impacts**Solid waste pollution**

The main solid waste stream is plastic waste. This is mainly from urban areas upstream of the Athi/Galana River and especially the informal settlements within Nairobi City which results to heaps of plastic waste along the river banks. The plastics can trap or entangle wildlife preventing them from being mobile to hunt for food, become more vulnerable to nearby prey or suffer from overheating, suffocation, dehydration, starvation and eventual death.

Water pollution

The water quality in the Galana River is mainly affected by human activities such as industrial, agricultural and sewer discharges upstream. The concentration of pollutants is mostly high when the water levels are low during the dry seasons thus stressing the wildlife leading to increased competition and potential conflicts. Water pollution results to alteration of habitat, direct toxicity to organisms through bioaccumulation processes and disruption of reproductive cycles and behaviour patterns among wildlife population. In addition, sedimentation particularly during the rainy seasons increase water turbidity and thus affecting the aquatic habitat.

Inadequate/poor infrastructure

Park infrastructure such as roads, gates, campsites, signages and airstrips are occasionally in poor conditions due to natural disaster and unavailability of adequate resources for maintenance. This significantly affects movements and connectivity within the park affecting the wildlife conservation activities and utilization of park facilities.

**Encroaching of the park**

The Tsavo East National Park is faced with challenges of encroachment especially on the South-East section of the park where herders from the neighbouring communities herd their livestock within the park resulting to conflicts between KWS and the neighbouring communities. This situation is mainly caused by challenges of boundary demarcation between the park and the wildlife conservation areas around the park. When livestock illegally enters the Park, competition for food and water ensues and soil degradation occurs making it harder for plants to survive. Subsequent conflict between herders and wildlife can have fatal consequences for both.

Park fires

There are incidences of fire outbreaks within the park and especially during dry season. They are mainly caused by human activities within the park or the immediate neighbourhood of the park. Some of these fire outbreaks are accidental while others are deliberate due to community retaliations after animal attacks. The park fires result to habitat loss and wildlife mortalities.

Floods

Galana River is occasionally faced with flooding due to heavy downpours/precipitation upstream at the catchment area. The flooding normally has negative effect on wildlife resulting to wildlife mortality (through drowning), disease proliferation, displacement of wildlife from waterways and disruption of wildlife habitat.

Drought and limited rainfall

Tsavo East National Park falls under arid to semi-arid area. The area is faced by water shortage challenges as climate change is altering long established weather patterns leading to less frequent and less predictable rainfall. Failed rains see dry seasons tip into droughts leading to already limited natural water sources like rivers to dry up. This results to wildlife mortality especially elephant mortalities due to the scarcity of food and water.

Poaching

Illegal hunting, particularly of elephants for ivory and rhinos for their horns, remains a significant threat. Poaching depletes wildlife populations and disrupts the ecosystem balance.

**Human-wildlife conflict**

As human settlements and agricultural activities expand near the park boundaries, conflicts between humans and wildlife increase. Animals sometimes venture into farms, leading to crop damage, livestock predation and sometimes human casualties.

Invasive species

The introduction and spread of invasive plant species can alter the native ecosystem, outcompeting indigenous plants and affecting the food supply for herbivorous wildlife.

Conservation and Management Challenges:

Wildlife disease: Outbreaks of diseases among wildlife, such as anthrax or bovine tuberculosis, can have devastating effects on animal populations. Monitoring and managing disease outbreaks are crucial for conservation efforts.

Cross-border issues: Wildlife often migrates across national and regional boundaries, requiring coordinated efforts between neighboring countries and regions to ensure effective conservation and management.

Economic Challenges:

Funding and resources: Limited financial resources and funding can hinder effective park management, anti-poaching efforts, and infrastructure maintenance. Adequate funding is crucial for sustaining conservation programs and ensuring the park's long-term viability.

Tourism fluctuations: Tourism, a major revenue source, can be affected by global economic downturns, political instability, health crises like pandemics, and security concerns. Fluctuations in tourist numbers impact the park's revenue and the livelihoods of those dependent on tourism.

Social Challenges:

Community relations: Ensuring positive relations with local communities is essential for the park's success. There can be tension if communities feel excluded from the benefits of tourism or if their needs and concerns are not adequately addressed.

**Policy and Governance Challenges:**

Policy implementation: Effective implementation of conservation policies and regulations is essential. Bureaucratic delays, lack of political will and insufficient enforcement can undermine conservation efforts.

Operational Challenges:

Security and law enforcement: Ensuring the safety of the park, its wildlife and visitors is a constant challenge. Anti-poaching units and park rangers often face risks from armed poachers and require ongoing training and support.

7.2 Anticipated Environmental and Social Impacts occasioned by the Dam Project

Under the existing environmental and social impacts, there are both positive and negative impacts.

7.2.1 Anticipated Positive Impacts

The anticipated is divided into four categories; within the park, within Galana-Kulalu irrigation area, to the Country in General and to the Communities living Downstream of Galana River.

a. Within the Park

Water supply to wildlife: The dam project will provide adequate water supply for wildlife within the park since the park is located within a semi-arid area hence being critically water stressed. The reservoir will therefore increase the access of wildlife to drinking water significantly reducing mortality of wildlife significantly. In addition, the dam will also result to increased foliage for wildlife around the reservoir resulting to multiplication of species.

Moderate the micro-climatic conditions: The dam will also moderate the micro-climatic conditions of the immediate surrounding areas through increased humidity and/or cooling effects to the comfort of the tourists and workers within the park.

Flood control: A dam can help manage and control flooding, protecting the surrounding ecosystems and human communities.

Drought mitigation: The reservoir can serve as a water reserve during dry periods, ensuring consistent water availability.

Habitat creation: The reservoir can create new aquatic habitats for various species, potentially increasing biodiversity.



Controlled water flow: Managing water flow can help sustain wetland areas downstream, which are crucial for various plant and animal species.

Research opportunities: The dam and its reservoir can serve as sites for scientific research on hydrology, ecology and environmental science.

Educational resources: The area can be used for educational programs, raising awareness about water resource management and environmental conservation.

Improvement of transport infrastructure: The upgrading of certain roads (e.g. C103 highway) necessary for the construction and maintenance of the dam, will also contribute to a better transport and travel networks in the park as well as provide better transport linkages.

Boost tourism: The dam project will boost the development of tourism within the Tsavo East National Park since the dam project will be a new tourism component which will provide an additional tourist attraction feature. This results to increase in number of visitors to the park and hence boosting business for the hotels and lodges within and around the park.

Job creation: During construction period of the project, the project will directly provide employment opportunities to local people within the project site such as casual workers, engineers and technicians. After the completion of the project, there are work opportunities of operation in the irrigation areas and dam management and operation office.

b. Within Galana-Kulalu irrigation area

Provision of water for irrigation: The dam project is primarily conceptualized to provide adequate water supply for Galana-Kulalu irrigation area. The community within the Galana irrigation area will be assured an all-year-round access to water from the dam through the distribution system (canal system). Areas suitably situated to receive water for irrigation will not only help the local communities in sustaining food production but also all the residents of the neighbouring counties in food supply. There will be enhanced crop yield and food security resulting reliance on irrigation, as opposed to reliance on rainfall.

Provision of water for domestics uses: The dam will ensure consistent and reliable water supply to the communities within the irrigation area for domestic uses water such as watering of livestock washing and lawn and garden watering.



Improved livelihood: The standard of living of the beneficiary residents will improve such as to include income generation and productivity, housing, health and hygiene, etc. In addition to water supply, the dam has numerous economic benefits to the local residents such as to include fishing and tourism.

Boost investments: The project will attract more investment to the region such as real estate, tourism, farming, industrial, etc. hence leading to accelerated business growth and increase in land value.

Enhance development and growth of local markets: The provision of water has the potential to enhance development and growth of local markets as more economic and social interests arise.

c. To the Country in General

Food security: The implementation of the project can help to achieve an annual output of 2 million tons of staple food grains and other cash crops in the irrigation area, so as to achieve two-thirds of the country's staple food grains localization, which can reduce the annual foreign exchange expenditure of 1 billion US dollars.

Implementation of government's infrastructure plans: The project will be a major boost to realizing the vision 2030 and achievement of the MDGs through eradication of extreme poverty and hunger by enhancing income sources and food security.

Source of revenue to the government: During construction period of the project, the dam project will bring much tax which will increase the income of the government.

Increase the country's per capita annual freshwater availability: The project is posed to increase the country's per capita annual freshwater availability which currently stands at 600 cubic meters per capita placing the country in the bottom 8 percent of countries globally. The dam project will therefore contribute significantly to the country's freshwater availability.

d. To the communities downstream (Galana River)

Flood control: The dam will help manage and control flooding, protecting the surrounding ecosystems and human communities. The reservoir regulates river flows by storing varying volumes of floodwaters and meticulously controlling the timing of water discharge.



7.2.2 Anticipated Negative Impacts

The anticipated negative impacts are categorized according to the construction phase; Pre-Construction Phase, Construction phase, operation phase and decommissioning phase.

7.2.2.1 Anticipated Negative Impacts during Pre-Construction Phase

The activities which are undertaken during the pre-construction phase entail; undertaking topographic survey and geological exploration, feasibility studies, detailed designs preparation and preparation of the project technical report, statutory approvals/consents, construction of roads, site clearance, gathering of building materials and construction of temporary workers 'camp. The following are the anticipated negative impacts:

Land use change: the proposed dam project including the reservoir, canal, workers' camp and related infrastructures covers a total area of approximately 3,872 Hectares which is a significant land use change from conservation to public infrastructure. The affects the area under conservation.

Disturbance to wildlife: interfere with movement of wildlife, interfere with animal territories, reduction in feeding area, interfere with migratory routes especially for elephants

Wildlife displacement: the construction of roads, workers' camp and reservoir and canal construction sites' clearance will result to displacement of wildlife given that the site is a wildlife hotspot. This may result to wildlife moving to the neighbouring communities escalating the human-wildlife conflicts.

Water flow alteration: due to diversions of the river to pave way for construction, the natural habitat of aquatic life will be negatively affected.

Habitat loss: there will be clearance of vegetation and excavations to pave way for the construction of the access roads, workers' camp, reservoir and canal which result to loss of habitat for barrowing animals and soil micro-organisms as well as the terrestrial habitat.

Noise pollution: from machinery and vehicles, construction workers

Air pollution: dust, emissions from machinery and vehicles and particulate matter

Increased Traffic Volume and Conflicts on the Access Roads: the supply of building materials to the dam project components' various construction sites of the will result to increased traffic at the park's entrance and the access roads within the park resulting to negatively affecting the general



movement of wildlife and park users (tourists, staff). This may also result to increase in wildlife accidents.

Soil erosion: the clearing of vegetation on the designated construction site leads to exposing the soil to agents of erosion such as wind and rain resulting to soil erosion

Illegal activities: the establishment of a workers' camp may increase the possibility of bushmeat poaching, trophies, firewood, charcoal burning.

Increased water demand: the presence of the workers' camp will result to increase in clean water demand to be used in the camp for domestic uses. In addition, water will also be required for construction of access roads, canal lining and the concrete face rockfill dam section and concrete dam section.

7.2.2.2 Anticipated Negative Impacts during Construction Phase

Loss of habitat: inspired by the construction of the reservoir, canal, workers' camp and roads resulting to destruction of terrestrial and aquatic habitats. This can negatively affect plants, animals, and fish species that rely on these habitats. In addition, there is expected loss of the riverine habitat due to the river sections that will be submerged by the reservoir eliminating valuable carbon sinks. However, the section of Galana River between sections of Luggards falls and Sala Gate has very little riverine forest according to the Tsavo East National Park Management Plan (2021-2031).

Habitat fragmentation: inspired by the construction of the reservoir, canal and workers' camp results to division of the natural habitat

Loss of biodiversity: contribute to decline or disappearance of biological diversity in the dam project site given the fact that the project area falls under the wilderness zone (according to the Tsavo East National Park Management Plan (2021-2031)) where development activities are restricted since the wilderness is the essence of Tsavo.

Human-wildlife conflict: workers at threat of animal attacks, displaced wildlife may find their way to the neighbouring community farms especially elephants, large carnivores, hippos

Poaching: by construction workers and neighbouring communities on the displaced wildlife

Accidents on wildlife: wildlife being hit by the moving trucks, falling into excavation sites



Disturbance to wildlife: affecting migratory routes, breeding areas, blasting

Water Pollution: water pollution during the construction phase will mainly be from oil spills from the construction machines/equipment and solid and liquid waste from the construction site, roads and workers' camp resulting to negatively affecting on the health of the consumers, livestock and wildlife using the water from the water.

Air pollution: dust, emissions from machinery and vehicles and particulate matter

Noise pollution: from machinery and vehicles, construction workers

Increased traffic volume and conflicts on the access roads: affect movement of wildlife, result to wildlife mortality, blockage of roads, interfere with movement of tourists

Incidents, accidents and dangerous occurrences/ health and safety: The construction phase of the reservoir and canal may generate safety hazards in relation to increases in traffic and access to the construction site (if not adequately controlled) and potential health impacts and nuisance factors due to noise, dust, vibrations and gaseous emissions. Due to increased and diverse activities within and around the project site, unexpected eventualities might occur leading to incidents such as occupational related accidents that may lead to injuries, loss of life and property

Rerouting of sections of Manyani Gate to Sala Gate (C103): the water reservoir is expected to flood sections of the access road from the Manyani Gate to Sala Gate (C103) resulting to rerouting of the road at that section.

Solid waste pollution: solid waste from the reservoir and canal construction sites and the workers' camp such as broken building blocks, cement, paper, packaging bags, bottles, welding rods, isolated steel piles wasted lengths, electrical wires and reinforcement steel can pose a danger to the health of wildlife if consumed or when wildlife come into contact with them. These wastes can be inert, hazardous or non-hazardous.

Liquid waste pollution: during the construction phase, there will be cases of liquid waste pollution mainly from effluent from cleaning of the workers' camp, washrooms within the workers' camp and oil and grease spills from the machinery and trucks. This significantly contributes to water pollution and soil pollution.



Soil erosion: The construction activities such as excavations, landfilling and levelling and the general movement of heavy construction machinery and trucks result to loosening of the soil leading to soil erosion.

Natural Landscape alteration: The proposed project is in an area zoned for wildlife conservation. Thus, increased anthropogenic activities (human activities) from the proposed dam construction and associated infrastructure such as the canals are likely to lead to changes in the existing natural landscape attributes.

Increased demand for power supply: some of the construction activities such as welding, concrete mixing, steelworks, powering machinery etc. will require a reliable power supply increasing the demand of the same.

7.2.2.3 Anticipated Negative Impacts during Operation Phase

Dam and canal safety risks: during the operational phase of the dam, there are potential risks of overspill of either the reservoir or the canal and dam/canal failure which can lead to flooding downstream resulting to destruction of habitat, wildlife mortality, destruction of agricultural land, displacement of people downstream and loss of life and property of communities living downstream.

Change in river discharge: the abstraction of water from the Galana River to the reservoir affects the amount of water flowing downstream to areas of Shakahola, Chakama and Malindi hence significantly affecting the downstream water supply. Affecting the farming activities

Deterioration of water quality in the reservoir: retention of water within the reservoir may affect the water quality due to salt accumulation, turbidity, biomass decay and pollution from agricultural, industrial and human waste from upstream.

Human-wildlife conflict: the proposed reservoir and drinking pools along the canal are posed to provide reliable water supply and foliage especially during the dry seasons which will attract both wildlife and livestock from the neighbouring communities given the fact that the proposed dam project is situated within a livestock incursion area as noted in the Tsavo East Park management plan 2021-2031. This is likely going to escalate the human-wildlife conflict as both wildlife and livestock compete for the water in the dam and the foliage around the dam. In addition, the dam and drinking pools will result to wildlife congregation/Influx of wildlife and especially mammals such as



elephants and hippopotamus and hence increasing the likely of the wild animals moving outside the park to the neighbouring communities. This may lead to destruction of crops, injuries and death in some cases.

Land use conflicts: the reservoir/dam and the canal which are major land use change in the area will act as a new tourism product diversifying the tourism offerings within Tsavo due to the scenery, project induced microclimate and concentration of wildlife around the dam and the drinking pools. This will result to demand for more tourism facilities such as camping sites and lodges due to the increase in tourist numbers resulting to land use conflict between conservation and tourism infrastructure.

Invasion of new species: Reservoirs can become breeding grounds for invasive species which can outcompete native species and further disrupt the ecological balance. In addition, there will be alien invasive plant species that colonize disturbed areas such as *Prosopis juliflora*, *Opuntia stricta*, and *Solanum incanum* that suppress native plants that are palatable to wildlife which reduces available forage.

Siltation: the proposed reservoir is expected to intercepts sediments from the catchments resulting to reduction reservoir storage capacity and reduce reservoir life depriving downstream areas of sediments essential for aquatic habitat. In addition, in the downstream areas, the reduction in sediment load in rivers can also result in increased erosion of river-banks and beds, loss of floodplains and degradation of coastal deltas.

Natural landscape alteration: the presence of the reservoir and the canal which are artificial features alters the natural landscape of the area which was initially characterized by uninterrupted open plains.

Wildlife congregation/Influx of wildlife: the presence of a water reservoir and drinking pools along the canal providing water for wildlife will result to influx of animals from other parts of the park and the conservation areas resulting overutilization of the area by wildlife.

Water loss: due to limited vegetation around the dam and along the canal, there will be water loss through evaporation and evapotranspiration processes.



7.2.2.4 Anticipated Negative Impacts during Decommissioning Phase

Decommissioning is an important phase in the project cycle and comes as the last step to wind up the operation activities of a particular project. The main purpose of decommissioning is to restore/rehabilitate the site to acceptable standards.

Quality and standard projects of this nature have a lifespan of about 100 years which is much dependent on the maintenance measures. This is long period of time and there may be many changes which may not be foreseeable including technological and legal aspects.

The decommissioning may also come earlier than the lifespan of the dam project due to various reasons like dam/canal failure, change in physical planning policy or the discovery/realization of a more optimal use of the land.

Decommissioning will in brief involve the demolitions of structures, removal of debris and landscaping. The other social implications involve laying off workers who may be employed thus will lose their income and issues of safety and health. It is therefore recommended that an environmental impact assessment be conducted when the time for decommissioning comes so that all aspects will be looked at in totality against the prevailing conditions and requirements.

7.3 Climate Change and Disaster Risks Considerations

7.3.1 Introduction

The construction of water dams is not without its challenges when considering climate change. As climate change intensifies, the risks associated with dam infrastructure grow, prompting stakeholders to reconsider their strategies for managing water resources. There are risks like flooding when there is higher than normal rainfall and changes in water availability when there are droughts. There is therefore a need for proactive measures to ensure the resilience of dam systems in the face of climate change, especially in the light of increased risk of flooding and changes in water availability. The proposed project site lies within climate-vulnerable the agro-ecological zone VI-VII characterized by recurrent droughts, high rainfall variability, and increasing temperatures consistent with projections for south-eastern Kenya. Thus, climate change and disaster consideration are crucial for the project.



7.3.2 Potential climate related positive impacts

i. Reduced fossil fuel use in irrigation

The proposed gravity-fed water conveyance system significantly reduces dependence on diesel-powered pumping systems typically used in large-scale irrigation schemes. The use of gravitational flow will result in:

- Lower direct CO₂ emissions from fuel combustion
- Reduced operational energy demand
- Long-term mitigation benefits compared to pumped irrigation systems

ii. Climate-smart agricultural potential

If aligned with climate-smart agricultural practices, the dam-supported irrigation system may:

- Enhance crop productivity per unit of water.
- Reduce pressure for land expansion into natural ecosystems.
- Improve water-use efficiency.
- Promote drought-tolerant crop varieties.
- Encourage conservation agriculture.

iii. Enhanced drought resilience for agriculture

The dam enhances water security for the Galana-Kulalu Food Security Project through:

- Increased reliability of irrigation during rainfall failure
- Stabilized agricultural productivity under drought conditions
- Reduced vulnerability of downstream farming communities

iv. Reduced climate-induced wildlife mortality

The creation of wildlife watering points which is part of the proposed project will support long-term ecosystem-based adaptation in the Tsavo landscape. During prolonged droughts, natural water pans dry up, increasing wildlife mortality. This is particularly relevant for drought-sensitive megafauna within Tsavo. The benefits of these wildlife watering points include:

- Artificial watering points provide supplementary water during extreme dry periods.
- Reduce dehydration-related mortality
- Buffer wildlife populations against climate extremes
- Reduced travel distances in search of water
- Reduced energy expenditure



- Reduce risky dispersal
- Minimized human-wildlife conflict
- Lower stress-related impacts on wildlife populations
- Stabilization of herbivore populations (Stable herbivore populations indirectly support predator persistence and overall ecosystem function)
- Reduced collapse of prey base

v. Microclimatic regulation

The proposed Athi reservoir has the potential to contribute to localized microclimate stabilization. Although localized, these effects may improve ecological buffering capacity. These benefits will be achieved through:

- Increasing local humidity
- Reducing extreme temperature fluctuations
- Supporting vegetative cover development

vi. Socio-ecological resilience

The proposed project strengthens resilience by:

- Reducing livelihood vulnerability
- Enhancing food security
- Decreasing drought related emergency dependence
- Supporting adaptive land use planning
- Improved socio-economic resilience indirectly reduces illegal resource extraction within protected areas during drought crises.

Table 7-1: Summary of climate adaptation and resilience benefits of the proposed Athi Dam

Impact category	Positive effect	Climate relevance
Wildlife	Reduced drought mortality	Adaptation
Ecosystem	Reduced pressure on natural water sources	Ecosystem resilience
Irrigation system	Reduced fossil fuel use	Mitigation
Agriculture	Drought-resilient food production	Adaptation
Communities	Improved food and livelihood security	Socio-economic resilience



7.3.3 Potential climate related negative impacts of the proposed project

i. Construction-phase emissions are anticipated from:

- Earthworks and excavation
- Cement production (high embodied carbon)
- Transport of construction materials
- Heavy machinery fuel combustion

ii. The reservoir related emissions (methane generation) are likely to result from:

- Decomposition of submerged vegetation and soils
- Anaerobic breakdown of organic matter
- Methane (CH₄) emissions, especially in warm climates

iii. Increased agricultural/ land-use intensification emissions downstream from:

- Nitrous oxide (N₂O) emissions from fertilized soils
- CO₂ emissions from mechanized agriculture
- Potential methane emissions from poorly drained irrigated fields

iv. Altered down stream flow regime

The proposed project has the potential to lead to altered downstream flow regimes. Under climate change scenarios (increased rainfall variability), regulated flows may either buffer or amplify downstream drought stress depending on management. The negative impacts are likely to lead to:

- Reduced peak flood pulses
- Altered seasonal flow variability in the Athi/Galana river
- Potentially reduced environmental flows

v. Reduced sediment transport

The proposed Athi Dam has the potential to trap sediments. In climate-stressed ecosystems, sediment starvation may reduce resilience of riparian systems leading to:

- Reduced nutrient delivery downstream
- River channel incision
- Degradation of downstream floodplain productivity

vi. Evaporation losses from reservoir surface

The project site is in a hot semi-arid climate, characterized by high temperatures and evaporation rates. Projected temperature increases may exacerbate evaporative losses over time.



- High temperatures increase evaporation rates
- Significant water losses may occur
- Water-use efficiency may decline under rising temperatures

vii. Ecological and micro climate effects

The proposed water dam and wildlife watering points have the potential to:

- Increased wildlife aggregation
- Localized vegetation degradation
- Soil compaction and erosion
- Potential disease transmission
- Alter surface moisture balance
- Alter vegetation structure

viii. Extreme rainfall and flood risk

Extreme rainfall phenomena have the potential to:

Projected increases in rainfall intensity may:

- Elevate dam safety risks
- Increase downstream flood hazard during extreme storms
- Climate change may require revised hydrological design return periods

ix. Human-wildlife conflict dynamics

The proposed projects under climate stress may increase wildlife reliance on artificial water, potentially:

- Altering wildlife movement patterns
- Increasing human-wildlife interactions near agricultural zones
- Affecting landscape connectivity

7.4 Methodology for Impacts' Analysis

The present section describes the procedure implemented to assess the significance of the impacts potentially induced by the different components of the project described in chapter 2 (the dam/reservoir, irrigation canal, 'Temporary Workers' Camp, Transport Infrastructure and related infrastructure) on the environmental and social components. Once identified, analysis of the impacts was done using Leopold's matrix to enable a judgement of their significance that allows a prioritization of the mitigation/enhancement and management measures



The parameters considered during the analysis included; Biodiversity, large carnivores (cheetah, wild dog, lion, leopard and hyena), elephants, riverine vegetation, scenic value (Diverse Landscape & scenery, wilderness and volcanic features), aquatic life, grassland, soil and socio-economic and cultural impacts/effects. These are the critical environmental and natural resources within the Tsavo Conservancy Area (TCA). The potential Impacts were ranked based on their effect on the baseline of TCA. Information was derived from key resources such as Tsavo East National Park Management Plan 2021-2031, relevant studies on Tsavo Conservancy area, community and stakeholders' input, key informants and experts' opinion. Based on the aforementioned criteria, a comprehensive evaluation is provided for each impact, considering a four-level rating of impact significance: negligible, low, medium, high represented with specific colour codes as shown below. The score range is 1-10 with a score of 10 being the highest score in regards to significance and the score of 1 being the least score.

Table 7-2: Impact Significance Analysis Rating

Impact Rating	Colour Code	Score
High	Red	8-10
Medium	Amber	5-7
Low	Green	2-4
Negligible	No Colour	1

**Table 7-3: Definitions of the Impact Significance Analysis Rating**

Impact Rating	Colour Code	Explanation
High		High or medium magnitude impact on highly sensitive environmental, biological and socio-economic resources. Negative impact must be avoided, mitigated or compensated to an acceptable level through implementation of specific mitigation or compensation measures.
Medium		Low magnitude impact on highly sensitive environmental, biological and socio-economic resources, medium magnitude impact on medium sensitive resources, high magnitude impact on low sensitive resources. For negative impacts, mitigation measures are required and, as needed, compensation measures.
Low		Low impact on medium or low sensitive environmental, biological and socio-economic resources, medium impact on low sensitive resources. The negative impact can still be minimized to a negligible level through best practices and mitigation measures
Negligible		Negligible magnitude impacts on low or medium sensitive environmental, biological and socio-economic resources. The impact is hardly distinguishable from background conditions and expected development in a no-project situation



Table 7-4: Impact Analysis Matrix

Environmental Resources	Biodiversity	Water resources	Large carnivores	Elephants	Riverine	Scenic Value	Aquatic life	Grassland	Soil	Socio-Economic & Cultural	Score
Disturbance to wildlife	x		x	x			x				
Wildlife displacement	x		x	x			x				
Land use change	x	x	x	x	x	x	x	x	x	x	
Water flow alteration	x	x			x		x		x		
Loss of habitat	x		x	x	x	x	x	x	x	x	
Habitat fragmentation	x		x	x	x	x		x	x	x	
Loss of biodiversity	x		x	x	x	x	x	x	x	x	
Human-wildlife conflict	x	x	x	x			x	x	x	x	
Increased water demand	x	x	x	x	x		x			x	
Dam safety risks	x	x	x	x	x	x	x	x	x	x	
Increased demand for power supply		x									
Poaching	x			x						x	
Accidents on wildlife	x		x	x			x			x	
Water pollution	x	x	x	x	x		x			x	
Air pollution										x	



Environmental Resources	Biodiversity	Water resources	Large carnivores	Elephants	Riverine	Scenic Value	Aquatic life	Grassland	Soil	Socio-Economic & Cultural	Score
Risks of fire	x		x	x		x		x	x	x	
Noise and vibrations										x	
Increased traffic volume & conflicts on the access roads										x	
Solid waste pollution	x	x				x	x			x	
Liquid waste pollution	x	x					x				
Soil erosion	x								x		
Natural landscape alteration	x					x					
Change in river discharge	x	x					x			x	
Deterioration of water quality in the reservoir	x	x	x	x			x			x	
Risks of accidents and injuries to workers										x	
Sedimentation		x					x			x	



CHAPTER EIGHT: PROPOSED MITIGATION MEASURES

8.1 Introduction

Once the impact is identified and assessed, suitable mitigation measures are defined to reduce or totally avoid the potential impacts. Where the total elimination of the impact is not possible, residual impact is codified and its significance is assessed after the implementation of the mitigation measures, on the basis of the principle that, after mitigation, the negative impact should be reduced to minor or negligible.

Positive impacts should be enhanced through enhancement measures. In the following paragraphs, the key components described in the previous sections are analyzed in order to identify and assess all the potential project-related environmental and social impacts and to identify the mitigation measures and procedures to be adopted to reduce them.

Mitigation measures are proposed based on critical environmental and natural resources within the Tsavo Conservancy Area (TCA), national requirements, best practices, preliminary stakeholders' views, ESIA experts' advice, and according to the following mitigation hierarchy:

- i. avoid as much as possible;
- ii. where avoidance is not possible, minimize following best practices;
- iii. where minimization is not sufficient, mitigate through specific measures;
- iv. where mitigation is not sufficient, compensate for residual risks and impacts.

From the analysis of the impacts, the following mitigation measures were proposed:


Table 8-1: Proposed Mitigation Measures

Anticipated Impact	Mitigation Measures
Loss of habitat	- Prohibit unnecessary vegetation clearing - Demarcation and restriction of construction sites - Sparing mature trees - Plan for vegetated buffer zones with suitable indigenous tree species around the dam and along the canal - Establishment of continuous ecological monitoring system - Collaboration between KWS and other stakeholders on habitat rehabilitation plans/programs
Land use change	- Ensure that the workers' camp will be temporary - Preparation of a restoration plan on the entire dam project area - Demarcation and restriction of construction site - Establishment and strengthening of community conservancies-as compensation of land used - Establishment of continuous ecological monitoring system
Habitat fragmentation	- Provision of adequate wildlife overpasses prioritizing wildlife corridors - Phasing the construction works to minimize the fragmentation of habitat - Backfilling of all open excavation areas - Establishment of continuous ecological monitoring system
Loss of biodiversity	- Establishment of continuous ecological monitoring on biodiversity - Strengthening KWS and WRTI in Tsavo to conduct ecological monitoring - Restoration programs of the degraded areas - Update/review of Tsavo East National Management Plan 2021-2031 to include the dam project
Human-wildlife conflict	- Fencing the construction site and workers' camp - Training the construction workers on personal conduct within the park - Implementation of a joint security plan aiming at protecting the workers - Conducting continuous risk assessment reports - Provision of adequate PPEs - Training workers on health and safety and environmental awareness - Compliance to Occupational Health and Safety measures Work Injury Benefit Act



Dam/canal safety risks	• Provide clear emergency preparedness strategies • Regular maintenance and upgrade of the dam, canal and the associated infrastructure • Provide safe access points to the water for the local residents and their livestock • Review and update existing species conservation and management plans for focal species • Enhance close surveillance of the dam, canal and surrounding • Sensitize the public and tourists on dam safety issues associated with the dam and canal. • Provide clear emergency preparedness strategies. • Undertake a detailed Assessment study for the proposed dam and establish quantifiable risks • Integrate simulated flood release programme in the dam operations • Inform the public on any un-usual releases from the dam's spillway for appropriate safety precautions.
Water flow alteration	• Provision of artificial water pools for utilization by hippos and crocodiles • Restrict construction works to dry season when there is low water flow to ensure minimal river diversion
Increased water demand	• Drilling a well near the river to provide water for the camp • Build sedimentation tank and reservoir in the camp
Accidents on wildlife	• Moving vehicle speed control to be limited to 40 KM/H • Sensitize drivers to observe park speed limits • Adequate hoarding of the construction site • Adequate signage on key wildlife corridors • Observe Park working hours 6.00 am to 6.00pm • Immediately reporting any wildlife accidents for clinical interventions • Proper record keeping of any wildlife accidents or kills • Use of quarry stone aggregate or quarry chips as buffer along the canal in place of grass to discourage wildlife from breaching the fence in search of foliage
Water pollution	• Conduct regular water quality analysis • Construction of check dams control siltation • Inter-agency coordination between NIA, KWS, NEMA for regulation of water resource • Liaison with communities on the catchment areas upstream
Risks of fire	• Provision of firefighting equipment



	• Regular trainings of the construction workers • Develop a fire management and response plan • Conducting regular fire drills • Clear marking and demarcation of the fire assembly points • Train workers on first aid and keeping fully equipped first aid kits • Fire detection and detection system • Good maintenance of the access roads acting as fire breaks
Solid waste pollution	• Ensure waste materials are disposed at the County and NEMA approved sites • Use of the 3Rs – Reduce, Re-use, Re-cycle • Solid waste to be put in designated areas for appropriate disposal (waste cubicle) • Waste segregation at source • Engage a licensed, competent and effective waste handler
Deterioration of water quality in the reservoir	• Clearing and removal of all vegetation materials at the dam site • Institute a broad water quality monitoring system focusing on catchment sources, incoming flows, entire dam water quality variations and water downstream of the dam location. • Maintain appropriate records on water quality as required by the law upon commissioning of the dam
Disturbance to wildlife	• Provision of adequate wildlife overpasses along the migratory routes • Establishment of continuous ecological monitoring
Wildlife displacement	• Increase aerial and ground surveillance on wildlife • Setting up a Problem Animal Control (PAC) camps along the park's boundary
Increased demand for power supply	• Construction of a KPLC sub-station • Use of ecofriendly generators • Use of renewable sources of energy i.e. solar panels
Poaching	• Increased aerial and ground surveillance • Inclusion of a KWS camp within the worker's camp • Benefit sharing programs • Education and awareness campaigns on conservation • Strict enforcement of existing laws



Liquid waste pollution	• Provision of temporary conservancy tank and mobile lavatories within the workers' camp • Engage NEMA and County licensed waste handlers • Provision of a service bay for machinery and equipment • Ensure proper decommissioning of the conservancy tank after completion of the construction works
Soil erosion	• Create and maintain soil traps and embankments. • Excavated soil to be used for back filling • Confine vegetation removal to the surveyed dam components' extent only • Sprinkling water on the construction sites • Undertake soil stabilization and conservation measures-retainer walls/gabions and riprap
Natural landscape alteration	• Habitat rehabilitation using the indigenous tree species e.g. <i>Acacia tortilis</i> and <i>Balanites aegyptica</i> • Backfilling of excavations, voids etc. • Direct seeding • Continuous monitoring of the revegetation process
Change in river discharge	• Installation river gauging stations around the dam and upstream to monitor effects of the dam to the river basin over time. • Controlled abstraction of water from the Galana River to the dam without compromising the natural continuous downstream flow
Sedimentation	• Provide a soil trap downstream the dam site to intercept excessive silt during the construction. • Provide sand check dams upstream of the dam to intercept excessive silt from the catchment and effectively increase the capacity of the dam in the long term. • Incorporate silt release in the dam design
Air pollution	• Provision of adequate and appropriate Personal Protective Equipment • Regular servicing and maintenance of construction equipment • Regular air quality monitoring • Dampening the working areas and access roads • Switching off the machines not in use • Covering of construction materials during transportation
Noise and vibrations	• Regular servicing and maintenance of construction equipment



	• Regular noise monitoring • Restrict working hours to daytime only
Increased traffic volume and conflicts on the access roads	• Consider using access roads that are less tourism traffic • Observe the recommended park speed limits of 40KM/H • KWS to enforce the speed limits • Delivery of materials to be restricted to off peak game drive hours
Water loss	• Creation of a buffer zone around the dam to minimize loss of water through evapotranspiration processes • Lining the canal with concrete on the floor and both banks reduce seepage losses
Risks of accidents and injuries to workers	• Education and awareness to all construction workers • Ensure use of appropriate PPEs • Provide First Aid Kits on site • Put in place an emergency response plan • Proper supervision



CHAPTER NINE: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

9.1 Introduction

Environmental planning and management as a concept seek to improve and protect environmental quality for both the project site and the neighbourhood through segregation of activities that are environmentally incompatible. Environmental planning and management integrate land use structure, social systems, regulatory law, environmental awareness and ethics.

Environmental and Social management plan (EMP) for development projects such as the proposed Athi Dam and Associated Irrigation Water Conveyance System aims at providing a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, ESMP assigns responsibilities for action to various actors and provides time frame within which mitigation measures can be done. ESMP is a vital output for an environmental impact assessment as it provides a check-list for project monitoring and evaluation. A number of mitigation measures are already incorporated into the project design. The ESMP outlined in Table 8-1 has addressed the identified potential negative impacts and mitigation measures for the proposed development.

9.2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in the project lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

- i. Disruption of natural environment and modification of micro-climate
- ii. Air and noise pollution
- iii. Proliferation of related activities
- iv. Workers' accidents and health infections during construction process


Table 9-1: Environmental and Social Management and Monitoring Plan (ESMMP)

Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
Pre-Construction Phase				
Surveys Camp site setting Material holding site setting	Acquire Consent from KWS before survey, camp site setting and material holding site setting	NIA CCCC	-Before commencement of construction works -No direct cost implications	• Presence of Consent from KWS
Commissioning of the Construction Works	• Site hand-over • Ground breaking	NIA CCCC	-After acquisition of all requisite approvals and licenses -Covered in the Project Cost	• Presence of the project Team
Securing the Construction Site	• Construction of a temporary fence and Hoarding	CCCC NIA	-After acquisition of all requisite approvals and licenses -Covered in the Project Cost	• Presence of a Fence and hoarding nets
Security for Construction Material	• Construction of Site Stores • Construction materials to be delivered in small quantities to minimise storage problems	CCCC NIA	-onset of material supply -Covered in the Project Cost	• Presence of designated material storage areas and warehouses
Extraction and Use of Construction Materials	• Ensure suppliers and handlers are licensed by NEMA • Acquisition of blasting permits	CCCC	-After acquisition of necessary permits -Covered in the Project	• Material site rehabilitation • Presence of



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
			Cost	blasting permits
Disturbance of Traffic flow	• The NIA to come up with a traffic management plan • Consider using access roads that are less tourism traffic • Observe the recommended park speed limits of 40KM/H • KWS to enforce the speed limits • Delivery of materials to be restricted to off peak game drive hours	NIA, KWS, CCCC	-Before movement of materials to site 2,000,000	• Traffic Management Plan • Awareness & sensitization programs • Signage
Site clearing • Vegetation removal, • Biodiversity degradation	• Confine vegetation removal to the surveyed dam extent only • Plan for vegetated buffer zones with suitable indigenous tree species around the dam and along the banks of the rivers, • Provide for approve direct access to the river upstream and downstream of the dam, • Removal for offsite disposal all plant matter and organic residual for future water quality safety.	NIA CCCC	- After acquisition of all requisite approvals and licenses -Covered in the Project Cost	• Absence of unnecessary vegetation removal • Presence of buffer zones
Disturbance to Wildlife	• Develop and operationalize an ecological monitoring and management plan • Engagement of an ecologist to oversee monitoring and management of ecological changes around the dam ecosystem	KWS WRTI	-Before commencement of construction works -3,000,000	• Ecological Monitoring & Management Framework • Monitoring reports
Construction Phase				
Loss of Habitat	• Prohibit unnecessary vegetation clearing • Demarcation and restriction of construction site	CCCC	- Throughout the	• Presence of a tree buffer zone



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	• Sparing mature trees • Plan for vegetated buffer zones with suitable indigenous tree species around the dam • Establishment of continuous ecological monitoring system • Collaboration between KWS and other stakeholders on planning on programs	KWS Park Management Partners	project cycle -3,000,000	• Ecological Monitoring and Management Framework • Monitoring reports
Land Use Change	• Ensure that the workers' camp will be temporary • Preparation of a rehabilitation plan on the entire dam project area • Demarcation and restriction of construction site • Establishment and strengthening of community conservancies-as compensation of land used • Establishment of continuous ecological monitoring system	CCCC KWS	- Throughout the project cycle -Covered in the Project Cost	• Rehabilitation Plan • Temporary structures in the worker's camp • Monitoring reports
Habitat fragmentation	• Provision of adequate wildlife overpasses prioritizing wildlife corridors • Phasing the construction works to minimize the fragmentation of habitat • Backfilling of all open excavation areas • Establishment of continuous ecological monitoring system	NIA CCCC	-During and after construction -Covered in the Project Cost	• Presence of Wildlife Overpasses • Absence of open excavations
Loss of Biodiversity	• Establishment of continuous ecological monitoring on biodiversity • Strengthening KWS and WRTI in Tsavo to conduct ecological monitoring • Rehabilitation programs of the degraded areas	KWS WRTI CCCC	-Throughout the project cycle -3,000,000	• Ecological Monitoring and Management Framework • Monitoring reports



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	Update/review of Tsavo East National Management Plan 2021-2031 to include the dam project			
Human-Wildlife Conflict	- Fencing the construction site and workers' camp - Training the construction workers on personal conduct within the park - Implementation of a joint security plan aiming at protecting the workers - Conducting continuous risk assessment reports - Provision of adequate PPEs - Training workers on health and safety and environmental awareness - Compliance to Occupational Health and Safety measures Work Injury Benefit Act	CCCC KWS	-Before commencement of the construction works & throughout the project cycle -6,000,000	- Presence of a fence around the construction sites - Presence of game wardens /trained security personnel - Presence of Problem Animal Control (PAC) camps
Water flow alteration	- Provision of artificial water pools for utilization by hippos and crocodiles - Restrict construction works to dry season when there is low water flow to ensure minimal river diversion	CCCC	-During construction period -Covered in the Project Cost	- Presence of artificial water pools - Presence of river diversion tunnels
Increased water demand	- Drilling a well near the river to provide water for the camp - Temporary water storage tanks in the camp	CCCC	-Before construction of the workers' camp -3,000,000	- Presence of a well in the workers' camp - Presence of water storage tanks - Metering of water
Accidents on Wildlife	Moving vehicle speed control to be limited to 40 KM/H	CCCC	- Traffic Management	Presence of a fence



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	• Sensitize drivers to observe park speed limits • Adequate hoarding of the construction site • Adequate signage on key wildlife corridors • Observe Park working hours 6.00 am to 6.00pm • Immediately reporting any wildlife accidents for clinical interventions • Proper record keeping of any wildlife accidents or kills • Provision of appropriate watering points for wildlife • Provision of drinking pools	KWS WRTI	Plan to be prepared before construction works and implemented throughout the project cycle -5,000,000 over a period of 3 years	around the construction sites • Presence of signage on wildlife corridors • Ecological Monitoring and Management Framework • Traffic Management Plan • Presence of drinking pools
Water Pollution	• Conduct regular water quality analysis • Construction of check dams control siltation • Inter-agency coordination between NIA, KWS, NEMA for regulation of water resource • Liaison with communities on the catchment areas upstream	NIA KWS NEMA CCCC	-Throughout the project cycle -2,000,000	• Presence of check dams • Water quality monitoring framework
Risks of fire	• Provision of firefighting equipment • Regular trainings of the construction workers • Develop a fire management and response plan • Conducting regular fire drills • Clear marking and demarcation of the fire assembly points • Train workers on first aid	CCCC KWS KWS Development	-During the 3 years of the project -4,000,000	• Fire management and response plan • Designated Fire assembly points • Presence of firefighting



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	• Keep fully equipped first aid kits • Fire detection system • Good maintenance of the access roads acting as fire breaks	Partners		equipment and fire detection system
Solid Waste Pollution	• Ensure waste materials are disposed at the County and NEMA approved sites • Use of the 3Rs – Reduce, Re-use, Re-cycle • Solid waste to be put in designated areas for appropriate disposal (waste cubicle) • Waste segregation at source • Engage a licensed, competent and effective waste handler	CCCC NIA	-Throughout the project cycle -3,000,000	• Presence of sanitation facilities and waste holding bins • Absence of Solid waste on the site
Disturbance to Wildlife	• Provision of adequate wildlife overpasses along the migratory routes • Establishment of continuous ecological monitoring • Confine construction activities and movements only on dam constructions sites, campsite and the access roads • Fencing of the construction sites	CCCC KWS WRTI	-Throughout the project cycle -Covered in the Project Cost	• Presence of wildlife overpasses • Presence of a fence around the construction sites • Ecological Monitoring and Management Framework • Monitoring reports
Wildlife displacement	• Increase aerial and ground surveillance on wildlife • Setting up a Problem Animal Control (PAC) camps along the park's boundary	KWS	-At the beginning of the project and carried on throughout the project cycle	• Presence of Problem Animal Control (PAC) camps



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
			-10,000,000	
Increased demand for Power Supply	• Construction of a KPLC sub-station • Use of ecofriendly generators • Use of renewable sources of energy i.e. solar panels	CCCC	-Before construction of workers' camp -10,000,000	• Presence of a KPLC sub-station • Presence of solar panels and ecofriendly generator
Poaching	• Increased aerial and ground surveillance • Inclusion of a KWS camp within the worker's camp • Benefit sharing programs • Education and awareness campaigns on conservation • Strict enforcement of existing laws	KWS CCCC WRTI	-Throughout the project cycle -Covered in the Project Cost	• Presence of KWS Camp at the project site • Wildlife surveillance plan
Liquid Waste Pollution	• Provision of temporary conservancy tank within the workers' camp • Engage NEMA and County licensed waste handlers • Provision of a service bay for machinery and equipment • Ensure proper decommissioning of the conservancy tank after completion of the construction works • Provision of mobile lavatories	CCCC	-During construction of the workers' camp -3,000,000	• Presence of temporary conservancy tank and mobile lavatories within the workers' camp • Presence of machinery and equipment service bay
Soil erosion	• Create and maintain soil traps and embankments. • Excavated soil to be used for back filling	CCCC	-During construction phase	• Presence of soil traps and



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	• Confine vegetation removal to the surveyed dam extent only • Sprinkling water on the construction sites • Undertake soil stabilization and conservation measures- retainer walls/gabions and riprap	NIA	-Covered in the Project Cost	embankments • Presence of retainer walls/gabions and riprap
Natural Landscape alteration	• Habitat rehabilitation/restoration using the indigenous tree species e.g. Acacia tortilis and Balanites aegyptica • Backfilling of excavations, voids etc. • Continuous monitoring of the revegetation process	KWS WRTI CCCC	-During and after construction works -Covered in the Project Cost	• Ecological Monitoring and Management Framework • Absence of open excavations
Air Pollution	• Provision of adequate and appropriate Personal Protective Equipment • Regular servicing and maintenance of construction equipment • Regular air quality monitoring • Dampening the working areas and access roads • Switching off the machines not in use • Covering of construction materials during transportation	CCCC	-During the construction phase -Covered in the Project Cost	• Air pollution monitoring framework • Workers wearing PPEs • Presence of machinery and equipment service bay
Noise Pollution and Vibration	• Regular servicing and maintenance of construction equipment • Regular noise monitoring • Restrict working hours to daytime only • Switch off engines not in use • Provide and enforce use of PPE e.g. ear muffs	NIA CCCC	-During the construction phase -Covered in the Project Cost	• Noise pollution monitoring framework • Workers wearing PPEs



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	Monitor noise levels as per NEMA guidelines			Presence of machinery and equipment service bay
Increased Traffic Volume and Conflicts on the Access Roads	- Consider using access roads that are less tourism traffic - Observe the recommended park speed limits of 40KM/H - KWS to enforce the speed limits - Delivery of materials to be restricted to off peak game drive hours	CCCC KWS	-During the construction phase -Covered in the Project Cost	- Traffic Management Plan - Awareness and sensitization programs - Signage
Water Loss	Lining the canal with concrete on the floor and both banks reduce seepage losses	CCCC	-During construction of the canal -Covered in the Project Cost	Concrete lining of the open canal
Risks of Accidents and Injuries to Workers	- Education and awareness to all construction workers - Ensure use of appropriate PPEs - Provide First Aid Kits on site - Put in place an emergency response plan - Proper supervision	NIA CCCC Health and safety officer	-Before and during the construction phase -5,000,000	- Presence of well-equipped First Aid kit - Presence of Security Guards on site - Presence of a register on the site
Operation Phase				
Dam/canal safety risks	- Provide clear emergency preparedness strategies - Regular maintenance and upgrade of the dam and the associated infrastructure	NIA Operations	-Before and during the operation phase of the dam	- Flood release programme - Emergency



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
	• Provide safe access points to the water for the local residents and their livestock • Review and update existing species conservation and management plans for focal species • Enhance close surveillance of the dam and surrounding • Sensitize the public and tourists on dam safety issues associated with the dam. • Provide clear emergency preparedness strategies. • Undertake a detailed Assessment study for the proposed dam and establish quantifiable risks • Integrate simulated flood release programme in the dam operations • Inform the public on any un-usual releases from the dam's spillway for appropriate safety precautions.	Manager	-Covered in the Project Cost	response system • Dam deformation monitoring system • Dam & canal seepage monitoring system • Stress and strain monitoring system • Seismic deformation monitoring system
Deterioration of water quality in the reservoir	• Clearing and removal of all vegetation materials at the dam site • Institute a broad water quality monitoring system focusing on catchment sources, incoming flows, entire dam water quality variations and water downstream of the dam location. • Maintain appropriate records on water quality as required by the law upon commissioning of the dam	NIA	-During the operation phase of the dam -Covered in the Project Cost	• Presence of water quality record • Presence of water quality monitoring system • Absence of vegetation material at the dam



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
Wildlife displacement	• Increase aerial and ground surveillance on wildlife • Setting up a Problem Animal Control (PAC) camps along the park's boundary	KWS	-Throughout the operation phase of the dam -Annual budget of 2,000,000	• Presence of Problem Animal Control (PAC) camps
Poaching	• Increased aerial and ground surveillance • Benefit sharing programs • Education and awareness campaigns on conservation • Strict enforcement of existing laws	KWS CCCC WRTI	-Throughout the operation phase of the dam -Annual budget of 2,000,000	• Presence of KWS Camp at the dam site • Wildlife surveillance plan
Change in river discharge	• Installation river gauging stations around the dam and upstream to monitor effects of the dam to the river basin over time. • Controlled abstraction of water from the Galana River to the dam without compromising the natural continuous downstream flow	NIA	-During construction of the dam -3,000,000	• Presence of river gauging stations
Natural Landscape alteration	• Habitat rehabilitation/restoration using the indigenous tree species e.g. Acacia tortilis and Balanites aegyptica • Backfilling of excavations, voids etc. • Continuous monitoring of the revegetation process	KWS WRTI CCCC	-After completion of the construction works -20,000,000 for 5 years	• Ecological Monitoring and Management Framework • Absence of open excavations
Water Loss	• Creation of a buffer zone around the dam to minimize loss of water through evapotranspiration processes	NIA	-After completion of the construction works -3,000,000 for 3 years	• Presence of a tree buffer zone



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
Sedimentation	• Provide a soil trap downstream the dam site to intercept excessive silt during the construction. • Provide sand check dams upstream of the dam to intercept excessive silt from the catchment and effectively increase the capacity of the dam in the long term and revise dam design to incorporate silt release	NIA	-During construction phase -5,000,000	• Presence of check dams
Traffic	• Come up with traffic management plan • Provide adequate parking facilities within the project site	CCCC NIA	-Before commencement of the project -1,000,000	• Presence of ample parking within the dam facility
Increased demand for Power Supply	• Construction of a KPLC sub-station • Use of ecofriendly generators • Use of renewable sources of energy i.e. solar panels	CCCC	-Before commencement of the construction works -10,000,000	• Presence of a KPLC sub-station • Presence of solar panels and ecofriendly generator
Decommissioning Phase				
• Removal of construction camp sites • Removal of construction residual material holding sites,	• The contractor to prepare a decommissioning plan of all construction installations and associated sited at least 3 months prior to end of construction	CCCC	-3 months prior to end of construction for the decommissioning plan -1 years after completion of construction works for the other activities	• Presence of a decommissioning plan • Absence of workers' camp and construction material holding warehouses



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
- Effects of material borrow pits left open - Disposal effects of wastes and debris.			-20,000,000	- Absence of open borrow pits - Absence of debris
Dam/canal Safety	Assess the condition of dam & canal to ascertain usefulness	Engineer NIA	-Throughout the operation phase of the dam -Annual budget of 1,000,000	Engineer's report on tests of the dam
Demolition of the dam structure	- Notify NEMA at least one year before the intention to decommission - Undertake a decommissioning audit at least six months before the activity and provide a decommissioning plan, - Undertake the decommissioning following the decommissioning	CCCC	-Upon issuance of NEMA license for dam decommissioning -50% of the project cost (19 billion)	Presence of a decommissioning plan
Rehabilitation and restoration of the project site	- Backfilling to near original state - Planting of indigenous vegetation - Securing the site by fencing off	CCCC KWS	-After decommissioning of the dam -2 billion	- Presence of the indigenous vegetation - Absence of the reservoir dam
Accidents/Injuries	Securing the Site by fencing off	CCCC NIA	-Before commencement of decommissioning works	Presence of a fence



Environmental Impact	Mitigation Measures	Responsibility	Timelines & Cost Estimate (Kes)	Monitoring Measures
			-20,000,000	
Un-disconnected Services	- Ensure disconnection of all services - Remove all surface and underground cables and wiring	CCCC	-Before and during decommissioning works -5,000,000	Absence of cabling
Noise Pollution and Vibration	- Regular servicing and maintenance of equipment - Regular noise monitoring - Restrict working hours to daytime only	NIA CCCC	-During decommissioning works -1,000,000	- Workers wearing PPEs - Presence of service bay



CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The ESIA study has established that the positive impacts of the proposed Athi Dam and associated auxiliary infrastructure construction far outweigh the anticipated adverse impacts. It is therefore concluded that the proposed project should be implemented for improved water supply in the Galana-Kulalu irrigation project area, enhanced food production, and enhanced ecosystem resilience through the wildlife water supplementation. The proposed project is of great benefit to the Kenyan economy as it will enable growth in agricultural food chain job opportunities. The proposed project is also in line with the Galana-Kulalu food security scheme, a project implemented as part of the flagship projects in Vision 2030. Vision 2030 envisaged to put 1,000,000 acres under irrigation by the year 2022 to address the cyclic hunger in the country. The transformation of land use will be done by putting idle land in existing farming areas into productive agricultural use. In this regard, through the Galana -Kulalu project at least 1 million additional hectares will be brought into production through the irrigation.

10.2 Recommendations

Implementation: It is recommended that the proposed project be implemented in compliance with all the relevant legislation and planning requirements of Kenya at all times. In line with this, the proponent and the contractor must take the legislative framework provided in this report into consideration, during and after the implementation of the project, as will be appropriate.

Adherence to ESMP: In addressing the environmental issues, the contractor and/or the proponent must follow the mitigation guidelines provided under ESMP. This will ensure the Environmental and safety of operators and the neighbouring communities. It is also recommended that an Environmental and safety officer should be stationed in the proposed project site, during the whole construction phase. The safety officer will make sure that all the workers follow the safety rules.

In addition, the proponent is recommended to maintain records of the socio-economic outcomes of the project to ensure that the benefits are realized and any negative impacts are addressed, maintain constant engagement with key stakeholders including public meetings and transparent reporting of



project impacts and mitigation measures and ensure that the dam maintains adequate downstream flow to support ecosystems and human needs.

Annual Environmental Monitoring and Audit: During Construction phase the Consultant and the Contractor is required to undertake Environmental Monitoring to ensure that the Construction is done in compliance with the provisions of the EIA License and during Operations the proponent should undertake an environmental audit (EA) of the project, as required by the NEMA. This will ensure that the project does not lose track of its good environmental management record achieved during construction and in addition, undertake remedial actions based on the recommendations from the annual audit.

Management Plans and Strategies: Prior to commencement of the construction works, the project proponent (NIA) are required to mitigate high risks, ensure cost-effectiveness and guarantee technical viability in a complex and remote environment. These plans and strategies are crucial for addressing previous failures in planning, funding and construction management. A pre-construction strategy ensures compliance with environmental regulations and addresses the impact of large-scale agriculture on the delicate ecosystem including human-wildlife conflict management for animals from adjacent areas like Tsavo. Proper planning helps coordinate the development of vital infrastructure such as roads, electric fencing, and staff housing, needed to support the project's success, especially given the remote location and poor initial infrastructure. The plans and strategies include:

1. Stakeholders' management plan
2. Security and safety management plan
3. Child protection plan
4. Sexual exploitation redress plan
5. Transport management plan
6. Soil erosion management plan
7. Labour management plan
8. Supply chain and sub-contractor management Plan
9. Pollution prevention and waste management plan
10. Invasive species management plan



11. Air quality/noise level monitoring plan
12. Detailed Grievance Redress Mechanism
13. Ecological and Biodiversity monitoring procedures and plans



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