Republic of South Sudan

Ministry of Transport

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE REHABILITATION AND CONSTRUCTION OF THE JUBA AND BOR PORTS, THEIR ACCESS ROADS AND FOR CLEARING (DREDGING) WORKS BETWEEN THE JUBA-BOR SECTION OF THE RIVER NILE



DRAFT FINAL REPORT

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DRAFT FINAL ESIA REPORT

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ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
AAQ	Ambient Air Quality
AIDS	Acquired Immunodeficiency Syndrome
ANL	Ambient Noise Level
BOD	Biochemical Oxygen Demand
CAR	Central African Republic
CCTV	Closed Circuit Television
CESMP	Construction Environmental and Social Management Plan
CGRC	Community Grievance Redress Committee
CIA	Cumulative Impact Assessment
CNG	Compressed Natural Gas
COC	Code of Conduct
COD	Chemical Oxygen Demand
CR	Critically Endangered
CSOs	Civil Society Organizations
dB(A)	Decibels
DG	Diesel Generator
DRC	Democratic Republic of Congo
EAC	East African Community
EAS	East African Standard
EC	Electrical Conductivity
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
ESF	Environmental and Social Framework
ESHS	Environmental, Social, Health, and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESSs	Environmental and Social Standards
FGD	Focus Group Discussion
GBV	Gender-Based Violence
GHG	Greenhouse Gases
GIIP	Good International Industry Practices
GM	Grievance Mechanism

GOSS	Government of South Sudan
GRC	Grievance Redress Committee
GRS	Grievance Redress Service
GWQ	Groundwater Quality
HDPE	High-density polyethylene
HFL	High Flood Level
HIV	Human Immunodeficiency Virus
HR	Human Resources
HSE	Health, Safety and Environment
IBAs	Important Bird and Biodiversity Areas
IDA	International Development Association
IDPs	Internally displaced persons
IFC	International Finance Corporation
ILO	International Labour Organization
IUCN	International Union for Conservation of Nature
IWT	Inland Water Transport
JICA	Japan International Cooperation Agency
KII	Key Informant Interviews
LAP	Land Acquisition Plan
LC	Least Concern
LMP	Labour Management Procedure
LNG	Liquefied Natural Gas
LRP	Livelihood Restoration Plan
MCM	Million Cubic Meters
MEAs	Multilateral Environmental Agreements
MIS	Management Information System
MOEF	Ministry of Environment and Forestry
MOT	Ministry of Transport
MWRI	Ministry of Water Resources and Irrigation
NGOs	Nongovernmental Organizations
NT	Near Threatened
NTU	Nephelometric Turbidity Unit
OSHA	Occupational Safety and Health Administration
PA	Protected Area
PCM	Public Consultation Meeting
PIU	Project Implementation Unit

PM	Particulate Matter
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SEP	Stakeholder Engagement Plan
SSAHUTLC	Sub-Saharan African Historically Underserved Traditional Local Communities
SS-CGP	South Sudan – Connectivity for Growth Project
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
STP	Sewage Treatment Plan
SWQ	Surface Water Quality
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOR	Terms of Reference
TSS	Total Suspended Solids
UN	United Nations
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
VECs	Valued Environmental Components
VU	Vulnerable
WASH	Water, Sanitation, and Hygiene
WB	World Bank
WBG	World Bank Group
WHO	World Health Organization

EXECUTIVE SUMMARY

E-1 INTRODUCTION

Ministry of Transport (MOT) of the Republic of South Sudan is charged with ensuring a safe secure, and affordable intermodal transportation system in the country. MOT has engaged EQMS Consulting Limited, Bangladesh ("Consultant") to undertake an Environmental and Social Impact Assessment (ESIA) study for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile, to identify environmental and social impacts and to assess the viability of development of the project in the proposed sites.

E 1.1 Project Background

The Directorate of River Transportation under the Ministry of Transport of South Sudan intends to develop inland water transportation infrastructures including Bor port at Leudier site and access road, access roads in the Juba port area, and clearing (dredging) in the selected sections of the White Nile River between Juba to Bor section. This project will potentially enhance the accessibility between the Juba and Bor sections. The project will increase employment opportunities for the local people around the project.

The aim of the ESIA study is to proactively evaluate the possible environmental and social impacts (both positive and negative) of the proposed project. The scope of the ESIA encompassed the identification of valued environmental and social components that describe the elements of the physical, biological, and socio-economic environment that may be affected by the proposed project. The assessment was conducted in the Jonglei and Central Equatorial states of South Sudan.

E 1.2 The Need for ESIA

The proposed project activities are likely to induce environmental and social impacts that could be positive and/or negative. To harness the potential positive impacts and avoid or reduce the potential negative impacts, this ESIA has been prepared.

The ESIA provided the framework for gathering and documenting information and views on the environmental and social consequences of the proposed activities so that the importance of the impacts and the scope of enhancing, modifying, and mitigating them can be properly evaluated and beneficial decisions made. The ESIA inter alia, contains an Environmental and Social Management Plan (ESMP) which consists of mitigation, monitoring, and institutional measures to be undertaken during implementation and maintenance of the intervention work to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

It is the requirement of the Ministry of Environment and Forestry (MOEF) of South Sudan and the integrated safeguards system of the World Bank to prepare before financing the proposed Project. Thus, with this ESIA obtaining the necessary approvals prior to the implementation of the project to ensure that the potential environmental and social impacts associated with the development and implementation of the proposed project are identified, assessed, and managed properly with a view to ensuring sustainability is possible.

E 1.3 Objectives of the ESIA

The primary purpose of the ESIA was to assess and predict potential adverse environmental and social impacts of the project and to develop suitable mitigation measures, which have been documented in the ESMP. The specific objectives are outlined below:

- Identification of the project-sensitive components of the existing physical, biological, and social environment within the project area and area of influence.

- Appraisal of the project activities including pre-construction/planning and design, construction, operations and maintenance, and decommissioning and dismantling that may result in significant modification of any human or natural environmental resources.
- Determination of existing environmental and social risks and impacts of the site/effect of the proposed operational activities on the environment.
- Identification of any impacts that cannot be avoided, and outline ways of enhancing the beneficial ones.
- Recommendation of measures to avoid, ameliorate, or mitigate the identified impacts.
- Establishment of an appropriate ESMP to verify and improve the accuracy of the ESIA predictions, and control levels for the life of the project.
- Preparation of a detailed ESIA report, presenting clear and concise information on the environmental and social impact of the proposed project activities.

E 1.4 ESIA Preparation Approach

The ESIA report was prepared in a manner consistent with applicable national legislation and World Bank Environmental and Social Standards. The approach followed the path of screening and scoping exercise, literature review, field visits and baseline data collection, stakeholder consultation and engagement, identification and assessment of potential impacts, development of environmental and social management plan including mitigation/enhancement measures, monitoring plans, and institutional framework for the ESMP implementation.

E-2 SUMMARY DESCRIPTION OF THE PROJECT

E 2.1 Proposed Project Location

The geographical coordinates of the proposed Bor Leudier port is 6°12'16.57"N and 31°33'10.39" E. Bor is the second most developed city, in central South Sudan, approximately 190 kilometers north of Juba, the capital, and is the capital of Jonglei State. Infrastructure development in the JUba port as well as three roads will be developed around the Juba port in Juba Town. Administratively the area is located in Juba County under Central Equatoria State, and on the west bank of the White Nile. In addition, clearing (dredging) activities will take place in selected locations in the White Nile River between Juba to Bor section to remove rocks, shipwrecks, floating tankers, and vegetation and clear the shallow areas and sharp bends.

E 2.2 Project Activities

E 2.2.1 Pre-construction/Planning and Design Phase

Pre-construction activities will include:

- Undertake preconstruction preparation activities including Hydrodynamic and Bathymetric study, Pre-Feasibility study, Preliminary Engineering Design, and preparation of cost estimates.
- Land acquisition and Resettlement Action Plan including Livelihood Restoration Plan following national legal requirements as well as World Bank Environmental and Social Standards.
- Perform a Scoping and Environmental and Social Impact Assessment including an
- Environmental and Social Management Plan following national legal requirements as well as World Bank Environmental and Social Standards.
- Acquiring licenses and permits i.e., environmental permit, water use permit, permit to work inside of the protected area boundary, etc.

E 2.2.2 Construction Phase

Construction activities will include:

- Site clearance and site preparation including soil excavation/leveling/land preparation for the proposed project.

- Establishment and operation of worker facilities and mobilization of workers for construction activities.
- Installation of the temporary security fence at the campsites, site office, and storage facilities.
- Collection and transportation of construction materials and storage in the construction site.
- Mobilization of dredges, equipment, and machinery at the project construction site.
- Construction of Bor port at Jonglei State.
- Construction/strengthening of access roads in Juba and Bor port area.
- Commencement of clearing (dredging) and transportation and disposal of dredge materials.
- Operation of diesel generator set.
- Commencement of civil work, mechanical work, electrical work, etc.
- Collection, storage, transportation, treatment, and disposal of wastes (solid, liquid, and hazardous) generated from construction activities.
- Maintenance and replacement of dredgers, vehicles, equipment, machinery, etc.
- Implementation and monitoring of environmental and social safeguards as well as health and safety management.
- Closure of contractor's office, and removal of construction machinery, storage yard, etc.

E 2.2.3 Operation and Maintenance Phase

Operation and maintenance activities will include:

- Operation of the river port and access roads
- Transportation, offloading, and storage of materials/products
- Ongoing maintenance of the port terminal facilities
- Maintenance dredging (as needed)
- Generation of solid waste and management
- Generation of liquid waste (wastewater) and management
- Storage and handling of hazardous waste (fuels, chemicals, etc.)
- Operation and maintenance of utilities including power, water, and waste treatment facilities.

E 2.2.4 Decommissioning and Dismantling Phase

Decommissioning and dismantling activities will include:

- Remove and disposal of surface structures
- Movement of vehicles, equipment, and personnel
- Storage and handling of fuels and chemicals
- Treatment and disposal of wastes
- Major rehabilitation or upgrading of project structures
- Reinstatement and restoration of the affected sites

E-3 POLICY LEGAL, AND ADMINISTRATIVE FRAMEWORK

E 3.1 National Environment and Social-Related Regulatory Instruments

Environment, social, health safety, forest, and wildlife management-related national regulatory instruments include but are not limited to Draft Environmental Protection Bill 2023, Environment (Protection) Act 2001, Land Act 2009, Local Government Act 2009, Child Act 2008, Forests Bill 2009, Wildlife Conservation and National Parks Act 2003, Freshwater Fisheries Act 1954, Traffic Act 2003, Public Grievances Act 2011, etc. were followed.

E 3.2 International Agreements and Conventions Signed by South Sudan

Several Conventions, Protocols, and Treaties that promote the maintenance of a viable environment and achieve sustainable development have been endorsed by South Sudan. They are applicable to the proposed Project based on the environmental and social dimensions alongside the inherent health and

safety implications such as the Treaty of the East African Community, United Nations Convention on Biological Diversity, Convention on Illegal Trade of Endangered Species, Ramsar Convention, Conservation of Nature and Natural Resources, UN Framework Convention on Climate Change, Paris Agreement, etc. were considered.

E 3.3 WB Environmental and Social Standards & WBG EHS Guidelines

As part of the international environmental and social requirements of project financing institutions, WB ESS1-10 under ESF 2018 were considered. In addition, WBG applicable EHS guidelines including general and Ports, Harbors, and Terminals, and other Good International Industry Practices were considered.

E-4 DESCRIPTION OF THE PROJECT ENVIRONMENT

E 4.1 Climate and Meteorology

The project area experiences a tropical wet and dry climate with two rainy seasons and high humidity. Temperature averages are normally above 25°C, with highs exceeding 35°C, particularly during the dry season. The rainy season differs by location, but it generally occurs between April and November. The lowland areas of Eastern Equatoria, Jonglei, Upper Nile, and Bahr el Ghazal receive annual rainfall between 700 mm to 1,300 mm.

E 4.2 Topography

The major geographical features of the project area are the White Nile, which flows north from Central Africa's uplands and dominates the center of the country, and the vast Sudd wetland, one of the world's largest wetlands. The low-lying areas in the project area are mainly characterized by Savannah grasslands, which are interspersed with marshlands, swamps, and riverine forests.

E 4.3 Geology

In the study area, three types of geological formations are found i.e., Quaternary-Tertiary Unconsolidated Sedimentary, Precambrian, and Tertiary-Quaternary Um Ruwaba formation.

E 4.4 Hydrology and Drainage

The White Nile is the main river in the proposed project site. The Sudd wetland is a Ramsar site, and its seasonal coverage ranges between 10,000-35,000 km^2, making it one of the largest in the world.

E 4.5 Soil

In the project area, different types of soil including Ferric Luvisols, Gleyic Luvisols, Eutric fluvisols, and Chromic Vertisols are found.

E 4.6 Agroecology

The proposed project area falls in three agroecological zones i.e., Nile and Sobat Rivers, Ironstone Plateau, and Hills and Mountains.

E 4.7 Traffic and Transport

The transport system in South Sudan consists of four modes including river, rail, air, and road transport-the largest being road transport. There are seven main river ports in South Sudan, and with the support from JICA the Juba port rehabilitation activities are ongoing. The river port in Bor consists of a natural embankment for offloading fish, fuel, and general cargo.

E 4.8 Air Quality

The primary ambient air quality in the study area was monitored at ten locations during the baseline data collection. The $PM_{2.5}$ and PM_{10} are observed to vary from 9.5 µg/m^3 to 21.7 µg/m^3 and 12.4 µg/m^3 to 42.9 µg/m^3 respectively. At three locations the observed values exceeded the $PM_{2.5}$ WHO stipulated

standards for $PM_{2.5}$ (15 µg/m^3). The CO and O_3 observed values in all ten locations were within the WHO stipulated standard for Co and O_3.

E 4.9 Noise Level

The primary ambient noise monitoring has been conducted at ten locations in the study area. Daytime noise levels were found to vary from 44.1 dB(A) to 57.5 dB(A). All the observed values were within the WHO standards set for the respective zone.

E 4.10 Surface Water Quality

Five surface water samples were collected and analyzed from the White Nile River. The analysis results indicate that all the parameters except turbidity and chromium at one location were within the permissible limit of the East African Standards used by the South Sudan National Bureau of Standards.

E 4.11 Groundwater Quality

Five groundwater samples were collected and analyzed from the study area. The analysis results indicate that all the parameters were within the permissible limit of the WHO Guidelines value except cadmium and nickel in all five samples.

E 4.12 Natural Hazards

In the study area, flood and erosion are the major two natural hazards. The proposed project site has extremely high exposure to flood hazards due to its proximity to the river. Riverbank erosion is one of the most serious problems in river morphology. The significant flows cause floods, bank overflow, and surface drainage difficulties during the rainy season (generally June to October), which cause bank erosion.

E 4.13 Flora and Fauna

The aquatic and terrestrial ecosystems of the White Nile River, particularly along the Juba to Bor stretch, are rich in biodiversity and ecological significance. Baseline data collection identified 16 aquatic plant species from 12 families, with notable emergent plants such as Papyrus *(Cyperus papyrus),* Reed Mace *(Typha latifolia),* and Common Water Hyacinth *(Eichhornia crassipes).* A key aquatic wildlife species of conservation concern found in the White Nile River is the Nile softshell turtle *(Trionyx triunguis),* listed as Vulnerable (VU) on the Global IUCN Red List. The terrestrial ecosystems along this stretch are equally diverse, with 35 species of flora from 23 families recorded. The Fabaceae family had the highest representation with four species, followed by *Solanaceae and Poaceae,* each with three species. Terrestrial fauna includes 54 bird species, 16 reptiles, seven amphibians, and 16 mammals. Notable conservation significant species recorded include the Critically Endangered (CR) Hooded Vulture *(Necrosyrtes monachus),* the Endangered (EN) Nile lechwe *(Kobus megaceros),* and the African bush elephant *(Loxodonta africana),* and the Vulnerable Cheetah *(Acinonyx jubatus).*

E 4.15 Conservation Concerns

The Bandingilo National Park, a protected area and Important Bird and Biodiversity Area (IBA), also intersects portions of the White Nile River, further enhancing the ecological value of the region.

E 4.16 Social Environment

The proposed project area is located in Central Equatoria and Jonglei states. The population density is 21.1 people per square kilometer. The average household size is 5.9. The project area features ethnic groups like Dinka Bor and Aliab Dinka in Bor South and Awerial, Mundari in Terekeka, and a mix of Bari, Lokoya, Lulubo, Nyangwara, and others in Juba, making it the most ethnically diverse region. The literacy rate remains among the lowest globally, with only 35% of the population over the age of 15 able to read and write. In the project area prominent livelihood pattern is fishing-related activities and trading. Central Equatoria has more income diversity with wages (17.4%) and business (9.8%). Animal

husbandry is most common in Jonglei (9%). Fishery involvement is highest in Jonglei (31%) and lowest in Central Equatoria (9%). Agriculture and livestock are key livelihoods across all regions.

About 55% of households have access to improved drinking water sources. This includes sources such as protected wells, boreholes, and piped water systems. According to the 2010 Southern Sudan Household Survey, 67.7% of the population has access to safe water, and 14.6% has access to improved sanitation. The water, sanitation, and hygiene situation remains critical, with only 41% of the population having access to basic water supply and just 11% with basic sanitation coverage. Additionally, 63% of the population still practices open defecation, according to the 2019 UNICEF-WHO Joint Monitoring Program. Central Equatoria demonstrated better access to private and shared pit latrines as well as modern sanitation options, whereas Jonglei and Lakes had a much higher percentage of households without any toilet facilities. This variation underscores regional differences in access to sanitation infrastructure. Gender-based violence affects 65% of women in South Sudan, worsened by conflict and cultural norms.

E-5 Potential Impacts and Mitigation/Enhancement Measures

Beneficial and adverse impacts of various components of the selected project alternative on the physical, biological, and socio-economic environments were identified.

E 5.1 Summary of Identified Impacts

The proposed project is envisaged to have many positive environmental and social impacts. Impact identification was carried out through field visits, literature reviews, and stakeholders' input. Below is a summary of the positive impacts anticipated from the proposed project implementation.

E 5.1.1 Project Benefits/Positive Impacts

The nation, states, and counties will have the following benefits from the proposed project.

- Assist the government in providing efficient, reliable, safe, and secure river transportation services for both passengers and goods as part of a seamless, integrated multimodal transport system.
- Navigational difficulties including riverbed weeds growth, water hyacinth, debris from sunk vessels, and riverbed condition on the Juba-Bor stretch will be removed and travel time between Juba and Bor port will be significantly reduced.
- Cost-effective transportation will be developed, and business opportunities will be increased in the region.
- Appropriate cargo handling capacity and equipment for facilitating integration with other modes of transportation.
- Employment opportunities for the local community in different phases of the project for the skilled, semiskilled, and unskilled persons as well as the surrounding region.
- The community livelihoods (fishing-based livelihoods) will be advanced through employment activities and transportation/supplies that will be provided through proposed project facilities and infrastructures.
- Skill development and training for the local people.
- Transfer of relevant technical skills and tools.
- Improved security in the region.
- Increased market for local agricultural products, and fish.
- Improved public transportation system in the region

E 5.1.2 Negative Impacts

A summary of negative risks and impacts anticipated from the proposed project has been given below:

- **Ambient air quality:** site clearing, development, excavation, vehicle movement, operation of construction equipment and machinery, and operation of dredgers during the construction

phase will impact ambient air quality by generating dust and exhaust emissions into the atmosphere. It will impact health and safety risks to residents.

- **Ambient noise level and vibration:** noise and vibration levels will be increased due to the operation of construction machinery and equipment, materials transportation vehicles, and port construction activities. It will impact the local community, workers, and flora and fauna.
- **Soil and Groundwater:** contamination of soil and groundwater by stored fuel, lubricants, paints, and refueling of vehicles.
- **Surface Water Quality:** clearing (dredging) activities in the river, port construction activity, accidental spillage of hazardous waste, municipal waste from the workers' facility, increased boat movement, and waste disposal into the water body will impact the surface water quality. Clearing (dredging) and disposal of dredge materials may lead to impacts on water quality from increased turbidity and from the release of contaminants to the water column due to the resuspension of sediments and/or changes of certain chemical compounds in the dredged materials when exposed to the different level of oxygenation.
- **Waste Generation and Disposal:** waste from workers' facilities, dredgers, boats, port operations, accidental spillage of hazardous substances, and improper waste handling could introduce toxic substances into the water, adversely impacting sensitive aquatic ecosystems. Improper solid waste can also pollute the soil quality in the project area.
- **Traffic and Transport:** increasing traffic due to the construction and operation of ports, construction workers, pedestrians, and onlookers are also prone to accidents. The construction vehicles will add more traffic and as a result, traffic congestion and road accidents will increase. The river traffic will be increased during the operation phase of the project.
- **Natural Hazards:** natural hazards anticipated at the project site are flood and erosion. Bor County in Jonglei state is a severe flood-prone area in South Sudan. The river Nile is a perennial river, and floods and erosion are very common. Thus, threats to navigation are anticipated during heavy flow and flood-like situations, especially to smaller vessels.
- **Flora and Fauna**: clearing (dredging) activities in the White Nile River will disrupt aquatic ecosystems, degrade water quality, and damage fish and aquatic wildlife habitats, leading to a decline in species diversity. Port activities further introduce pollutants and invasive species, posing a significant threat to biodiversity. Increased river traffic due to port rehabilitation in Bor and Juba may also facilitate the poaching activities in the Bandingilo National Park.
- **Land Acquisition and Resettlement:** both physical and economic displacement at the proposed Bor port construction site.
- **Livelihoods:** temporary disruptions will affect small businesses, fishermen, and workers in the project areas, though alternative sites for affected individuals are planned. Dredging may momentarily affect fishing, but the impacts are short-term and localized.
- **Community Health, Safety, and Security:** increased population density during construction could spread diseases like tuberculosis, HIV/AIDS, and waterborne illnesses. An influx of workers may create social and security concerns.
- **Occupational Health and Safety:** construction-related hazards like heavy machinery, inadequate safety protocols, and exposure to pollutants pose risks for workers.
- **Child Labor and Forced Labor:** South Sudan’s economic conditions make child labor and forced labor significant concerns.
- **Gender-Based Violence and SEA/SH:** women, children, and IDPs are particularly at risk, facing heightened threats from gender-based violence, displacement, and loss of livelihoods. The influx of workers and poor enforcement of laws heighten the risk of GBV, with women and girls particularly vulnerable.

E-6 ALTERNATIVE ANALYSIS

The project alternatives included the different means of completing the project while still meeting the purpose of the proposed activity. Based on the nature of the proposed project the following project alternatives or options were considered: no-go alternative, alternative sites, access road alignment,

dredging methods, dewatering, disposal options, selection of disposal site, and alternative construction technology and materials.

E-7 STAKEHOLDER CONSULTATION AND MANAGEMENT OF GRIEVANCE

E 7.1 Stakeholder Consultations

Consultants have undertaken a number of consultations with stakeholders as part of the ESIA process. Key stakeholders identified and consulted in the project area, including the port, port access road, and river clearing section, comprised community leaders, asset owners (both directly and indirectly affected), and business owners. These consultations provided an opportunity for affected and interested parties to share their concerns, opinions, and views about the proposed development. The consultations involved various stakeholders such as national and state government officials, local leaders, and representatives from other departments. Different methods were employed, including Focus Group Discussions, Key Informant Interviews, and large-scale public consultations in areas close to the project site.

Stakeholder engagement meetings took place from August 3 to September 4, 2024, with two major public consultation meetings held in Bor Port (August 12, 2024) and Juba Port access road (August 20, 2024). During these meetings, an overview of the proposed project, its study methodology, and potential impacts were presented. The objective of these meetings was to give stakeholders a chance to express their concerns, expectations, and observations regarding the proposed project, to ensure that no issue has been missed during the ESIA.

Key insights and opinions from the stakeholder consultations include the following:

- Stakeholders are well-informed about the proposed project interventions and the project is welcomed by the community and will assist in alleviating the suffering of the people on the port access roads, river port to be constructed and clearing (dredging) will be done in waterways.
- The local community and country and state governments are ready to give maximum cooperation to the contractors/subcontractors for the implementation of the project.
- The community in the proposed Bor Leudier port site is willing to give up their land and property for the implementation of the project as long as they will be fully compensated.
- The youth should be given special consideration in employment and make them useful to help in the provision of security and safety materials and personnel and other construction-related activities.
- Bandingilo National Park is a protected area and according to the national regulations, there are restrictions on working in the protected area. Therefore, a permit will be required from the Ministry of Wildlife Conservation and Tourism before the mobilization of activities in the area.
- The proposed project will use the river Nile and has the potential to discharge waste into the river. A permit will be required from the Ministry of Water Resource and Irrigation for any use of water bodies and disposal of waste into any waterbody.
- Waste (solid, liquid, and hazardous) management should be prioritized in the project area.
- Health and safety risks stem from increased traffic, port operations, cargo handling, ships/boat operations, and other activities in the waterway.
- An influx of workers could lead to increased crime and weakened social cohesion.
- Gender-based violence and exploitation risks may rise due to the influx of male workers.
- To enhance the livelihood of economically displaced persons in the proposed project area a Livelihood Restoration Plan should be developed.
- The project implementation activities should include the stakeholders and ensure a coordinated approach in addressing compensation and resettlement issues as they affect various parties, especially the local communities and port users.

These observations and options have been noted and are taken care of in the mitigation measures in the ESMP, making them support efficient project delivery in an environmentally sustainable, socially acceptable, and culturally appropriate way.

E 7.2 Management of Grievances

A grievance mechanism has been developed to receive grievances from both the workers and the local community separately aligning with the World Bank's Environmental and Social Standards. This mechanism will ensure the timely resolution of complaints and concerns from workers and the community. It is expected that it will foster positive relationships between the project, affected communities, and workers.

E-8 KEY IMPACT MANAGEMENT MEASURES

E 8.1 Project Potential Impact Mitigation Measures

The measures proposed are specific, measurable, achievable, and relevant to the proposed intervention and time-based. The measures also considered the environmental laws in South Sudan and internationally, and the principles of sustainable development, and the best available technology.

Table-1 summarizes the potential key impacts associated with the project, together with corresponding mitigation measures.

Table-1: Mitigation Measures for Potential Impacts

Potential Impacts/Aspects	Mitigation Measures
Ambient Air Quality	• Regularly spray water to suppress the resuspension of dust during construction, particularly during the use of gravel roads and dirt tracks. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust. • Avoid unnecessary vehicle idling and switch off the engines of vehicles, machinery, and equipment while not in use. • . • Solid waste burning at the project site is prohibited.
Ambient Noise Level and Vibration	• Barricading (temporary noise barrier) the construction sites to minimize the noise level outside the site boundary. • Use soft start/slow ramp-up during pile driving and dredging activities to allow time for sensitive aquatic species to vacate the area. • Protection devices i.e., earplugs/earmuffs shall be provided to the workers operating near high noise-generating machines.
Soil and Groundwater Quality	• Dredge soil shall also be either utilized for construction activity or disposed of along with excavated soil to the identified debris disposal site. • Fuel shall be stored in High-density polyethylene (HDPE) containers on paved surfaces with the provision of a catchment pit to prevent soil contamination from oil spillages. • Arrangements should be made for the segregation of municipal solid waste into recyclable and non-recyclable waste. • Refueling should be carried out in designated areas using strict protocols. • Adequate sanitary facilities, i.e., toilets and showers, will be provided for the construction workforce.
Surface Water Quality	• Labor deployed onsite should be sensitized about the use of sanitation facilities, disposal of waste in dustbins, and storage of materials in designated locations.

Potential Impacts/Aspects	Mitigation Measures
	• Maintain fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g., impermeable surface, settlers, and oil separator). • Fuel, oil and used oil storage areas will be contained in bunds of 110 percent capacity of the stored material.
Waste Generation and Disposal	• The port authority should follow the 3Rs principle (reduce, reuse, and recycle) to manage solid waste. • Adequate sanitary facilities, i.e., toilets and showers, shall be provided for the construction workforce, and septic tanks and soak pits shall be provided.
Traffic and Transport	• Prepare and submit a traffic management plan to the PIU of MOT for approval at least 30 days before commencing work on any project component involved in traffic diversion and management. • Inform local communities about the construction program in advance. • Enforce on-site speed limits. • Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the project information in both local language and English. • Use flagmen to give directions to traffic.
Natural Hazards	• A detailed flood risk assessment must be carried out before the detailed design of the project infrastructures. • All structures should be designed above the high flood level (HFL) of the river for 50 years return flood period. • An emergency response cell at the river port should be developed to take care of and handle the expected emergency situation.
Flora and Fauna	• Implement sediment control measures (e.g., silt fences) to reduce pollution from dredging and construction runoff. • Designate disposal sites away from sensitive habitats (wetlands, riparian zones) to protect aquatic life and maintain water quality. • Use noise-reducing technologies such as mufflers or bubble curtains around pile-driving equipment to minimize underwater noise pollution. • Limit the use of heavy machinery during sensitive periods such as nesting or hibernation seasons, breeding, and migration seasons.
Land Acquisition and Resettlement	• A Resettlement Action Plan including a Livelihood Restoration Plan should be prepared and followed during the project implementation. • Grievance Management system should be introduced to the affected community and continuous consultation with them.
Livelihoods	• A Livelihood Restoration Plan (LRP) to mitigate economic displacement impacts and to cushion the vulnerable and disadvantaged groups from being disproportionately affected by project induced development. • Temporary business relocation places should be selected in consultation with affected parties and relevant stakeholders. • Identification of economically displaced persons at the Juba port access road and Bor port area.
Community Health, Safety, and Security	• Barriers will be provided to prevent the ingress of persons into the construction site and also to protect the public from exposure to hazards associated with construction activities. • Ensuring that only licensed drivers are employed by the Project.

Potential Impacts/Aspects	Mitigation Measures
	• Collaboration with local communities and responsible authorities to improve signage (e.g., pedestrian crossings, speed limits, etc.), visibility, and awareness of traffic and pedestrian safety.
Occupational Health and Safety	• Demarcate all hazardous trenches with signs posts and warning tapes. • Contractors shall provide appropriate Personal Protective Equipment (PPEs) to all project workers and visitors and ensure their use at the construction sites. • Confirm the availability of permanent first-aid kits at the project sites. • Education and sensitization of workers and the local communities on HIV/AIDS and STIs.
Child Labor and Forced Labor	• Children under the age of 18 years should not be hired on-site as provided by the Labor Act. • Ensure that the recruitment inventory indicates the ages of employment applicants and age verification is done using national identification cards or birth certificates.
Gender-Based Violence and Sexual Exploitation and Abuse/Sexual Harassment	• During the recruitment of workers, there will be no discrimination against one gender either by design or oversight. • The contractor to ensure the provision of the necessary basic sanitary facilities to each gender - provides separate sanitary facilities for each gender. • Contractor to put in place mechanisms for reporting and addressing gender discrimination incidents and other human rights violations. • Contractors should develop and implement a code of conduct.

E 8.2 Environmental and Social Monitoring Plan

Environmental and Social Monitoring Plan provides specific means to ensure that the activities of the project during preconstruction, construction, operation and maintenance, decommissioning, and dismantling comply with the applicable environmental and social standards and practices.

The E&S monitoring activities shall be based on direct or indirect indicators of emissions, and resource use applicable to the road project. Monitoring frequency shall be sufficient to provide representative data for the parameter being monitored. Monitoring shall be conducted by trained individuals who can carry out the monitoring and record-keeping effectively using properly calibrated and maintained equipment.

Monitoring data shall be analyzed and reviewed at regular intervals and compared with operating standards so that any necessary corrective actions can be taken. As part of the monitoring programme, visual inspections and quality monitoring for light attenuation shall be conducted daily, for instance, during construction.

Inspection oversight should rest with the PIU supported by the Ministry of Transport with local knowledge, policies, and procedures. However, the Safeguard Officer of the PIU shall ensure routine inspections are carried out, especially during the construction, and maybe the contractor‘s project manager, site supervisor, contractor representative, etc. All inspection details should be formally documented, filed, and made available for inspection as required by PIU and relevant authorities.

E 8.3 ESMP Implementation

The ESMP is instituted for the proposed project to ensure that impact mitigation, control, and recovery measures are well implemented. The ESMP is designed to commit PIU to operate with little or no long-

term negative impacts on the project. This ESMP shall be updated and revised on a regular basis throughout the project's life cycle.

Since contractors will implement the project on behalf of the PIU, the Contractor(s) will be required to develop a Construction Environmental and Social Management Plan (CESMP) to ensure compliance with the requirement of the ESMP, country system, and WB ESS before construction works begin. The range of contractors' responsibilities in this regard includes managing the direct, indirect, and cumulative impacts of their activities from the construction as well as impacts on their workforce and compliance with health, safety, and labor requirements. In addition, they will be expected to comply with specific project HSE policies, regulations, and standards through a self-verification program by undertaking preconstruction surveys, and assessments to identify and manage HSE risks and impacts, performing Contractor HSE inspections and audits, performing contractor HSE monitoring and reporting, and putting to put in place corrective and remedial measures for non-conformance and have an incident notification and Emergency Management Plan.

E 8.4 Cost Estimates for ESMP Implementation

The total cost of mitigation by the Contractor will be included in the contract as part of the implementation cost by the Contractor. A tentative amount of 320,000 USD has been considered for ESMP implementation.

E 8.5 Key Measures and Actions for the Environmental and Social Commitment Plan

MOT shall comply with the provisions of environmental and social documents required under the Environmental and Social Framework and referred in the ESCP that will be developed for the Project including the Environmental and Social Impact Assessment including Environmental and Social Management Plan, Labor Management Procedures, Stakeholder Engagement Plan, Occupational Health and Safety Plan, Community Health and Safety Plan, Waste Management Plan, SEA/SH Action Plan, Security Management Plan, Resettlement Plan, Livelihood Restoration Plan, Biodiversity Management Plan, Chance Find Procedures, and Grievance Mechanism for both workers and community and implement before project appraisal and throughout the project lifecycle.

The MOT is responsible for compliance with all ESCP requirements during the project life cycle. MOT will establish and maintain a Project Implementation Unit (PIU) with qualified staff and resources to support the management of environmental, social, health and safety, GVB and SEA/SH risks and impacts of the Project.

MOT shall organize different capacity-building training for PIU staff, stakeholders, communities, contractors, and project workers on the relevant aspects of the project's environmental and social risk management.

Contractor shall prepare and submit monthly environmental and social monitoring reports to MOT and MOT shall be responsible for the preparation of quarterly reports to WB.

MOT shall maintain collaboration with the relevant agencies including the Ministry of Environment and Forestry, Ministry of Labor, Ministry of Water and Irrigation, Ministry of Wildlife Conservation and Tourism, Ministry of Land, Housing and Urban Development to manage the project's environmental and social risks and impacts of the Project.

E-9 CONCLUSIONS AND RECOMMENDATIONS

E 9.1 Conclusions

The proposed inland water transportation project will have significant benefits in improving the navigability between Juba to Bor section and in reducing flood risk and damage to property along the waterways. The development of the Bor port and access roads in Juba and Bor ports will improve the accessibility between ports and communities, markets, farms, etc. in the region. The ESIA of the

proposed project shows that the project can be achieved and operated with minimal negative impacts on the surrounding environment and humans by strict adherence and implementation of the recommended mitigation measures. The ESIA has also developed an Environmental and Social Management Plan, which incorporates various mitigation measures that will eliminate or reduce the potential impacts of the proposed project on the environment. Mitigation measures were subsequently developed for adverse impacts based on industry best practices, available technology, as well as health safety, and environmental considerations. A RAP including LRP will address future involuntary impacts.

The ESMP shall be implemented and maintained throughout the duration of the project with the adverse impacts mitigated to as low as reasonably practicable levels. Impact mitigation monitoring shall also be carried out with the involvement of regulators to check compliance with the ESMP. The mitigation and management actions outlined in the ESIA shall be included in construction contract documents to be adopted by the construction contractors. The proposed project can be executed within the ambit of sustainable development, and this will therefore form the basis for the actual project implementation.

E 9.2 Recommendations

The following is a highlight of some of the key recommendations of this ESIA report:

- Air, noise, water, and soil pollution should be controlled with the use of good engineering practices including selection of pollution abetment devices, use of proactive measures, selection of proper sites, etc.
- Segregation of solid waste at sources is strongly recommended at construction sites, clearing (dredging) sites, as well as port operations.
- A dredge material disposal site should be selected and permission from the MOT as well as local administration and community to be obtained for the disposal site selected. Disposal sites should be located at least 1000m away from any sensitive locations like settlements, notified forest areas, sanctuaries, or any other sensitive locations.
- The proposed project area, specifically the Bor port area is flood-prone therefore a detailed flood risk assessment will be required before finalizing the project design.
- Priority should be given to local workers during the project implementation in order to limit the number of migrant workers. This will reduce threats to community culture, health, safety, and security as well as stimulate local socioeconomic activities, improve livelihood, and reduce poverty in the affected communities.
- A resettlement action plan (RAP) including a livelihood restoration plan (LRP) should be developed and adopted for the affected community.
- Community-based and a separate workers' grievance mechanism should be developed and implemented to promptly and effectively resolve grievances from affected groups or persons.
- The implementation of the proposed project should involve a well-established community relation to create a sense of ownership of the project by the communities and make the project more sustainable.
- The safeguard team of PIU should coordinate active monitoring to ensure the contractor(s)/ subcontractor(s) adhere strictly to the requirements of the ESMP, especially in the application of mitigation measures during project design and implementation.
- MOT should coordinate with the relevant national, state, county, and local administration with departments/agencies/institutes/authorities related at all stages of the proposed project implementation. This coordination will help relevant authorities develop their future strategies proactively to address the anticipated issues likely to arise in the project area.

1 INTRODUCTION

1.1 Background

Government of South Sudan (GOSS) has received funding from the International Development Association (IDA) for the preparation of the South Sudan - Connectivity for Growth Project (SS-CGP). As part of SS-CGP, the Ministry of Transport (MOT) (hereinafter referred to as "MOT" or "Client") is planning to rehabilitate and construct the Juba and Bor ports, their access roads, and clearing (dredging) works between the Juba-Bor section of the River Nile. The proposed project is located in Central Equatoria and Jonglei states of South Sudan.

The SS-CGP project has been designed around four components: Component 1-Inland Water Transport Infrastructure Development; Component 2-Operations and Marketing Improvement, and Logistics Enhancement; Component 3-Institutional Strengthening, Capacity Building, and Project Management; and Component 4-Contingent Emergency Response Component. The details of the project components and subcomponents have been summarized in Table 1-1.

Table 1-1: Project Components

Project Components	Subcomponents
Component 1-Inland Water Transport Infrastructure Development	***Subcomponent 1.1: Upgrading and maintenance of fairway along Juba to Bor*** • Construction of permanent protection works along the Juba to Bor section, to enhance climate resilience & mitigate erosion-related risks. • Clearing of objects/debris/obstructions from the navigational channels and port vicinities.
	Subcomponent 1.2: Development of ports at Juba and Bor, and typical designs for future ports along the River Nile • Technical study to assess the ports and port access between Juba and Bor. • Detailed port development or upgrading plan for the ports at Juba and Bor, followed by the implementation of physical works.
	Subcomponent 1.3: Last-mile connectivity to river terminals at Juba and Bor • Upgrading/rehabilitation of critical access roads that connect to the river terminals at Juba and Bor.
	Subcomponent 1.4: Survey and installation of equipment on commercial vessels • Acquisition of three multi-purpose survey vessels. • Installation of monitoring equipment on commercial vessels operating on the river.
	Subcomponent 1.5: Establishment of vessel traffic management, emergency response, and waste management systems • Installation of a basic vessel traffic management system equipped with navigational aids, navigation charts, and communication facilities. • Deployment of an emergency response mechanism and a waste management system at identified critical locations or hot spots.
Component 2-Operations and Marketing	***Subcomponent 2.1: Vessel design and upgrading/building of two shipyards at Juba and Bor*** • Design of several standardized vessel types, including dry bulk/multipurpose, roll-on/roll-off, and passenger vessels.

Project Components	Subcomponents
Improvement, and Logistics Enhancement	• Upgrading/building of two shipyards at Juba and Bor.
	Subcomponent 2.2: Creating an IWT fund for newly designed vessels
	• Drawing from best practices observed in other waterway basins, an IWT Fund will be created for newly designed vessels.
	Subcomponent 2.3: Providing port handling facilities and equipment for key cargo
	• Construction of dedicated warehouse and logistics facilities, at the ports of Juba and Bor, for essential cargo such as fish, agricultural bulk, and general cargo.
	Subcomponent 2.4: Strengthening Market Insights and Logistics Efficiency
	• Establishment of a Market Observatory at the MoT to track market trends and guide strategic decisions. • Implementation of a logistics and supply chain digital platform at the MoT aimed at improving operational efficiency and data management.
	Subcomponent 2.5: Supporting projects for supply chain innovation and investment attraction
	• Development of an IWT support program to stimulate the use of IWT by launching pilot projects for supply chain innovations that test new technologies and methodologies in the sector. • Establishment of an IWT incentive mechanism to foster sector growth and attract investment from the private sector, as well as to stimulate economic activities along the waterways and in port areas.
Component 3- Institutional Strengthening, Capacity Building, and Project Management	***Subcomponent 3.1: Support for the establishment of a governance structure for waterways transport***
	• Development of both the institutional and regulatory frameworks, as well as establishing implementation and inspection unit(s). • Providing technical and organizational support.
	Subcomponent 3.2: Capacity Building and Awareness Program
	• Training of government staff in IWT management and operations. • Short courses for nautical crew (captains and boat masters). • An awareness program to engage communities along the Juba-Bor corridor, promoting the benefits of IWT and encouraging local participation in project activities and job creation.
	Subcomponent 3.3: Technical assistance for conducting strategic sector studies
	Subcomponent 3.4: Support and Technical assistance for project management
	• All project management, hiring, communications, monitoring and evaluation, and operational costs of the project incurred by PIU.
Component 4- Contingent Emergency Response Component	Designed to provide a swift response in the event of an eligible crisis or emergency by enabling the client to request the WB to reallocate project funds to support emergency response and reconstruction where needed.

Source: Project Appraisal Document

EQMS Consulting Limited, Bangladesh in association with the sub-consultant Besmart Inter Technology Solution of Juba, South Sudan (hereinafter referred to as the “Consultant”) has been commissioned by

the MOT to undertake an "Environmental and Social Impact Assessment (ESIA) for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile" (hereinafter referred to as the 'Assignment' or 'Project') to identify and assess the environmental and social risks and impacts. The report has been prepared based on the review of the available project documents, site visits, and review of secondary environmental and socio-economic data available for the project site and surrounding areas as well as the primary baseline data.

1.2 Importance of the Project

River transport in South Sudan serves seven of the ten states and two of the administrative areas. It is the only practical and cost-effective transport option to reach communities along the White Nile and its tributaries in the absence of a good road network. However, it has been neglected for decades during the conflicts and has serious constraints for the provision of efficient and safe Inland Water Transport (IWT) services. Now, the major challenges facing river transport in South Sudan include river conditions and lack of navigation aids (riverbed weed growth, water hyacinth, debris from sunk vessels and riverbed characteristics), insufficiency of the river port facilities on the serviced routes with inadequate storage or port facilities existing in Juba and Bor, very old IWT fleets (built over 25 years ago) having poorly maintained leading to inadequate barge capacity, inadequate skilled manpower to operate the fleets and port facilities, and not yet integrated into the intermodal transportation system together with road and rail transport.

The overall aim of the IWT development is to provide efficient, reliable, safe, and secure river transport services for both passengers and goods as part of a seamless, integrated multi-modal transport system. The achievement of this objective will require the construction of river ports in Juba and Bor, their access roads, and the execution of clearing (dredging) works to clear the waterway from sediments and debris to improve the navigability from Juba to Bor. The project is expected to aid the development of river terminals with appropriate cargo handling capacity and equipment for facilitating integration with other modes of transportation. Further, the acceptable level of environmental and social risk mitigation and the security of passengers and goods are prerequisites for the sustainability of the inland water transport system.

1.3 Purpose of the ESIA

The conduct of an ESIA for the Project is currently not a regulatory requirement per national laws and regulations as the ESIA process is under development and has not yet been legally established. The Constitution mandates that appropriate measures be taken to protect and safeguard the national environment and biodiversity. The Draft Environmental Protection Bill foresees that projects that require a certain level of ESIA can be allocated into three categories i.e., Category A: projects that may have an impact on the environment, Category B: projects that are likely to have significant impacts on the environment, and Category C: projects that will have a significant impact on the environment. Depending on the environmental and social impact, the proposed project can be categorized as "Category C". Therefore, a full Environmental Impact Statement will be required for this project.

The ESIA is also needed because the Project is expected to satisfy the requirements of the World Bank's Environmental and Social Standards. The Project has been classified as a 'Substantial Risk' Project per the World Bank criteria for categorizing projects based on environmental significance, type, location, sensitivity, and scale. 'Substantial Risk' category Projects refer to projects that may not be as high-risk projects, their E&S scale and impacts are smaller, and their locations are not in a highly sensitive area. The potential risks and impacts are mostly temporary, predictable, and reversible. Few of the significant E&S risks and impacts of the project cannot be mitigated or specific mitigation measures require complex and/or unproven mitigation or compensatory measures or technology, or sophisticated social analysis and implementation. Cumulative impacts exist but they are less severe and more readily avoided or mitigated than for high-risk projects. Effects of the project on areas of high

value or sensitivity are lower than high-risk projects. Therefore, a full Environmental and Social Impact Assessment will be required for this project.

The World Bank is committed to several environmental and social standards that are applicable to preventing and mitigating undue harm to people and their environment in development initiatives or projects supported by the Bank. Details on the World Bank's Environmental and Social Standards that the Project is required to meet are provided in Section 2.7.

This ESIA therefore evaluated several issues that relate to the physical and biological environment of the Project area, as well as socio-economic, cultural, health, and safety issues. The ESIA identified potential impacts (positive and negative) that may result from the Project and recommended applicable mitigation measures for negative impacts and enhancement measures for positive impacts.

The ESIA report will be a significant source of information that the World Bank, public, and Government decision-makers would use in assessing the Project. This ESIA is based on a preliminary design which will be updated by the contracting entity based on the final design, approved by the Ministry of Transport of South Sudan.

1.4 Scope of ESIA

The scope of work for the ESIA is as follows:

- Review of project-related documentation/reports/study and development of an integrated project description of the project activities.
- Review of national policies, laws, regulations, standards, and administrative framework.
- Review of relevant international agreements, treaties, and conventions ratified by the Republic of South Sudan.
- Review of World Bank Environmental and Social Standards under World Bank Environmental and Social Framework, and applicable World Bank Group (WBG) Environmental, Health, and Safety (EHS) Guidelines.
- Assessment of baseline condition of the study area considering the physical, biological, and socioeconomic environment.
- Evaluate the project alternatives regarding the project location, technology option, design, and operation, including the without-project/no-go option, and the most environmentally, socially, and economically feasible option.
- Identification, prediction, quantification, and evaluation of potential direct, indirect, and cumulative environmental, social, and economic impacts and risks of the proposed project.
- Conduct public and stakeholder consultations to capture their views and suggestions for formulating adequate mitigation measures and preparation of a Grievance Mechanism for the proposed project.
- Develop an Environmental and Social Management Plan (ESMP) for implementing, monitoring, and reporting the environmental mitigation and enhancement measures suggested during all the stages of the project cycle.
- Review the institutional capacity of the implementing agencies to implement, manage, and monitor the proposed recommendations contained in the ESMP and any other instruments.
- Preparation of an ESIA including an ESMP for the proposed project following the Ministry of Environment and Forestry (MOEF) approved Terms of Reference (TOR) to obtain an environmental permit from the authority.

The study area for this ESIA considered both the direct and indirect influence area. The area that falls within the radius of two km from the proposed Bor Leudier port, access roads in Juba and Bor ports, and clearing (dredging) and disposal area are considered a direct influence area. In addition, the area that falls within the radius of two to five from the proposed Bor port, access roads in Juba and Bor ports, and clearing (dredging) area from where different services will be obtained for the project and will have an impact on the project implementation. The temporal scope of this ESIA has considered the project

phases including Pre-construction/Planning and Design Phase, Construction Phase, Operation Phase, and Decommissioning and Dismantling Phase. Further, the following project infrastructures were considered in this ESIA study as per the TOR.

- Bor Leudier port and access road
- Juba port and three access roads
- Clearing (dredging) in the Juba to Bor section of the White Nile River

1.5 Applicable Reference Framework

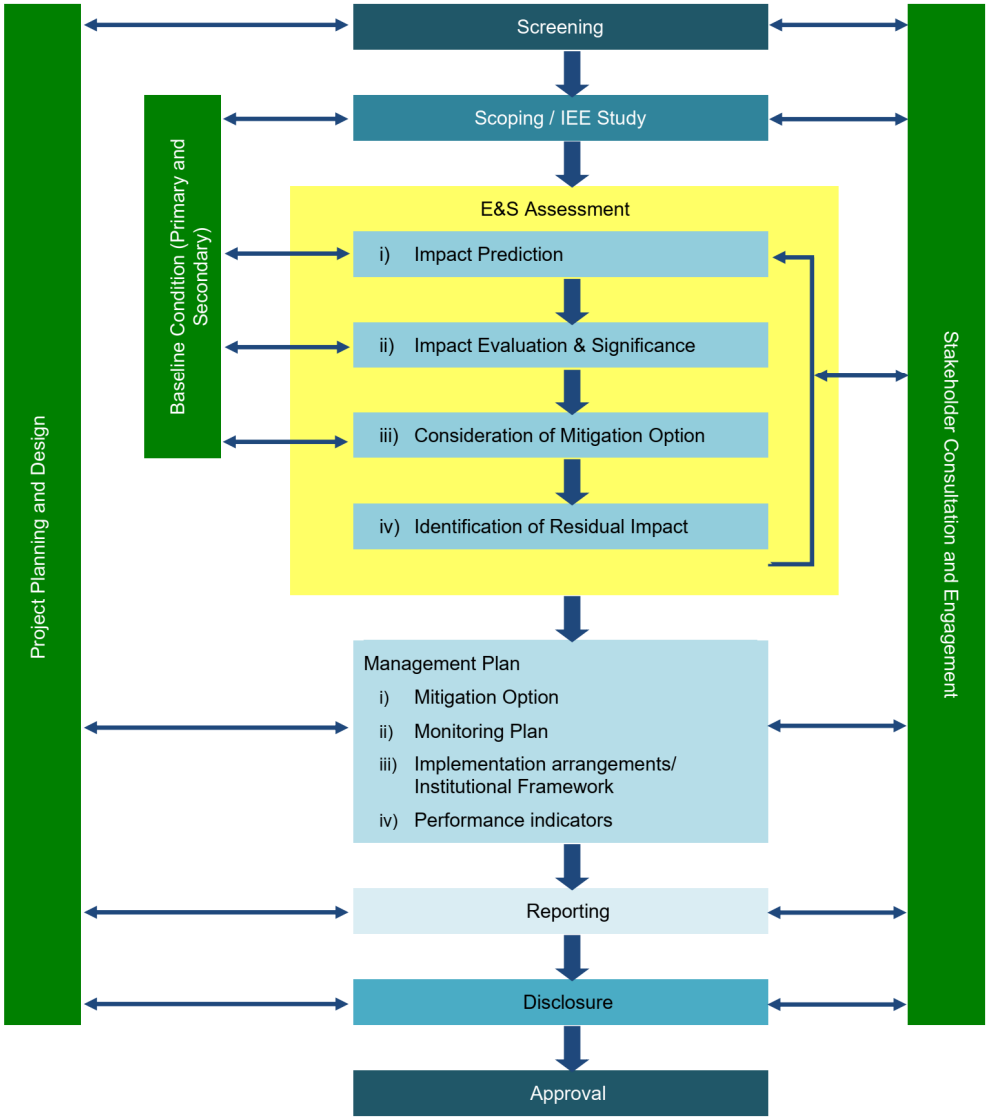
The applicable reference framework for this study includes:

- Relevant national policy, legislation, and institutional framework.
- International agreements, treaties, and conventions ratified by the Republic of South Sudan.
- World Bank's Environmental and Social Standards under World Bank Environmental and Social Framework, 2018 (ESS1, ESS2, ESS3, ESS4, ESS5, ESS6, ESS8, and ESS10).
- World Bank Group General Environmental, Health and Safety Guidelines, 2007.
- World Bank Group Environmental, Health, and Safety Guidelines for Ports, Harbors, and Terminals, 2017.
- Good International Industry Practice.
- Involuntary Resettlement Sourcebook.
- World Bank's Good Practice Note Addressing Gender-Based Violence in Investment Project Financing Involving Major Civil Works.
- World Bank's Good Practice Note Addressing Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works.
- Good Practice Note on Labor Influx Management.
- Good Practice Note on Gender.
- Good Practice Note on Non-Discrimination and Disability.
- World Bank Environment and Social Incident Response Toolkit.

1.6 Approach and Methodology

The approach and key stages undertaken to prepare for the ESIA for the proposed project are shown in Figure 1-1.

Figure 1-1: ESIA Approach for this Project



Source: EQMS

The methodology followed to complete the ESIA is elaborated on in subsequent sections.

1.6.1 Literature Review

Consultant has reviewed all the applicable national institutional, legislative, and regulatory frameworks including the Constitution of South Sudan, Draft Environmental Protection Bill 2023, Environment (Protection) Act 2001, Land Act 2009, Labor Act 2017, Wildlife Conservation and National Parks Act 2003, Freshwater Fisheries Act 1954, etc. and international agreements, conventions, and treaties including Treaty of the East African Community 1999, United Nations Convention on Biological Diversity 1992, Convention on Illegal Trade of Endangered Species 1973, Ramsar Convention 1971, UN Framework Convention on Climate Change 1992, Paris Agreement 2015, International Labor Organization's Fundamental Conventions relevant to the activities of the project in South Sudan. In addition, the Consultant also reviewed international standards such as the WB ESSs under the WB ESF and the WBG applicable EHS Guidelines.

A section on the Project Description has been prepared based on the available documents shared by the MOT and the pre-feasibility study team with the Consultant. This was developed to the level of detail

needed to adequately understand potentially significant project impacts. This covered project location, project proponent, components, associated facilities, activities, and maps using appropriate scales. Also, identify components of key environmental indicators in physical, ecological, and social environments.

1.6.2 Site Visit and Baseline Data Collection

Baseline conditions with respect to the physical, biological, and socio-economic environment were collected by the Consultant from August to September 2024. An expert team of consultants was engaged to carry out baseline data collection from the study area. The environmental and social baseline data for the ESIA was collected from a number of sources including a review of existing published sources and other available secondary information, information held by government agencies, universities, non-governmental organizations, and research agencies, site visits, field surveys, and analysis and interpretation of data. Socio-economic data collection and consultation with the local community were also conducted at the same time. All the data was compiled and compared with applicable standards that were relevant and presented in Chapter 4 of this report.

1.6.2.1 Primary Baseline Data Collection

Consultant collected baseline information on environmental and social attributes like ambient air quality, ambient noise quality, surface water quality, groundwater quality, soil quality, flora and fauna, socioeconomics, etc. Other primary baseline data such as land use, and aesthetics/cultural environment were also collected.

1.6.2.2 Secondary Baseline Data Collection

Following secondary environmental and social baseline data has been collected from different government agencies, non-governmental organizations, universities and research agencies, and through literature review, etc. These are the Ministry of Environment and Forestry, Ministry of Water Resources and Irrigation, Ministry of Wildlife Conservation and Tourism, Ministry of Animal Resources and Fisheries, Ministry of Land, Housing, and Urban Development, Ministry of Agriculture and Food Security, Ministry of Education, Science, and Technology, Ministry of Gender, Child, and Social Welfare, Ministry of Culture, Youth, and Sports, Ministry of Labor and Public Service, State governments of Jonglei and Central Equatoria, Local government of Jonglei and Central Equatoria, University of Juba, John Garang Memorial University, African Parks, Nile Basin Initiative, Peace Canal, Food and Agriculture Organization, Japan International Cooperation Agency, United Nations Development Programme, etc.

- **Physical Environment:** climate and meteorology, land use and land cover, topography, geology, hydrology and drainage, hydrogeology, soil, agroecology, river morphology, traffic and transport, natural hazards/risks, (floods, drought, seismic activities and earthquakes, extreme heat, forest fire, erosion), and environmental quality (ambient air, ambient noise, surface water, groundwater, and soil).
- **Biological Environment:** terrestrial and aquatic ecosystems, flora and fauna, fisheries, protected areas, RAMSAR sites, important bird and biodiversity areas, etc.
- **Socio-economic Environment:** demographic profile, ethnicity, education, economic activities, employment, livelihoods, sources of drinking water, dwelling pattern, lighting and energy sources, sanitation, gender and gender-based violence, community health, vulnerable people, ecosystem services, tourism/tourist activity, cultural sites, heritage site, etc.

1.6.3 Stakeholder Consultation

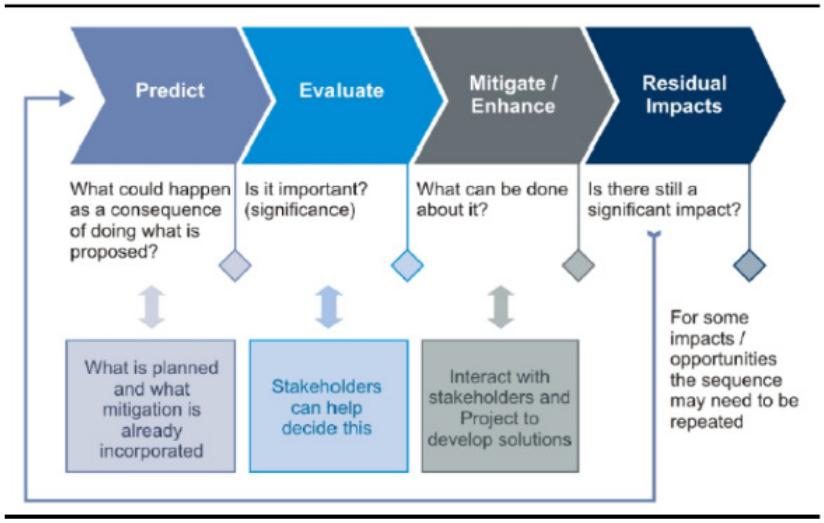
An extensive stakeholder engagement was undertaken as part of the ESIA. During the ESIA process, the key stakeholders consulted included the host community and other stakeholders i.e., fishermen, laborers, suppliers and service providers, boat owners, boat builders, boda-boda riders, dried fish sellers, porters, shop owners, truck drivers, food vendors, land users, women groups, youth, different government department/agencies/institutes, universities and research institutes, NGO's, etc., and shall

be continued throughout the project lifecycle. Two public consultation meetings were conducted at the Bor and Juba areas on 13 August and 20 August 2024 respectively. Stakeholder consultation was completed with the intent of collecting baseline information on the environmental and social conditions and sensitivities, developing a better understanding of the potential impacts, informing the public of the proposed project, and gaining an understanding of the perspectives/concerns of the stakeholders. A summary of the stakeholder engagement process and the profile of the groups and their opinions are given in Chapter-7 of this report.

1.6.4 Identification and Assessment of Potential Impacts

The ESIA evaluated potential impacts using a methodology based on the evaluation of the “significance" of identified issues and impacts on baseline parameters. Analysis of the baseline results and the incremental impacts of the project were assessed in accordance with the national guidelines and standards and with reference to the WB ESSs, and WBG EHS Guidelines including the General Guidelines and Guidelines for Ports, Harbors, and Terminals, 2017. Social impacts were assessed through the analysis of collecting baseline data, available data from the project proponent, and secondary sources. The impact assessment covered the full project lifecycle, including pre-construction, construction, operation & maintenance, and decommissioning & dismantling. The impact assessment involves the prediction, evaluation, and mitigation of impacts, and report on impacts including residual impacts and cumulative impacts (Figure 1-2). Impact prediction was taken into account in control measures that are part of the project design. Additional mitigation measures aimed at further reducing predicted impacts were proposed where necessary or appropriate.

Figure 1-2: Impact Assessment Process for the ESIA



Source: www.adb.org/projects/documents/ban-52362-001-iee

The impacts were identified and quantified for intensity using matrix techniques and evaluated both positive and negative (very low, low, medium-low, medium-high, high, and very-high significance) impacts on the environment and communities in the study area. Aspects that were considered in the impact assessment, for the whole lifecycle of the project, include the impact of clearing (dredging) on the riverbed substrate, water quality, increased turbidity, land use, surface water quality, groundwater quality, dust, air, noise and vibration, terrestrial and aquatic habitats and biodiversity, flora and fauna, ecosystem services, critical habitat, endangered species, threatened species, waste (solid, liquid, and hazardous), land acquisition and resettlement, physical and/or economic displacement, traffic, flood and erosion risks, soil, socio-economic, employment, livelihoods, infrastructure service, occupational and community health and safety, women and vulnerable groups, labor and working conditions, labor influx, child and forced labor, GBV and HIV/AIDS, etc. The environmental, ecological, socio-economic, and project information was collected to assess the potential impacts of the proposed activities.

For all negative impacts, mitigation measures have been identified where possible, based on the following hierarchy: avoid, minimize, mitigate, and offset the negative risk and impacts while enhancement measures increase the benefits wherever possible. Residual impacts were then identified, which remain after the implementation of the proposed mitigation.

1.6.5 Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) has been prepared, based on the findings of the environmental and social impact assessment. The ESMP consists of a set of management, mitigation, and monitoring measures to be taken during the Project lifecycle to manage key potential environmental and social impacts identified in the ESIA.

ESMP suggested economically feasible control technologies and procedures to minimize any impact on aspects of the environment and society that have been developed. The ESMP has:

- Identify and summarize anticipated significant adverse environmental impacts and risks and propose mitigation measures.
- Describe each mitigation measure with technical details, including the type of impact to which it relates and the conditions under which it is required, together with designs, equipment descriptions, and operating procedures, as appropriate.
- Describe monitoring measures with technical details, including parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, and definition of thresholds that will signal the need for corrective actions.
- Describe institutional or organizational arrangements for carrying out the mitigation and monitoring measures.
- Estimate capital and recurrent costs and describe sources of funds for implementing the ESMP.

1.6.6 ESIA Report

Consultant has prepared and submitted this draft ESIA report upon completion of the above tasks. Based on one set of consolidated comments from the Ministry of Transport, Ministry of Environmental and Forestry, and World Bank this draft ESIA report will be revised.

1.7 Limitations

This ESIA study is confined to the study of the project's potential impacts on the physical, biological, and socioeconomic environments of the area. For the ESIA, both the direct and indirect influenced areas are considered. The area that falls within the radius of two km from the proposed Bor Leudier port, access roads in Juba and Bor ports, and clearing (dredging) and disposal area are considered a direct influence area. In addition, the area that falls within the radius of two to five km is considered as indirect influence area from where different services will be obtained for the project and will have an impact on the project implementation. This study has been carried out by accessing data from a wide range of primary and secondary data. These include literature reviews, reports, and other documents supplemented with primary field data collection.

The Consultant has prepared this report based on the available information provided by the PIU of MOT during the site visit and information shared by the Design, Hydrodynamic and Bathymetric Study Consultant till 5 November 2024. The Consultant followed the information/documents provided and incorporated them into this report. This report is also based on certain scientific principles and professional judgment to ascertain facts with resultant subjective interpretation. The professional judgment expressed herein is based on the available data and information. If information to the contrary is discovered, the findings in this ESIA report need to be modified accordingly. This ESIA process is limited to the assessment of the proposed project, as defined in the scope of ESIA (section 1.3) of this report.

1.8 Layout of the Report

The ESIA report has been prepared to meet the requirements of national legislation and World Bank ESSs. The report is divided into ten chapters that follow the activities stipulated in the approved TOR of the ESIA. The structure and content of the ESIA report are presented below.

Chapter 1: Introduction provides basic information about the background, purpose, scope of work, applicable reference framework, approach and methodology, limitations, and structure of the report.

Chapter 2: Legal and Institutional Framework describes national legislative, policy, and administrative requirements, as well as WB ESSs and WBG EHS guidelines applicable to the Project.

Chapter 3: Project Description provides a brief overview of the project including project location, project proponent, environmental settings, brief project description, associated facilities, resources requirements, activities, etc.

Chapter 4: Baseline Data describes the baseline condition considering the physical, biological, socioeconomic, and cultural heritage characteristics of the project site and its surrounding area.

Chapter 5: Environmental and Social Risks and Impacts and Mitigation Measures provides the potentially significant environmental and socio-economic impacts of the proposed project considering the lifecycle of the project.

Chapter 6: Analysis of Alternatives provides an analysis of different alternatives options for the project and alternatives with respect to technical, socio-economic, and environmental viability.

Chapter 7: Stakeholder Consultation and Participation provides descriptions of the stakeholder engagement activities undertaken as part of the ESIA.

Chapter 8: Grievance Mechanism provides a mechanism for managing project grievances including receiving and resolving complaints from stakeholders that arise throughout the project lifecycle.

Chapter 9: Environmental and Social Management Plan provides a management plan for the identified environmental and socio-economic impacts including mitigation and enhancement measures, monitoring requirements, and roles and responsibilities.

Chapter 10: Conclusions and Recommendations summarizes the key findings or outcomes of the ESIA.

2 LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Introduction

This chapter describes the institutional, national, and international legal framework relevant to the rehabilitation and construction of the Juba and Bor Ports, their access roads, and for clearing (dredging) works between the Juba-Bor section of the River Nile, covering national environmental, cultural, health and safety legislation, as well as international environmental and social standards, including the World Bank Environmental and Social Standards under Environmental and Social Framework, World Bank Group's Environmental, Health, and Safety (EHS) Guidelines, international conventions and agreement ratified by South Sudan, and Good International Industry Practices (GIIP) – to which any project funded by them must operate.

2.2 Constitution of South Sudan

The Transitional Constitution of the Republic of South Sudan of 2011 specifies that every person or community shall have the right to a clean and healthy environment. It speaks about the need to prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting rational economic and social development so as to protect genetic stability and biodiversity.

The Transitional Constitution of the Republic of South Sudan of 2011 includes the following numerous provisions that have a bearing on the environment.

- Article 41(1) - every person or community shall have the right to a clean and healthy environment.
- Article 41(2) - every person shall have the obligation to protect the environment for future generations.
- Article 41(3) - every person shall have the right to have the environment protected for the benefit of present and future generations, through appropriate legislative action and other measures that: (a) prevent pollution and ecological degradation, (b) promote conservation, and (c) secure ecologically sustainable development and use of natural resources while promoting rational economic and social development so as to protect genetic stability and biodiversity.
- Article 46(2) - every citizen shall protect the environment and conserve natural resources.
- Article 153(e) - all members of armed forces shall not be involved in illicit activities that may affect the environment and natural resources.
- Article 166(6j) - local governments shall involve communities in decisions relating to the exploitation of natural resources in their areas and promote a safe and healthy environment.

2.3 Environment and Social Legislation in South Sudan

Table 2-1 presents an outline of national legal instruments that will have relevance to the proposed Project with respect to E&S considerations.

Table 2-1: National Legal Instruments Relevant to the Project

Act/Rules/Law	Key Features	Applicability to the Proposed Project
Draft Environmental Protection Bill, 2023	• Protect the environment and promote ecologically sustainable development that improves the quality of life for both the present and future generations. • Section 18 introduces the requirement for Environmental Impact Assessments. • Section 32 intends to introduce the requirement for Environmental Audits. • Section 20 intends to introduce the requirement for Environmental Monitoring. • Monitor environmental phenomena to assess possible changes in the environment and their possible impacts. • Monitor the operations of any industry, project, or activity to determine its immediate and long-term effect on the environment. • Carry out a baseline survey to identify basic environmental parameters in the project area before implementation.	Addressing pollution prevention, control, and waste management since activities associated with the implementation of the project will generate pollution including air, water, noise, waste, etc. According to the Bill, all projects are divided into three categories i.e., category A, Category B, and Category C, and the level of assessment (whether a detailed ESIA is required or not) is determined. The bill is not yet approved, however, the MOEF officials are practicing it.
Environment (Protection) Act, 2001	• Protect the environment in its holistic definition for the realization of sustainable development. • Improve the environment while ensuring sustainable exploitation of natural resources. • Create a link between environmental and developmental issues and empower concerned national authorities and organs to assume an effective role in environmental protection. • Article 17 of the Act requires that anyone intending to implement any project likely to negatively impact the environment should present an EIA for approval by relevant government authorities.	Environmental and social impacts of the proposed should be addressed proactively by subjecting the respective projects to environmental and social assessments before their commencement.
Land Act, 2009	• Promote a land management system that protects and preserves the environment and ecology for sustainable development. • Customary land rights, including those held in common, shall have equal force and effect in law with freehold or leasehold rights. • Community land can be allocated to investors as long as investment activity 'reflects an important interest for the community' and 'contributes economically and socially to the development of the local community.	Land acquisition will be required at the Bor port site. Physical and economical displacement will take place therefore RAP including LAP and LRP needs to be prepared. The project should ensure fair compensation and during the implementation of the project, local

Act/Rules/Law	Key Features	Applicability to the Proposed Project
	• No person shall without permission carry out any activity on the communal grazing land which may prevent or restrict the residents of the traditional communities concerned from exercising their grazing rights.	communities should be adequately consulted.
Draft Water Bill, 2015	• Under Chapter 7, the Bill makes it a mandatory requirement to obtain a water permit for any works that will drain or use any wetland, marsh or swamp. • A permit is also required under the bill for the disposal of any liquid or solid waste into any water source or water body, including wetlands.	The proposed project will use the river and has the potential to discharge waste into the river. A permit will be required from the MWRI for any use of water bodies and disposal of waste into any waterbody**.**
Public Health (Water and Sanitation) Act, 2008	• Prevention of the pollution of air and water and encourages improvement in sanitation. • Protection of the sanitation of the environment. • Measures to prevent pollution of water for consumption and potable water. • Management and disposal of hazardous wastes. • Storage of waste on the premises of waste generators.	The proposed project activities have the potential to generate air, noise, water pollution, and generation of wastes including solid, liquid, and hazardous waste.
Labor Act, 2017	• Legal framework for the minimum conditions of employment, labor relations, labor institutions, dispute resolution, and provisions for health and safety in the workplace. • Section 6(1) provides that *'No person shall discriminate, directly or indirectly, against an employee or job applicant in any work policy or practice'.* • Section 6(2) also forbids discrimination by any trade union, employers association, or federation. • Section 6(3) defines discrimination as *'any distinction, exclusion or preference with the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation'* based on a series of grounds including sex and pregnancy or childbirth. • Article 7 provides that *"No person shall sexually harass an employee or an employer" and that the "employer shall ensure that no person shall sexually harass an employee in the course of such employee's work for the employer".* • Section 10 prohibits forced labor: *"No person shall engage in the recruitment or use of forced labor or assist any other person to engage in such activities".* • Section 12 - the general minimum age for work is 14. • Article 12(2) allows children between the ages of 14 and 18 to engage in the worst forms of child labor, violating international standards. The compulsory education age (13) is inconsistent with the minimum age for work (14).	The proposed project will generate employment opportunities. Therefore, the health, safety, welfare, and training of persons employed in workplaces should adhere to this act.

Act/Rules/Law	Key Features	Applicability to the Proposed Project
Local Government Act, 2009	• Section 110 specifically deals with the rights of women and provides the same protection as the Constitution and the Land Act by reaffirming that "women shall be accorded full and equal dignity of the person with men" and that "women shall have the right to own property and share in the estate of their deceased husbands together with any surviving legal hears of the deceased. • Contains provisions for land administration and management in accordance with the Land Act and defines the roles and responsibilities of traditional authority councils in the dispute resolution process. • Gives wide-ranging powers to local government councils to perform functions aimed at improving community livelihoods.	Implementation of the project must conform with the respective ordinances and by-laws of the local governments within the project area of influence.
Child Act, 2008	• Minimum age for the admission of a child to paid employment shall be fourteen years. • Minimum age for the engagement of a child in light work shall be twelve years which constitutes work that is not likely to be harmful to the health or development of the child and does not affect the child's attendance at school or the capacity of the child to benefit from school. • No employer shall engage a child in employment without satisfactory proof of the child's age.	The rights of children impacted by the project need to be protected. MOT and Contractors must ensure that no aspects of the Project work involve children under the minimum age for light work and hazardous work as mentioned in the act.
Wildlife Conservation and National Parks Act, 2003	• Section 5 recognizes that wildlife constitutes an important national natural wealth and is part of the heritage of South Sudan and therefore needs to be conserved, protected, and utilized for the benefit and enjoyment of all its people. • Conservation, management, and administration of parks, controlled areas, and other protected game reserves. • Control of hunting and management and preservation, conservation, and the protection of wildlife species from hunting, poaching, and environmental resources along with the control of illegal trade in protected animals and trophies. • Promotes the participation of local communities in wildlife conservation efforts and ensures they benefit from sustainable use and eco-tourism activities. • According to Section 14 of the act, except with the written authorization of the Director General, no person shall be within any national park. ▪ Cut, clear burn, or otherwise damage or remove any tree, bush, plant, or other vegetation or any part thereof. ▪ Occupy, cultivate, or plant any land or otherwise grow or harvest any crop.	Two protected areas namely Bandingilo National Park and Juba Game Reserve are located in the study area. However, Juba Game Reserve is an officially declared PA, but it does not exist in reality now. The game reserve area is a developed urban area. The proposed project has the likelihood of impacting biodiversity, ecosystems, and species in the project area. Therefore, permission/written authorization will be required to work inside the protected area/national park.

Act/Rules/Law	Key Features	Applicability to the Proposed Project
	▪ Construct or occupy any house, hut, shelter, or any other structure. ▪ Notwithstanding the provisions of any other law, mine, quarry, drill for, or remove any minerals, stones, gravel, earth, or other substances, or prospect for such substances. ▪ Fish, otherwise than with handheld rods and lines. ▪ Obstruct, divert, or pollute any river, pool, lake, or other points of water. ▪ Perform any act or engage in any other activity likely to destroy, endanger, or disturb wildlife in the national park or to destroy or shelter, or alter its natural habitat and environment. ▪ Use a national park as a disposition ground for any kind of waste.	
Wildlife Conservation and Protected Areas Bill, 2015	• Establishment and management of protected areas and the sustainable management and conservation of natural heritage and wildlife. • Allows local communities around Protected Areas to manage wildlife in collaboration with the South Sudan Wildlife Service and permits other organizations to manage any Protected Area on behalf of the government. • Protection of wetlands, which could potentially be in conflict with the Ministry of Environment and Forestry's role.	Two protected areas, namely Bandingilo National Park and Juba Game Reserve are in the study area. The project has the likelihood of impacting wildlife species in the project area.
Forests Bill, 2009	• Establishes a National Forest Fund to be managed semi-autonomously to support forestry research, education, and protection of forest biodiversity and heritage.	Protection of forest biodiversity and heritage in the project site.
Freshwater Fisheries Act, 1954	• Emphasizes the protection of fish habitats, including spawning and breeding grounds, to maintain healthy fish populations and ecosystem balance. • Bans the use of destructive fishing methods, such as dynamite fishing, poisoning, and the use of certain types of nets that can harm juvenile fish and other aquatic life. • Imposes size and catch limits on certain fish species to prevent overfishing and ensure that fish populations remain viable for future generations. • Establishes closed seasons and designated no-fishing areas to allow fish populations to recover and replenish during critical periods such as breeding seasons. • Supports research and data collection on fish populations, fishing practices, and aquatic ecosystems to inform management decisions and policy development. • Encourages the involvement of local communities in the management of freshwater fisheries and promotes education and awareness programs to foster sustainable fishing practices and conservation efforts.	The proposed project has the likelihood of impacting fisheries resources, fish habitats, and breeding grounds in the White Nile River due to the clearing (dredging) and river port construction activities.

Act/Rules/Law	Key Features	Applicability to the Proposed Project
Access to Information Act, 2013	• Every citizen shall have the right of access to information. • Focuses on the right to access information held by public bodies in South Sudan. • To give effect to the constitutional right of access to information, promote maximum disclosure of information in the public interest, and establish effective mechanisms to secure that right.	Project information will be disseminated to all relevant stakeholders to establish good governance following the act.
Traffic Act, 2003	• No person shall drive or being the owner or the person in charge of a vehicle, cause or permit any other person to drive a vehicle on a road at a speed higher than such speed as may be prescribed as the maximum speed for that class of vehicle. • According to section 43, no person shall drive or being the owner or person in charge of the vehicle cause or permit any other person to drive any vehicle at a speed exceeding 50 KM per hour on any road within the boundaries of any village, town, or city. • According to section 51, when any person in charge of any cattle raises his hand or gives a signal to stop, the driver of a vehicle shall stop his vehicle and keep it stationary for as long as reasonably necessary.	MOT and Contractors/Subcontractors will follow the act to ensure all matters related to road traffic as well as water transport and safety regulations in the project area.
Human Rights Commission Act, 2009	• Investigate, on its own initiative or on a complaint made by any person or group of persons against any violation of human rights. • Educate and encourage the public to defend the Constitution at all times against all forms of abuse and violation of human rights. • Monitor compliance of all levels of government in Southern Sudan with international and regional human rights treaties and conventions ratified by the Republic of South Sudan.	All forms of abuse and violation of human rights in the project site will be managed by the act.
Public Grievances Act, 2011	• Establishment of an independent Chamber to redress public grievances and remove patent injustices and prevent injuries suffered by citizens in relation to institutions of the Government of Southern Sudan. Furthermore, it strives to improve the performance of the Government Institutions by ensuring their efficiency and propriety. • The chamber shall consider grievances only after exhausting all means and stages of litigation by the complainant. • Any aggrieved person may make a complaint in writing to the Secretary of the Chamber giving specific details of his or her grievances or as the case may be.	MOT will ensure the free flow of information to the citizens to establish good governance and redress public grievances following the act.
Penal Code Act, 2008	• Whoever has sexual intercourse or carnal intercourse with another person, against his or her will or without his or her consent, commits the offense of rape, and upon	Enforce to manage criminal and criminal-related matters on the project site.

Act/Rules/Law	Key Features	Applicability to the Proposed Project
	conviction, shall be sentenced to imprisonment for a term not exceeding 14 years and may also be liable to a fine. • Whoever intentionally engages in sexual harassment commits an offence, and upon conviction, shall be sentenced to imprisonment for a term not exceeding 3 years, liable to a fine or both.	

2.4 Environment and Social Policies in South Sudan

Additional South Sudan policies, their key features, and applicability to the subject Project are detailed in Table 2-2.

Table 2-2: Policies Relevant to Environment and Social

Policy	Key Features	Applicability to the Proposed Project
National Environment Policy, 2015 - 2025	• Protect and improve the environment in a manner that contributes to the quality of life of both present and future generations. • Harmonize environmental protection with other factors such as occupational safety and health. • Ensure the protection, conservation, and sustainable use of natural resources, which include wetlands, without compromising the tenets of inter-generational equity. • Facilitate the development of laws, regulations, and guidelines to ensure sustainable management of the environment as well as the prudent utilization of natural resources. • Provides guidance on the implementation and enforcement of international, regional, and domestic environmental laws. • Addressed a number of aspects including climate change, management of resources, corporate social and environmental responsibilities, and environmental planning, among others.	The proposed project activities such as civil works as part of the port infrastructure will involve vegetation clearance which should be undertaken in a sustainable manner. Additionally, the project will generate waste during its lifecycle that should be responsibly managed to avoid environmental pollution.
National Water Policy, 2007	• Recognition that water has social, economic, and ecological value in all its competing uses. • With respect to transboundary water management, the policy recognizes the transboundary nature of the Nile waters and commits South Sudan to fulfilling its international obligations on the Nile. • Introduce effluent discharge permits to, among other things, protect ecosystems and conserve biodiversity in areas such as the Sudd Wetlands.	The project will use surface water, and the White Nile is a transboundary river. There is the possibility of water pollution due to the project activities including clearing (dredging), effluent discharge to water bodies, and improper solid waste management.

Policy	Key Features	Applicability to the Proposed Project
Forest Policy, 2019	• Protect the roles forests play in stabilizing the global systems including the hydrological balance, carbon balance, atmospheric systems/cycles, etc. • Achieve ecological stability of river systems, lakes, swamps, agricultural production, and other natural ecological systems. • Ensure that there are optimal benefits from forestry and agroforestry activities for food security and poverty alleviation among our rural communities through the provision of woody and non-wood forest products. • Integrates forest sector actions with rural development efforts to ensure that the rural population has access to basic needs which include sustainable household food security, shelter, wood fuel, safe clean water, as well as sanitation and health facilities.	The project including the development of port facilities, access roads, and clearing (dredging) could affect ecosystems such as forests, rivers, and swamps.
Fisheries Policy, 2012-2016	• Sustainable fisheries production and development contribute to economic growth, poverty reduction, and food security. • Controlling overexploitation of fish stocks and eliminating Illegal, unreported, and unregulated fishing. • Increasing production from underexploited fish stocks and areas. • Supporting both capture fisheries (wild fish) and aquaculture (fish farming). • Minimizing post-harvest losses and ensuring the safety of fish products.	The project has the likelihood of impacting fisheries resources, fish habitats, and breeding grounds.
National Biodiversity Strategy and Action Plan, 2018 - 2027	• Reduce negative impacts and enhance positive impacts on biodiversity through facilitation, design, and capacity enhancement for enforcement and compliance, for biodiversity regulations and incentive mechanisms. • Restore degraded ecosystems and promote access and benefit sharing of biodiversity and ecosystem services. • To reduce negative impacts and enhance positive impacts on biodiversity strengthening biodiversity-inclusive environmental impact assessment (EIA) and Environmental Audits, and Strategic Environment Assessment (SEA). • Supporting the establishment of sanctuaries for rehabilitation of rescued species, and restoration to the wild.	The proposed project has the likelihood of impacting biodiversity, ecosystems, species, and ecosystem services.
National Gender Policy, 2012	• Gender equality for women and men, girls and boys and to protect women and girls from harmful social norms. • End female genital mutilation and child marriage and prevent and respond to gender-based violence.	Gender-related concerns such as GBV, SEA/SH, and gender discrimination among others that may be associated with the development of the project should be addressed in line with the

Policy	Key Features	Applicability to the Proposed Project
		policy to ensure that the project's desired benefits are attained.
South Sudan's Vision, 2040	• Create a vibrant, competitive, and diversified economy driven by agriculture, industry, mining, tourism, and services that attract investors. • Commitment to sustainable environmental management alongside limiting environmental pollution due to other development programs such as industrialization. • Minimize greenhouse gas emissions as a measure against climate change. • Mainstream gender in all development policies and programs and empower women and youth as drivers of growth and nation-building.	Adequate pollution control measures will be considered to ensure sustainable environmental management and minimize GHG emissions as a measure against climate change.

2.5 Administrative Setup Related to Environment in South Sudan

MOEF is the lead institution for environment and biodiversity protection in South Sudan. Their priority work programme includes the development of a policy and regulatory framework for wetlands and biodiversity management, capacity building, and strengthening of partnerships with stakeholders particularly for the justice and legislative institutions that contribute to delay legal and policy reviews, acceding to and implementing Multilateral Environmental Agreements (MEAs) and environmental audit and assessment.

National Ministry of Environment and Forestry:

MOEF is responsible for developing and executing policies and programs on environmental protection and conservation, developing programs in collaboration with other ministries for the control of environmental hazards and pollution, developing EIA standards methodologies and procedures, coordinate with the states and local government, review and approve EIA reports and issue EIA license, review and approve environmental audit reports and monitor and evaluate.

State Environment Authority:

State Environment Authority is responsible for overseeing the activities of the state relating to the management of the environment and natural resources, ensuring environmental concerns are integrated into all plans and projects approved by the state, formulating state-level laws relating to environmental management, liaison with authority and local government, evaluate and approve state-level development proposals and EMPs, ensure ESIA process is carried out, review and approve a state of the environment report for the state every year.

Ministry of Labor:

Ministry of Labor is responsible for the formulation of labor policies and legislation framework to regulate the private sector labor market; development, management, and administration of human resource policies, and implementation of uniform norms and standards nationally following the Labor Act 2017.

The functions of the Directorate of Occupational Safety and Health are to initiate and advise on the formulation and implementation of policies, laws, and regulations on occupational safety and health. They also inspect workplaces to ensure compliance with occupational safety and health laws and standards, promote and advise employers, employees, and their representatives on best practices of occupational safety and health at workplaces, coordinate and implement occupational safety and health programs and projects, investigate accidents at the workplace to establish liability and compensation, register and maintain a database of workplaces in line with occupational safety and health requirements, and conduct risk and hazard assessment.

Ministry of Gender, Child, and Social Welfare:

Ministry of Gender, Child, and Social Welfare is responsible for the formulation and implementation of policies and legislations for the promotion of gender equality, women's empowerment, child protection, as well as social protection and social welfare of other vulnerable groups. The ministry mainstreams gender equality, and disability into the national development process; ensures the welfare, promotion, and respect of the rights of persons with disabilities, children, and other vulnerable groups; manages programmes and institutions for children and social welfare; improves the working environment by strengthening the structures, systems and procedures, human and administrative capacity for efficient service delivery; strengthen monitoring and evaluation, research, documentation, planning, and budgeting.

2.6 Project Relevant International Conventions and Agreements

In addition to compliance with South Sudan's regulatory requirements, the proposed project will also adhere to the international conventions ratified by South Sudan. A list of relevant international conventions, treaties, and agreements is given in Table 2-3.

Table 2-3: International Treaties, Conventions, and Protocols Relevant to the Project

Treaty/Convention/ Protocols	Requirements	Ratification	Relevance to the project
Treaty of the East African Community, 1999	Articles 111 and 112 of the EAC Treaty provide for the conservation and management of environmental and natural resources. They require member states to take measures to control transboundary air, land, and water pollution arising from development activities and take necessary disaster preparedness, management, protection, and mitigation measures, especially for the control of natural and manmade disasters.	15/04/2016	Nile River is a transboundary water resource shared between surrounding countries. Therefore, measures should be undertaken to protect surface water resources within the Nile Basin during the development of the project.
United Nations Convention on Biological Diversity, 1992	Its objectives are to conserve biological diversity, promote the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies, and by appropriate funding (Article 1).	17/02/2014	South Sudan has a lot of biodiversity and wildlife-protected areas. Project will ensure that the project takes appropriate measures to minimize potential impacts on biodiversity.
Convention on Illegal Trade of Endangered Species (CITES) 1973	The convention ensures, through international co-operation, that the international trade in species of wild flora and fauna does not threaten the survival in the wild of the species concerned, and to protect endangered species from over-exploitation by means of a system of import-export permits.	Final stages	Two protected areas fall in the study area. The project will ensure that the project takes appropriate measures to protect endangered species from over-exploitation.
Ramsar Convention, 1971	The convention is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.	10/10/2013	Nearest Ramsar site from the Bor Leudier port is the Sudd wetland. Adequate measures will be taken to ensure that the project implementation activities are not impacting the wetland.

Treaty/Convention/ Protocols	Requirements	Ratification	Relevance to the project
Conservation of Nature and Natural Resources, 2003	Aims to enhance environmental protection, conservation, and sustainable use of natural resources. The convention further identifies water as a critical resource that needs to be maintained at quantitative and qualitative levels.	24/01/2013	Project will take appropriate measures to minimize potential impacts on biodiversity by putting in place measures to protect water bodies and wetlands, disorientation of migrating birds, and hunting/ illegal exploitation of wildlife by contracted teams.
Convention for the Safeguarding of the Intangible Cultural Heritage, 2003	Ensure respect for the intangible cultural heritage of the communities, groups, and individuals concerned, and raise awareness at the local, national, and international levels of the importance of the intangible cultural heritage, and of ensuring mutual appreciation thereof.	23/10/2017	There are no designated cultural sites within the proposed project site.
UN Framework Convention on Climate Change, 1992	Under Article 3 (3) parties are required to take precautionary measures to anticipate, prevent, or minimize the causes of climate change and mitigate its adverse effects.	17/02/2014	Project authority will take appropriate measures to mitigate the causes of climate change when implementing the proposed Project.
Vienna Convention on the Protection of the Ozone Layer, 1985	Parties should take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from the destruction of the ozone layer.	12/01/2012	Project authority will take appropriate measures to minimize emissions that deplete the Ozone layer.
Paris Agreement, 2015	Its goal is to limit global warming to well below 2°C, preferably to 1.5°C, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of GHG emissions as soon as possible to achieve a climate-neutral world by mid-century.	23/02/2021	Project authority will take appropriate measures to mitigate the causes of climate change/GHG emissions when implementing the proposed Project.
Bamako Convention, 1991	All signatories to the Convention are required to impose strict, unlimited liability as well as joint and several liabilities on hazardous waste generators; ensure that environmentally sound treatment and disposal facilities for hazardous wastes are located, to the extent possible, within its jurisdiction; and ensure that persons managing	24/01/2013	All the hazardous waste generated during the implementation of the proposed project will comply with the requirements of this Convention.

Treaty/Convention/ Protocols	Requirements	Ratification	Relevance to the project
	hazardous wastes take all actions necessary to prevent pollution arising from the management of such wastes.		
Convention on the Elimination of all Forms of Discrimination Against Women, 1979	Convention ensures the full development and advancement of women, for the purpose of guaranteeing them the exercise and enjoyment of human rights and fundamental freedoms on a basis of equality with men.	03/09/2012	The project has the potential for physical and economic displacement as a result of project activities (access road construction and port development), especially on roadside shops and businesses operating in the proposed Bor port site by women.
United Nations Convention on the Rights of the Child, 1989	It is the most comprehensive compilation of international legal standards for the protection of the human rights of children. It acknowledges children as individuals with rights and responsibilities according to their age and development, as well as members of a family or community.	23/01/2015	Aspects of this convention are covered under national legislation such as the Constitution, Children Act 2008, and Labor Act 2017. MOT will follow the requirements of the law during the implementation of the Project.
African Charter on Human and Peoples' Rights, 1983	An international human rights instrument that is intended to promote and protect human rights and basic freedoms in the African continent.	-	Project authority will follow the requirements of the law during the implementation of the Project.
African Charter on Human and Peoples' Rights on the Rights of Women in Africa, 2005	It guarantees comprehensive rights to women including the right to take part in the political process, social and political equality with men, improved autonomy in their reproductive health decisions, and an end to female genital mutilation.	-	Project authority will ensure the rights of women affected by the proposed project are protected in line with the Constitution and South Sudan's commitment to this convention.
International Labor Organization's Fundamental Conventions	Labor, working conditions, health and safety are the subject of numerous international agreements, conventions, policies, and standards. Fundamental labor standards formulated by the ILO include forced labor, child labor, and workmen's compensation among others.	2012	Labor policies for the proposed project and impact mitigation measures for employment should be in accordance with the requirements of these conventions.

2.7 World Bank Environmental and Social Framework

The applicability of the World Bank Environmental and Social Standards to the proposed project in South Sudan is given in Table 2-4.

Table 2-4: Applicability of the World Bank Environmental and Social Standards to the Proposed Project

World Bank Environmental and Social Standards	Applicability	Relevance to the proposed project
ESS1: Assessment and Management of Environmental and Social Risks and Impacts • Identify, evaluate, and manage project E&S risks and impacts. • Adopt a mitigation hierarchy (anticipate and avoid, minimize/reduce, mitigate, compensate/offset). • Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and sharing development benefits and opportunities. • Utilization of national environmental and social institutions, systems, laws, regulations, and procedures in the assessment, development, and implementation of projects. • Promote improved environmental and social performance.	Yes	The proposed Project is likely to have certain adverse environmental and social impacts during the project life cycle. Key environmental risks and impacts include noise and dust pollution, dumping and disposal of excavated materials, traffic congestion, as well as concerns for the health and safety of workers and communities. On social risks and impacts, the project activities may result in displacement and disruption of income-generating activities during the construction phase. Other social concerns include issues of equitable access to potable water for unserved and underserved low-income populations in the area as well as the potential SEA/SH which may arise from labor influx. These E&S risks and impacts have been preliminarily identified based on field visits, and consultations with stakeholders including communities and MOT. Therefore, an ESIA including ESMP is required to assess and manage environmental and social risks and impacts.
ESS2: Labor and Working Conditions • Promote safety and health. • Fair treatment, nondiscrimination, and equal opportunity of workers. • Protect workers, in particular, vulnerable workers such as women, persons with disabilities, children and migrant workers, contracted workers, community workers, and primary supply workers. • Avoid the use of all forms of forced labor and child labor. • Freedom of association and collective bargaining of project workers. • Provide accessible means to raise workplace concerns and grievance management.	Yes	The construction phase of the proposed project will involve employing both direct and contracted workers for various activities such as clearing (dredging), carrying out excavation, earth movement, trenching, access road construction, construction of ancillary facilities, etc. During the operation phase, workers will be employed for the operation and maintenance of the project. The labor hired during the project life cycle will need to be managed based on the requirements of WB ESS2 and the reference framework. The Project has prepared a Labor Management Procedures to manage labor-related risks. The LMP shall apply to all project workers whether full-time, part-time, temporary, or seasonal. During the implementation of project activities, Contractors shall prepare an Occupational Health and Safety Management Plan and a Community Health and Safety Management Plan to manage associated risks.

World Bank Environmental and Social Standards	Applicability	Relevance to the proposed project
ESS3: Resource Efficiency & Pollution Prevention and Management • Promote sustainable use of resources, including energy, water, and raw materials. • Avoid or minimize adverse impacts on human health and the environment from project activities. • Avoid or minimize project-related emissions of short and long-lived climate pollutants. • Avoid or minimize the generation of hazardous & non-hazardous waste. • Minimize and manage risks & impacts associated with pesticide use.	Yes	The proposed project will support the construction of improved access roads, port facilities, and an efficient inland water transportation system. During the construction phase of the proposed project, activities i.e., site preparation work, Diesel Generator sets operation, excavation, trenching, transportation of construction machinery and materials, material handling, construction vehicles movement, clearing (dredging) activities, use of the natural resource (mainly land and water), generation and disposal of wastes, etc. may cause pollution of air, noise, soil, and water bodies. Similar impacts may occur during the operation and maintenance of the port facility, access roads are expected to be minimal. A waste management plan needs to be prepared and followed by the appointed Contractors. The above activities will need to comply with pollution prevention measures in WB ESS3 and the reference framework.
ESS4: Community Health and Safety • Anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life cycle. • Promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure. • Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. • To have in place effective measures to address emergency events. • To safeguard personnel and property following relevant human rights principles.	Yes	The major community health and safety risks associated with the project may include accidents and injuries due to the movement of heavy machinery and vehicles carrying construction equipment on the access road. High dust levels from earthworks, high noise, and emission levels from traffic congestion and idling of vehicles, and an influx of workers could potentially cause local discomfort and potential conflicts with residents. The influx of labor could also expose local communities to public health risks and communicable diseases, such as HIV/AIDS. The project activities can also cause sexual exploitation and abuse. During the operation phase, precautionary measures against natural hazards and emergency events will be undertaken. The Project site will need to be extended to affected communities as recommended in WB ESS4. The requirement of security personnel in all phases of the project and their relevant health and safety risks will need to be considered in compliance with ESS4.
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Yes	Land acquisition will not be required for the access roads construction in Juba and Bor ports surrounding area as the existing

World Bank Environmental and Social Standards	Applicability	Relevance to the proposed project
• Avoid and minimize involuntary resettlement by exploring project design alternatives. • Avoid forced eviction. • Mitigate adverse social and economic impacts from the land acquisition or restrictions on land use by (a) providing timely compensation for loss of assets at replacement cost, and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and living standards. • Improve living conditions of physically displaced poor or vulnerable persons. • Conceive and execute resettlement activities as sustainable development programs. • Appropriate disclosure of information, meaningful consultation, and the informed participation of affected people.		road alignment will be followed to rehabilitate the access roads. However, the project access road component will potentially have temporary economic displacement on some businesses and street vendors during the construction/rehabilitation/improvement of access roads. Land acquisition will be required for the proposed Bor Leudier port construction site. During the site visit, housing structures as well as business activities were observed in the proposed project site. Consequently, the project would result in both physical and economic displacement triggering the applicability of ESS5. A separate Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) will be done to address ESS5.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources • Protection and conservation of biodiversity and habitats. • Mitigation hierarchy and the precautionary approach in the design and implementation of projects. • Promotion of sustainable management of living natural resources. • Maintenance of benefits from ecosystem services.	Yes	There are two protected areas i.e., Bandingilo National Park and Juba Game Reserve and two IBAs namely Bandingilo and Sudd (Bahr-el-Jebel system) are found in the project area. The project activities particularly the clearing (dredging) of the navigation channel between Juba and Bor section of the White Nile River are located in a natural habitat and the proposed Bor port location is located in a modified habitat having potential significant biodiversity value. Site clearance activities for the Bor port construction will involve the felling of trees. Potential impacts on fisheries resources and affected stakeholders are dependent on livelihood or primary income. Air emissions from the construction activities of the project as well as wastes including solid, liquid, and hazardous waste will be generated during the construction and operation. Consequently, the project would result in biodiversity degradation triggering the applicability of ESS6. A Biodiversity/Ecology Management Plan will need to be prepared to address ESS6.

World Bank Environmental and Social Standards	Applicability	Relevance to the proposed project
ESS7: Indigenous Peoples (IPs)/Sub-Saharan African Historically Underserved Traditional Local Communities (SSAHUTLC) • Ensure full respect for IPs/SSAHUTLC (human rights, dignity, aspirations, identity, culture, livelihoods, knowledge, and practices). • Avoid, minimize, mitigate, and/or compensate for adverse impacts on IPs/SSAHUTLC. • Sustainable and culturally appropriate development benefits and opportunities for IPs/SSAHUTLC. • Establishing and maintaining an ongoing relationship based on meaningful consultation with the IPs/SSAHUTLC affected by a project throughout the project's life cycle. • Free, Prior, and Informed Consent (FPIC) in certain circumstances.	No	Key requirements under ESS7 include that the World Bank determines whether Indigenous peoples/Sub-Saharan African historically underserved traditional local communities are present in or have a collective attachment to the project area; and that the borrower develops a rigorous consultation strategy and identifies means through which the borrower undertakes effective consultation with people identified for purposes of ESS7 on the project design and implementation. Furthermore, in the case of South Sudan, the project will not have adverse impacts on land, natural resources, as well as tangible and intangible cultural heritage, or relocation of Indigenous peoples since most people meet the ESS7 requirements.
ESS8: Cultural Heritage • Protection and preservation of cultural heritage from the adverse impacts of project activities. • Address cultural heritage as an integral aspect of sustainable development. • Meaningful consultation with stakeholders regarding cultural heritage. • Promotion of equitable sharing of cultural heritage benefits.	Yes	Discussions with the local communities, literature review, and government departments did not point toward the presence of any designated cultural, historical, archaeological, and heritage sites within the project footprint. However, during the site visit at the Bor port site, three graves were observed inside the proposed port boundary which will be impacted by the proposed project. In addition, as uncertainties exist regarding chance finds of tangible cultural material, a "Chance Find Procedure has been developed as part of this ESIA and will be put in place, especially during the port construction and clearing (dredging) activities.
ESS9: Financial Intermediaries	No	This project is not a financial intermediary project.
ESS10: Stakeholder Engagement and Information Disclosure • Identification of stakeholders and build and maintain a constructive relationship, in particular project-affected parties. • Assessment of stakeholder interest and views of the stakeholders taken into account in project design and environmental and social performance.	Yes	The project will conduct stakeholder mapping and analysis and identify different stakeholders under the project, i.e., project-affected parties and other interested parties, including vulnerable and disadvantaged groups, poor households (such as female-headed, widows, older persons, orphans, persons living with severe illness), persons with disabilities, Illiterate community members, government agencies, state and regional authorities, Payam and

World Bank Environmental and Social Standards	Applicability	Relevance to the proposed project
• Effective and inclusive engagement with PAPs throughout the project life cycle. • Disclosure of appropriate project information on E&S risks and impacts to stakeholders in a timely, understandable, accessible, and appropriate manner and format. • Accessible and inclusive means to raise issues and grievances and respond and manage such grievances.		boma authorities, religious and local leaders, NGOs, etc. The project will assess the project's impact on them as well as their interests in the project. A Stakeholder Engagement Plan (SEP) including a Grievance Mechanism (GM) will need to be prepared following the ESS10. The client will engage with, and provide sufficient information to, stakeholders throughout the life cycle of the project, in a manner appropriate to the nature of their interests and the potential environmental and social risks and impacts of the project.
OP/BP 7.50 Projects on International Waterways Applies to the following types of projects such as hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways as described following. • Any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states, whether Bank members or not. • Any tributary or other body of surface water that is a component of any waterway (river, canal, lake, or similar). • Any bay, gulf, strait, or channel bounded by two or more states or, if within one state, recognized as a necessary channel of communication between the open sea and other states and any river flowing into such waters.	Yes	Project activities such as clearing (dredging) work for navigation and water drainage as well as port construction at Bor will take place in the White Nile River. This river is known as an international waterway originating from the Equatorial Lakes region in the central part of Africa (Tariq, 2021) and flowing through Uganda, South Sudan, Sudan, and Egypt. The components of the proposed project comprised navigation and drainage activities. The proposed project will use waterways and have potential pollution risks and impacts if adequate mitigation measures are not considered during project implementation. Notification to all riparian countries will need to be sent.

Source: World Bank Environmental and Social Framework, 2018

2.7.1 World Bank Group Environmental, Health and Safety Guidelines

The World Bank Group Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The WBG EHS industry-specific guidelines that would be relevant and applicable to the proposed project include the EHS Guidelines for Ports, Harbors, and Terminals 2017.

The General EHS Guidelines contain a series of specific guidelines for different projects. They are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. The EHS Guidelines contain the performance levels and

measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent.

The EHS Guidelines for Ports, Harbors, and Terminals contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. The Guidelines apply to marine and freshwater ports, harbors, and terminals for cargo and passengers. Guidelines should be tailored to the hazards and risks established for the project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account.

2.8 Comparison of South Sudan Legal Framework and World Bank ESS1-10

Table 2-5 summarizes a comparison focusing on the WB ESSs relevant to the project and gaps identified in existing South Sudan laws and regulations.

Table 2-5: Gap Analysis WB ESF and South Sudan Legislations

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
ESS1: Assessment and Management of Environmental and Social Risks and Impacts • Identify, evaluate, and manage project E&S risks and impacts. • Adopt a mitigation hierarchy (anticipate and avoid, minimize/reduce, mitigate, compensate/offset). • Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and sharing development benefits and opportunities. • Utilization of national environmental and social institutions, systems, laws, regulations, and procedures in the	Transitional Constitution of the Republic of South Sudan of 2011 includes numerous provisions in regard to the environment. Article 41 (1) provides that the people of South Sudan shall have a right to a clean and healthy environment and (2) that every person shall be obliged to protect the environment and (3) that future generations shall have the right to inherit an environment protected for the benefit of present and future generations. Specific measures to ensure the objectives above include the prevention of pollution and ecological degradation, the promotion of conservation and the securing of ecologically sustainable development, and the use of natural resources while promoting rational economic and social development to protect the biodiversity of South Sudan. Article 166 (6) expects local governments to involve communities in decision-making in the promotion of a safe and healthy environment.	While communities have to be included in decision-making, South Sudan laws only stipulate the need for environmental impact assessments. Social impact assessments and a focus on the disadvantaged are not captured.	An Environmental and Social Impact Assessment including an Environmental and Social Management Plan has been developed in a way consistent with both national applicable legislation, policies, and guidelines as well as World Bank Environmental and Social Standards.

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
assessment, development, and implementation of projects. • Promote improved environmental and social performance.	South Sudan Draft Environmental and Protection Bill (2013). Section 18 of the South Sudan Draft Environmental and Protection Bill introduces the requirement for Environmental Impact Assessments. Section 32, Cap 5, introduces the requirement for Environmental Audits. Section 20, Cap 5, introduces the requirement for Environmental Monitoring. Environment Policy of South Sudan, from 2016, provides guidelines for a wide range of responses to environmental management. These include the promotion of effective, widespread, and public participation in the conservation and management of the environment.		
ESS2: Labor and Working Conditions • Promote safety and health. • Fair treatment, nondiscrimination, and equal opportunity of workers. • Protect workers, in particular, vulnerable workers such as women, persons with disabilities, children and migrant workers, contracted workers, community workers, and primary supply workers. • Avoid the use of all forms of forced labor and child labor. • Freedom of association and collective bargaining of project workers.	Labor Act of 2017 establishes a legal framework for the minimum conditions of employment, labor relations, labor institutions, and requirements for a dispute resolution mechanism. Chapter VI of the Labor Act says that no person shall discriminate, directly or indirectly against an employee or job applicant in any work policy or practice (discrimination is defined on grounds of race, sex, age, and religion). Section 12 of the Labor Act provides protection for children. The minimum age for work is 14, and the minimum age for hazardous work is 18. Section 10 of the Labor Act spells out that forced labor is prohibited. Article 12(2) of the Labor Act allows children between the ages of 14-18 to engage in labor.	The minimum age for general work is 14, which accords with ILO Convention 138, which recognizes the age of 14 as the minimum age for general work for the country whose economy and educational facilities are insufficiently developed. The Labor Act lacks clarity on prohibitions on the worst forms of child labor. A compulsory education age (13) is inconsistent with the minimum age for work (14).	The project will comply with the Labor Act. The Project will only allow the deployment from the age of 18. The project will not allow any forced labor. The project will apply an occupational health and safety management system that is consistent with the World Bank Group Environmental, Health, and Safety Guidelines.

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
• Provide accessible means to raise workplace concerns and grievance management.	Child Act of 2008 regulates the elimination of child labor, protection of children, and young persons, and hazardous child labor.		
ESS3: Resource Efficiency and Pollution Prevention and Management • Promote sustainable use of resources, including energy, water, and raw materials. • Avoid or minimize adverse impacts on human health and the environment from project activities. • Avoid or minimize project-related emissions of short and long-lived climate pollutants. • Avoid or minimize the generation of hazardous & non-hazardous waste. • Minimize and manage risks & impacts associated with pesticide use.	The Constitution of South Sudan: Article 41 (1) provides that the people of South Sudan shall have a right to a clean and healthy environment. (2) every person shall have the obligation to protect the environment. (3) future generations shall have the right to inherit an environment protected for the benefit of present and future generations. Specific measures to ensure the objectives above include Prevention of pollution and ecological degradation; promotion of conservation; and securing ecologically sustainable development and use of natural resources while promoting rational economic and social development so as to protect the biodiversity of South Sudan. Water Bill of 2013 provides for the protection of water sources from pollution, erosion, or any other adverse effects. Aims to conserve available water resources, manage water quality, and prevent pollution of ground and surface waters. Forest Bill of 2009 provides guidance on sustainable forest resource management.	South Sudan legislation doesn't cover resource efficiency (energy and raw materials). There is no specific law for solid waste management as well as dredging waste and hazardous waste management. Also, the pollution limits or maximum permissible concentrations are not established yet.	The proposed project will promote the sustainable use of resources and avoid or minimize adverse impacts on human health consistent with ESS3. In addition, applicable WBG EHS Guidelines, EAC standards, NEMA standards, USEPA standards, etc. will be followed.
ESS4: Community Health and Safety • Anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life cycle.	Public Health Act (2008) for South Sudan emphasizes the prevention of pollution of air and water and also encourages improvement in sanitation. Key provisions include the protection of the sanitation of the environment and encompasses the measures to address the pollution of water and air.	The national law does not adequately address the issue of GBV, and health and safety in the construction sites.	The project will ensure that project activities do not pose any unintended negative consequences on communities' health and safety, for example through increased GBV and SEA/SH incidents and security

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
• Promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure. • Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. • To have in place effective measures to address emergency events. • To safeguard personnel and property following relevant human rights principles.	Public Health Act of 2008 provides the need for the protection of pollution of water through the enforcement of regulations and measures necessary to combat all elements of pollution and protect the natural level of the environment and public health. Public Health (Water and Sanitation) Act of 2008 emphasizes the prevention of pollution of air and water and encourages improvement in sanitation. Key provisions include the protection of the sanitation of the environment and encompasses the measures to address the pollution of water and air.		risks/threats. The project will utilize WBG EHS guidelines for waste, air quality, noise and level, water quality, port security, traffic safety, pedestrian safety, etc. management. In addition, several management plans will be prepared by the contractors in their CESMP i.e., traffic management plan, health and safety plan, and SEA/SH action plan.
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement • Avoid and minimize involuntary resettlement by exploring project design alternatives. • Avoid forced eviction. • Mitigate adverse social and economic impacts from the land acquisition or restrictions on land use by (a) providing timely compensation for loss of assets at replacement cost, and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and living standards.	Land Act of 2009 provides for fair and prompt compensation to any person whose right of occupancy, ownership, or recognized long-standing occupancy of customary use of land is revoked or otherwise interfered with by the Government. Local Government Act of 2009 defines the primary responsibilities of local government and traditional authorities in the regulation and management of land.	While the Land Act of 2009 provides for fair and prompt compensation, the entitlement criteria are not fully addressed e.g., squatters or mobile traders.	Any activities that result in involuntary resettlement or land acquisition will be avoided and/or minimized. The project will compensate squatters and mobile vendors/traders for the improvements and/or loss of business. Where land is donated by private owners, a land donation agreement process is implemented. Any activities that require resettlement of people will be screened out, and livelihoods will be protected in accordance with ESS5. Additionally, the implementation of the provisions

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
• Improve living conditions of physically displaced poor or vulnerable persons. • Conceive and execute resettlement activities as sustainable development programs. • Appropriate disclosure of information, meaningful consultation, and the informed participation of affected people.			of ESS5 will be conducted accordingly.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources • Protection and conservation of biodiversity and habitats. • Mitigation hierarchy and the precautionary approach in the design and implementation of projects. • Promotion of sustainable management of living natural resources. • Maintenance of benefits from ecosystem services.	Environmental policy of South Sudan, from 2016, provides guidelines for a wide range of responses to environmental management. These include the promotion of effective, widespread, and public participation in the conservation and management of the environment. Wildlife and National Parks Protection Act, 2003 defines localization of protected areas, competent authorities, rules, and management. Draft Wildlife Bill of 2013 created the South Sudan Wildlife Service (SSWS) and defined the Authority's competency for protected areas and wetlands.	ESS6 categorizes habitats as natural, modified, and critical, implementing distinct risk management strategies for each type. In contrast, South Sudan's legislation lacks a comparable, detail classification of habitat types and corresponding management measures.	The proposed project will avoid any encroachment into any sensitive habitat, protected areas, national parks, wetlands, etc. Adequate measures will be taken for the conservation and management of the environment. A Biodiversity Management Plan (BMP) has been developed as part of this ESIA.
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities • Ensure full respect for IPs/SSAHUTLC (human rights,	The Constitution of South Sudan, Article 166 (6) expects local governments to involve communities in decision-making in the promotion of a safe and healthy environment.	South Sudan is characterized by a large number of distinct social and cultural groups. However, the laws of South Sudan don't	The proposed project will ensure that consultations with all stakeholders are undertaken in a manner that is accessible, culturally appropriate, and inclusive.

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
dignity, aspirations, identity, culture, livelihoods, knowledge, and practices). • Avoid, minimize, mitigate, and/or compensate for adverse impacts on IPs/SSAHUTLC. • Sustainable and culturally appropriate development benefits and opportunities for IPs/SSAHUTLC. • Establishing and maintaining an ongoing relationship based on meaningful consultation with the IPs/SSAHUTLC affected by a project throughout the project's life cycle. • Free, Prior, and Informed Consent (FPIC) in certain circumstances.		clearly identify "SSAHUTLC".	
ESS8: Cultural Heritage • Protection and preservation of cultural heritage from the adverse impacts of project activities. • Address cultural heritage as an integral aspect of sustainable development. • Meaningful consultation with stakeholders regarding cultural heritage. • Promotion of equitable sharing of cultural heritage benefits.	The Constitution of South Sudan, Article 38 (1e) spells out to protect cultural heritage, monuments, and places of national historical or religious importance from destruction, desecration, unlawful removal, or illegal export.	Currently, there is no legal framework related to cultural heritage and chance find procedures in South Sudan.	A "Chance Find Procedure" has been developed to protect cultural or archeological findings during project activities, especially during the construction phase.

WB Environmental and Social Standards	National Environmental and Social Policies and Regulations and Requirements	Gaps	Recommended Actions
ESS10: Stakeholder Engagement and Information Disclosure • Identification of stakeholders and build and maintain a constructive relationship, in particular project-affected parties. • Assessment of stakeholder interest and views of the stakeholders taken into account in project design and environmental and social performance. • Effective and inclusive engagement with PAPs throughout the project life cycle. • Disclosure of appropriate project information on E&S risks and impacts to stakeholders in a timely, understandable, accessible, and appropriate manner and format. • Accessible and inclusive means to raise issues and grievances and respond and manage such grievances.	The Constitution of South Sudan, Article 166(6) expects local governments to involve communities in decision-making in the promotion of a safe and healthy environment. The Constitution of South Sudan, Article 123 states the judicial power and its principles. The South Sudan Access to Information Act 2013 spells out that every citizen shall have the right access to information. The purpose of the Act is to give effect to the constitutional right of access to information, promote maximum disclosure of information in the public interest, and establish effective mechanisms to secure that right.	Decision-making is mostly oriented toward a safe and healthy environment and not broader issues. The justice system remains under construction and both legal practitioners and citizens still face great difficulties in making the law work for them.	The project will carry out stakeholder consultations throughout the lifetime of the project and timely disclosure of project information to inform meaningful consultations. The project will implement a Grievance Mechanism to allow stakeholders to raise issues and grievances that can be managed by the project authority.

Source: World Bank Environmental and Social Framework 2018 and Legal Framework of South Sudan

3 PROJECT DESCRIPTION

This chapter provides an overview of the proposed project proponent, project location, environmental settings, project description, associated facilities, components, activities, technology, project schedule, resources, utility demand, etc. for the proposed project in South Sudan.

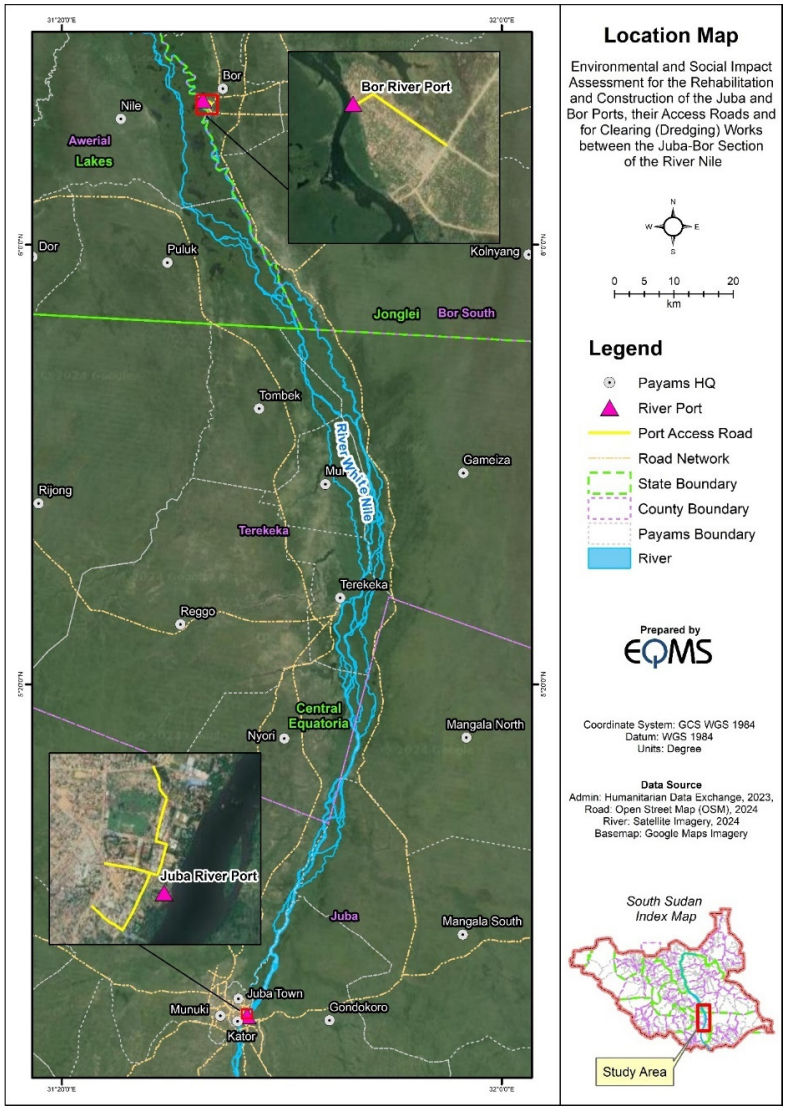
3.1 Project Proponent

The Ministry of Transport (MOT) and Ministry of Roads and Bridges (MRB) of the Republic of South Sudan is charged with ensuring a safe secure, and affordable intermodal transportation system in the country and the project proponent. The Directorate of River Transport under the Ministry of Transport is working to implement the project.

3.2 Project Location

The proposed project encompasses the Bor port and access road, access roads at the Juba port area, and clearing (dredging) in the White Nile River. This will be referred to as the “Project Area” or “Project Site” throughout this report. A location map of the proposed project site is presented in Figure 3-1.

Figure 3-1: Location Map of the Project Site



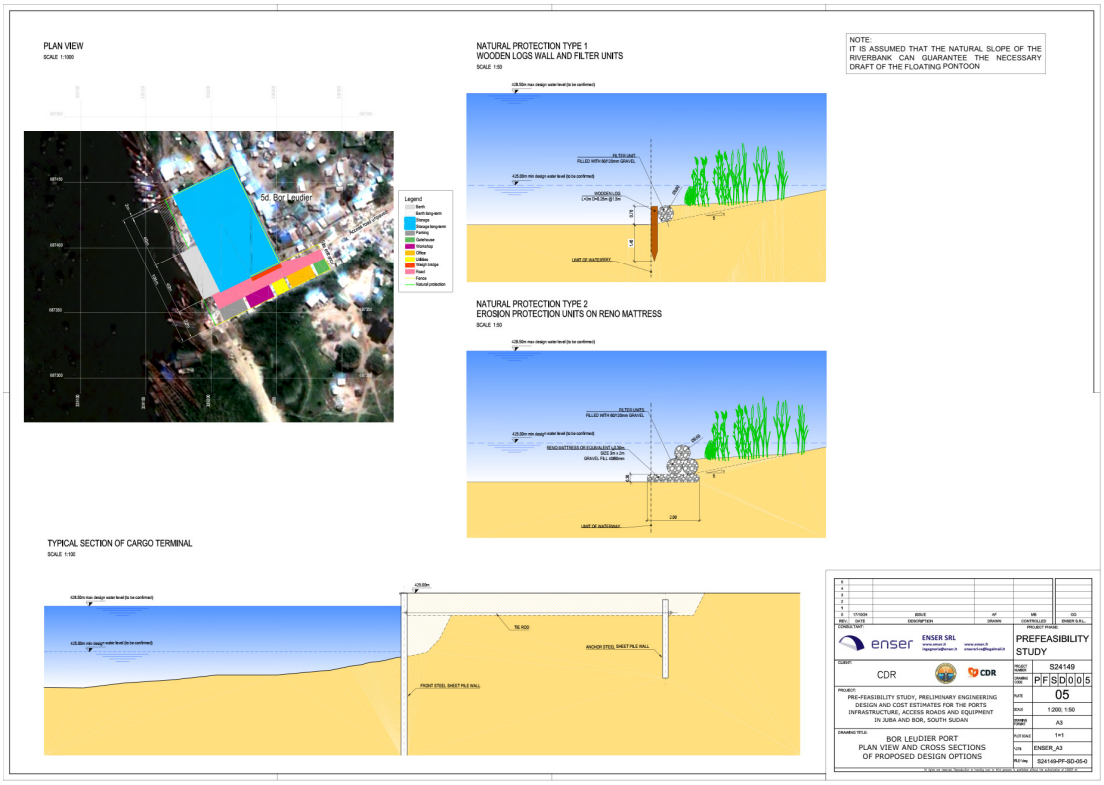
Source: EQMS, September 2024

3.2.1 Location of Bor Port and Access Roads

The geographical coordinates of the Bor river port is 6°12'16.57"N and 31°33'10.39" E. Administratively it is located in Bor Town, Bor South County in Jonglei State, and on the east bank of the White Nile. Bor is the second most developed city, in central South Sudan, approximately 190 kilometers north of Juba, the capital, and is the capital of Jonglei State.

The proposed access road is an earthen road/unpaved that is connected to a secondary road. The surface condition of the road is poor and extremely difficult to transit during the rainy season. Bor Leudier port plan view and cross sections of proposed design options are given in Figure 3-2**Error! Reference source not found.**.

Figure 3-2: Plan View and Cross Sections of Proposed Design Options for the Bor Leudier Port



Source: Design, Hydrodynamic and Bathymetric Study Consultant, November 2024

Photographs of the existing condition in the proposed Bor Leudier port site and its access road is presented in Figure 3-3.

Figure 3-3: Existing Condition of the Proposed Bor Port Site





Proposed site for the construction of Bor port



Existing access road condition at Bor port

Dry fish business activity at Bor port



Existing access road condition at Bor port

Source: Site Visit, August 2024

3.2.2 Location of Juba Port and Access Roads

Three roads will be developed around the Juba port in Juba Town. The existing road connecting national roads is a gravel road having a width of 6m and the length is approximately 750m. The surface condition of the access roads are very poor. Most of the gravel materials have been eroded, exposing the weak underlying subgrade which gives rise to impassable sections for most vehicles. Administratively the area is located in Juba County under Central Equatoria State, and on the west bank of the White Nile. Juba is the capital of South Sudan. Photographs of the existing condition in the proposed access road at the Juba port end is presented in Figure 3-4.

Figure 3-4: Existing Condition of the Access Road at Juba Port



Existing access road condition at the Juba port area



Existing access road condition at the Juba port area

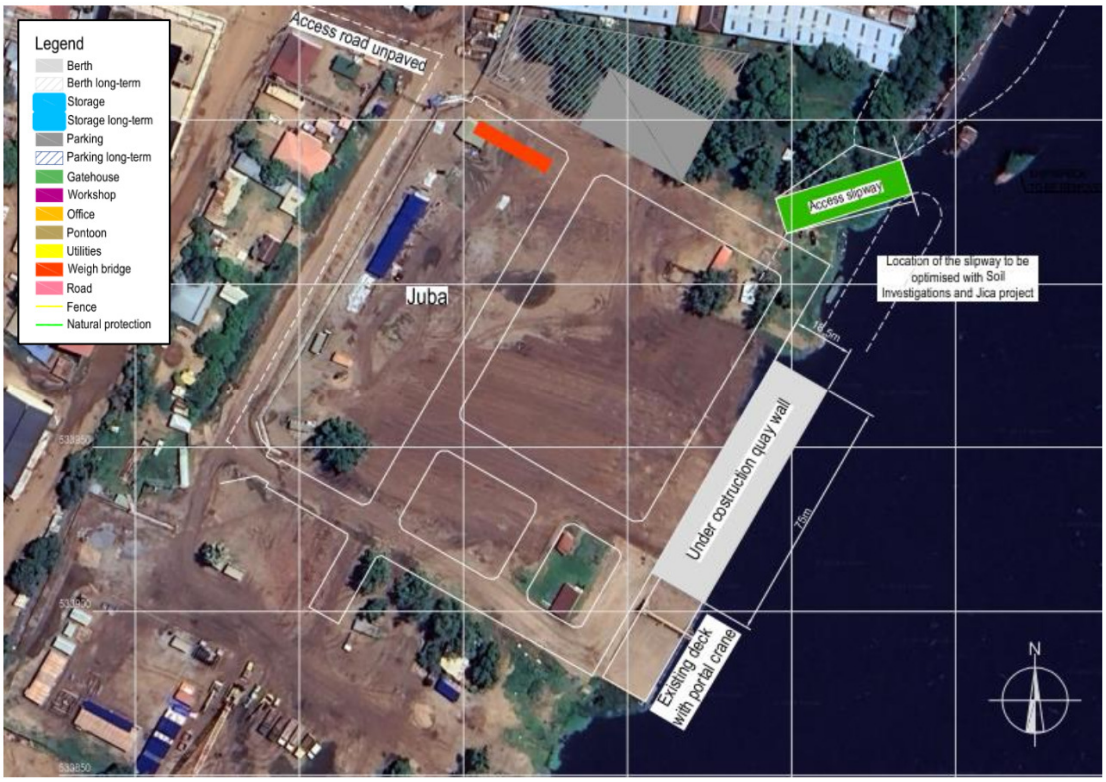
Source: Site Visit, August 2024

Design of infrastructure at Juba River Port

It is proposed to locate the additional slipway northeast of the JICA infrastructures, having 11m width, 40m length, and 10% slope (Figure 3-5 and Figure 3-6). The riverbank slopes will be re-profiled downstream of the slipway entrance, with nature-based solutions and a retaining wall, if needed, in order not to cause any interference with existing buildings.

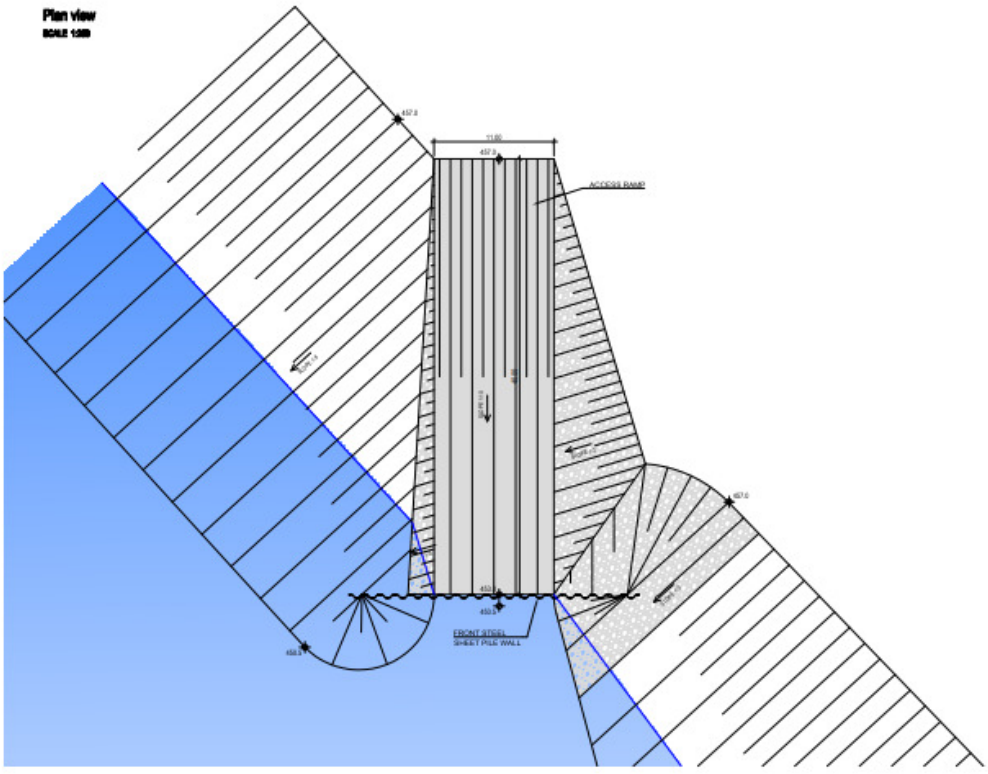
The proposed design is based on these assumptions. In the next stage of design after this Pre-feasibility, it is strongly recommended to collect the above-mentioned data by means of surveys and geotechnical soil investigation campaigns, to confirm whether these assumptions are valid and reasonable. If in situ conditions are significantly different, the proposed solution shall be reconceived.

Figure 3-5: Proposed slipway, parking area, and weigh bridge at Juba River Port



Source: CDR International B.V, November 2024

Figure 3-6: Top view of the slipway at Juba River Port



Source: CDR International B.V, November 2024

3.2.3 Location of Clearing (Dredging) Sites

The White Nile River, which flows from the south northerly, is the major artery for the transport of goods and people. In addition, the Sobat River and the Bahr el-Ghazal complement South Sudan's navigable waterways, further enhancing the reach of this mode of transport. During the wet season, when rivers are swollen with water, transportation becomes more feasible, but during the dry season, some sections of the rivers can become rather shallow and less navigable, making transportation more challenging.

The river sections between Juba and Bor will be cleared/dredged under the proposed project. The dredge areas will begin from Juba port and slope downstream to the Bor port. The main observations made in view of potential bottlenecks for inland waterway transport are discussed below briefly:

3.2.3.1 Rock Outcrops

Rock outcrops have only been observed at Juba (1-2 km from Jube port) (Figure 3-7). Not all the outcrops were seen because of the high-water level, but the heavy turbulence in the water and the rock outcrop itself are clearly an obstruction for navigation.

Figure 3-7: Rock Outcrops at Juba



Source: Hydrodynamic and Bathymetric Study, October 2024

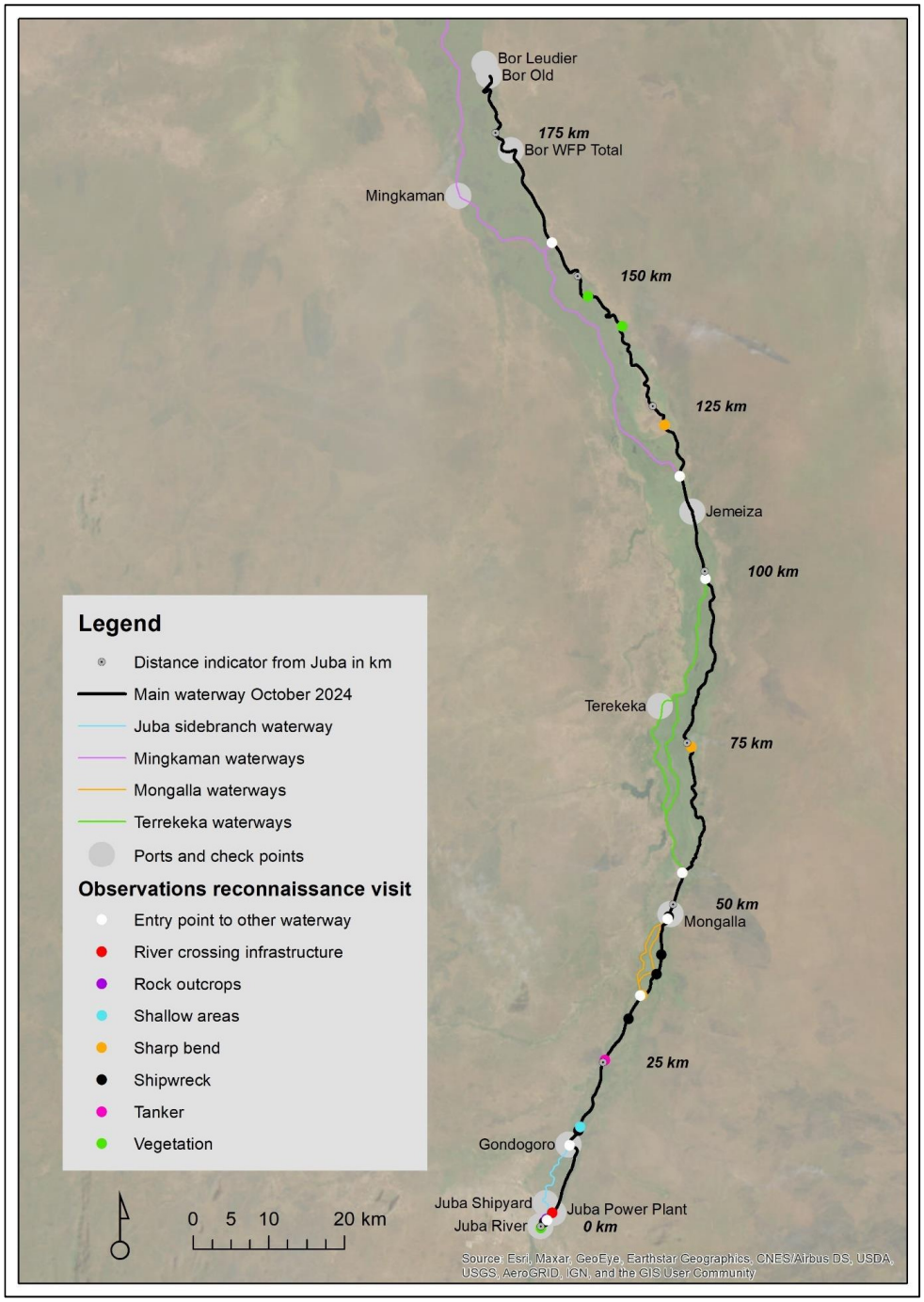
3.2.3.2 Shallow Areas

Shallow areas, areas in the waterways with limited water depth, were not easy to observe because of the high-water level. However, during the site visit a few locations have been mapped (Figure 3-8). Shallow areas were observed at Gondokoro approximately 15 km from Juba port and a larger shallow waterway between 35 km and 50 km from Juba port (upstream Mongalla), indicated in the maps as the Mongalla waterways.

3.2.3.3 Sharp Bends

Sharp bends which complicate navigation are observed at several points such as at approximately 35 km from Juba port. The meandering of the rivers is a constant natural process, so the waterways will continue to migrate over time. Also, it has become clear that most of the stretches of the currently navigable waterways do not have a solid riverbank that clearly emerges above the water surface. The waterway is mainly delineated by vegetation in swampy areas.

Figure 3-8: Location of the Shallow Areas in the Nile River



Source: Hydrodynamic and Bathymetric Study, October 2024

3.2.3.4 Shipwrecks

Several shipwrecks have been observed at several locations in the Nile River (Figure 3-9).

Figure 3-9: Observed Shipwrecks and Indicated Locations



At 1 km downstream of Juba port



At 32 km downstream of Juba port



At 40 km downstream of Juba port



At 43 km downstream of Juba port

Source: Hydrodynamic and Bathymetric Study, October 2024

Besides the above-listed locations, a ship sunken with metallic barrels about 15 km from Juba port. Also, at Mongalla port a ship has sunken causing rapids at that location (48 km from Juba port). It is expected there will be many more shipwrecks than the ones reported here. Especially the shipwrecks not emerging out of the water can be dangerous as they are not visible. The shipwrecks are considered a significant threat to IWT operations.

3.2.3.5 Floating Tanker

A floating tanker was observed about 25 km from Juba Port (Figure 3-10). The tanker got into the river upstream of the bridges in Juba and continued to drift downstream. If such events occur more frequently, they should be taken into account as a serious risk to IWT operations.

Figure 3-10: Floating Tanker in the Nile River



Source: Hydrodynamic and Bathymetric Study, October 2024

3.2.3.6 Vegetation

Vegetation mainly causes issues for inland water transport by floating islands of vegetation. At Juba, there is an island full of vegetation just upstream of the Juba River Port (Figure 3-11). This island could further migrate and the island with its vegetation can obstruct (future) operations of the Juba River Port.

Figure 3-11: Vegetation in the Nile River



Island with vegetation just upstream of Juba Port



Floating vegetation from lakes at Kaigo

Source: Hydrodynamic and Bathymetric Study, October 2024

Further downstream a main source of floating vegetation appears to be the lakes at Kaigo (between 135 km and 150 km from the Juba port). Most of the floating vegetation which crosses the ports in Bor originates from this area according to the local communities. Vegetation types include water hyacinth, papyrus, and reed species.

3.3 Environmental Settings

The details of the environmental setting of the project site and its surroundings are given in Table 3-1.

Table 3-1: Environmental Setting around the Project Site

SL#	Particulars	Details
1.	Location of the project	Juba and Bor town
2.	Present land use at the site	Port, settlement, roads
3.	Topography	Floodplain
4.	Nearest River	White Nile River
5.	Nearest Town	Juba and Bor
6.	Nearest Highway	Juba-Bor-Malakal Highway
7.	Nearest Airports	Juba International Airport and Bor Airstrip
8.	Nearest Sea Ports	Mombasa in Kenya and Mogadishu in Somalia
9.	Archaeological important places	No
10.	Protected Area	Bandingilo National Park and Juba Game Reserve
11.	Ramsar Site	Sudd Wetland
12.	IBA area	Bandingilo and Sudd (Bahr-el-Jebel system)
13.	Hills/valleys	No
14.	Displacement	Yes

SL#	Particulars	Details
15.	Flood	Yes
16.	Erosion	Yes

Source: Filed Visit, August 2024

3.4 Brief Project Description

An overview of the proposed Bor Leudier port development shared by the Design, Hydrodynamic and Bathymetric Study Consultant includes the following:

For Short to Mid Term:

- Access Road Upgrading
- Infrastructure and facilities
  - Reclamation, raising of platform level
  - Sheet pile wall including apron (approx. 40 m length)
  - Apron next to sheet pile
  - Floating Pontoon with gangway to sheet pile wall
  - Natural bank protection (wooden piles and Nature Based Solutions)
  - Service buildings (Admin, workshop, gate)
  - Storage area open
  - Storage area closed
  - Fish handling facilities
  - Generals - fencing, utilities.
- Equipment:
  - Tractor trailer units (1)
  - Forklift trucks (1)
  - Misc equipment (1)

For Long Term:

- Infrastructure and facilities:
  - Additional storage area open
  - Additional storage area closed
- Equipment:
  - Quay crane (1)
  - Tractor trailer units (1)
  - Forklift trucks (1)

3.5 Associated Facilities

The environmental and social assessment process also identifies and characterizes, to the extent appropriate, potentially significant environmental and social issues associated with activities or facilities that are not part of the project, but which may be directly or indirectly influenced by the project, exist solely because of the project or could present a risk to the project. These associated activities or facilities may be essential for the viability of the project and may either be under the control of the client or carried out by, or belong to, third parties.

For the purposes of this report, the rehabilitation of the existing Juba port facilities under JICA finance has been identified as Project related associated facilities considering the criteria i.e., significantly related to the project, carried out contemporaneously with the project, and necessary for the project to be viable. The proposed mitigation and enhancement measures for Juba port have been devised and presented in Chapter-9. A brief description of the Juba port facilities has been discussed below.

Juba River Port is situated in an industrial area of Juba town, approximately 800m downstream of the Juba White Nile River Bridge, bordering some commercial plots on the southern and northern sides.

The geographical coordinate of the Port is 4°49'50.18"N and 31°36'51.40"E. Administratively the port is located in Juba Town, Juba County in Central Equatoria State, and on the west bank of White Nile. A plan view of the Juba port is shown in Figure 3-12.

Figure 3-12: Plan View of the Juba River Port



Source: Katahira & Engineers International Co. Ltd., August 2024

Currently, Juba Port has one Jetty (length 35 m and width 16m) with a crane (loading capacity is 1.5 tons) and a natural bank (length of about 300m). The annual cargo handling capacity is 3,600 tons. There is no warehouse facility at the Juba port.

The Juba port expansion project has already started, and the Ministry of Transport has engaged Katahira & Engineers International Co. Ltd. to perform the activities. As part of the expansion work, a new jetty will be additionally constructed by JICA at the present port site. After completion, Juba port will have a jetty (205m in length, 2.5m in depth), a mobile crane (150 tons capacity), a warehouse (1,700 square meters), and an administration office in a 5.4 ha landside area. The fluctuating water levels, particularly extreme high-water levels, are imposing issues on the site. For this reason, the platform of the new port as well as the existing platform will be raised by 70 cm compared to the level of the existing jetty. Photographs of the ongoing activities in the Juba Port are given in Figure 3-13.

Figure 3-13: Ongoing Activities in the Juba Port



Ongoing construction activities related to associated facilities under JICA finance



Land development and leveling activities related to associated facilities under JICA finance

Source: Site Visit, August 2024

3.6 Resources Requirements

3.6.1 Land Requirement

Land acquisition will be required for the port construction at the Leudier site in Bor. A Resettlement Action Plan including a land acquisition and livelihood restoration plan has been initiated by the MOT to identify the landowners, prepare an inventory of losses, and ensure proper compensation.

3.6.2 Water Requirement

As the project is in the pre-feasibility study stage, the exact amount of water required for construction and operation activities and the source of water to be used are yet to be finalized. However, it is envisaged that the required water will be sourced from the White Nile River.

3.6.3 Power Requirement

During the construction phase of the project, it is common practice for the contractors to provide the required power for activities on site. However, the exact amount and source are yet to be defined as the study is in progress.

3.6.4 Fuel Requirement

As the project is in the pre-feasibility study stage, the exact amount of fuel required for construction and operation activities and the source of fuel to be used are yet to be finalized. However, it is envisaged that the required fuel will be sourced from the local market.

3.6.5 Human Resources Requirement

As the project is in the pre-feasibility study stage, the exact number of workers required for the construction and operation phase activities is yet to be received. However, it is envisaged that different types of workers including unskilled, semiskilled, and skilled manpower will be required. Skilled job opportunities such as engineers, technicians, consultants, surveyors, E&S experts, etc. and semi-skilled and unskilled job opportunities such as laborers, security personnel, housekeeping, etc. will be required. Both direct and indirect employment opportunities will be generated at the project site.

Human resources requirements during the operations phase will include skilled job opportunities such as engineers, technicians, administrative employees, E&S experts, etc., and unskilled job opportunities such as security personnel, drivers, etc. These human resources will be procured from the local communities including both men and women according to their skills and experiences and opportunities for employment will be governed by a transparent and fair process.

3.7 Project Activities

3.7.1 Pre-construction/Planning and Design Phase Activities

The following activities are to be undertaken during the preconstruction phase of the proposed project:

- Undertake preconstruction preparation activities including Hydrodynamic and Bathymetric study, Pre-Feasibility study, Preliminary Engineering Design, and preparation of cost estimates.
- Preparation of Land acquisition and Resettlement Action Plan including Livelihood Restoration Plan following national legal requirements as well as World Bank Environmental and Social Standards.
- Perform a Scoping and Environmental and Social Impact Assessment including an Environmental and Social Management Plan following national legal requirements as well as World Bank Environmental and Social Standards.
- Acquiring licenses and permits i.e., environmental permit, water use permit, permit to work inside of the protected area boundary, etc.

3.7.2 Construction Phase Activities

The following activities are to be undertaken during the construction phase of the proposed project:

- Site clearance and site preparation including soil excavation/leveling/land preparation for the proposed project.
- Establishment and operation of labor facilities and mobilization of workers for construction activities.
- Installation of the temporary security fence at the campsites, site office, and storage facilities
- Collection and transportation of construction materials and storage in the construction site
- Mobilization of dredges, equipment, and machinery at the project construction site
- Construction of Bor river port at Jonglei State
- Construction/strengthening of access roads in Juba and Bor port area
- Commencement of clearing (dredging) in the river and transportation and disposal of dredge materials
- Operation of diesel generator set
- Commencement of civil work, mechanical work, electrical work, etc.
- Collection, storage, transportation, treatment, and disposal of wastes (solid, liquid, and hazardous) generated from construction activities
- Maintenance and replacement of dredgers, vehicles, equipment, machinery, etc.
- Implementation and monitoring of environmental and social safeguards as well as health and safety management.
- Closure of contractor's office, and removal of construction machinery, storage yard, etc.

3.7.3 Operation Phase Activities

The following activities are to be undertaken during the operation phase of the proposed project:

- Operation of the river ports, access roads, and vessels.
- Transportation, offloading, and storage of materials/products
- Ongoing maintenance of the port terminal facilities
- Maintenance dredging (as needed)
- Generation of solid waste and management
- Generation of liquid waste (wastewater) and management
- Storage and handling of hazardous waste (fuels, chemicals, etc.)
- Operation and maintenance of utilities including power, water, and waste treatment facilities.

3.7.4 Decommissioning and Dismantling Phase Activities

The following activities are to be undertaken during the decommissioning phase of the proposed project:

- Remove and disposal of surface structures
- Movement of vehicles, equipment, and personnel
- Storage and handling of fuels and chemicals
- Treatment and disposal of wastes
- Major rehabilitation or upgrading of project structures
- Reinstatement and restoration of the affected sites
- Stakeholder consultation regarding restoration of the affected sites.

3.8 Project Cost

According to the preliminary designs and cost estimates prepared by CDR, Table 8-7 provides a summary of the cost estimates for the Juba and Bor Leudier ports. However, the cost for clearing/dredging is to be confirmed after completion of the hydrodynamic study (early Feb 2025).

Table 3-2: Summary of Cost Estimates

SL#	Ports	Short term	Mid-term	Long term	Total (USD)
1.	Jube River Port	-	1,020,000	146,250	1,166,250
2.	Bor Leudier port	1,475,000	2,217,550	1,580,000	5,272,550
	Total	**1,475,000**	**3,237,550**	**1,726,250**	**6,438,800**

Source: CDR International B.V, November 2024

3.9 Project Schedule

The schedule for the overall project implementation is in progress and it will be incorporated in the next version of the ESIA.

4 BASELINE DATA

To assess environmental and social impacts, it is essential to monitor the appropriate environmental and social quality prevailing at the project site and its surrounding areas before the implementation of the project. This chapter outlines the existing environmental and social baseline setting of the project site and its influence area.

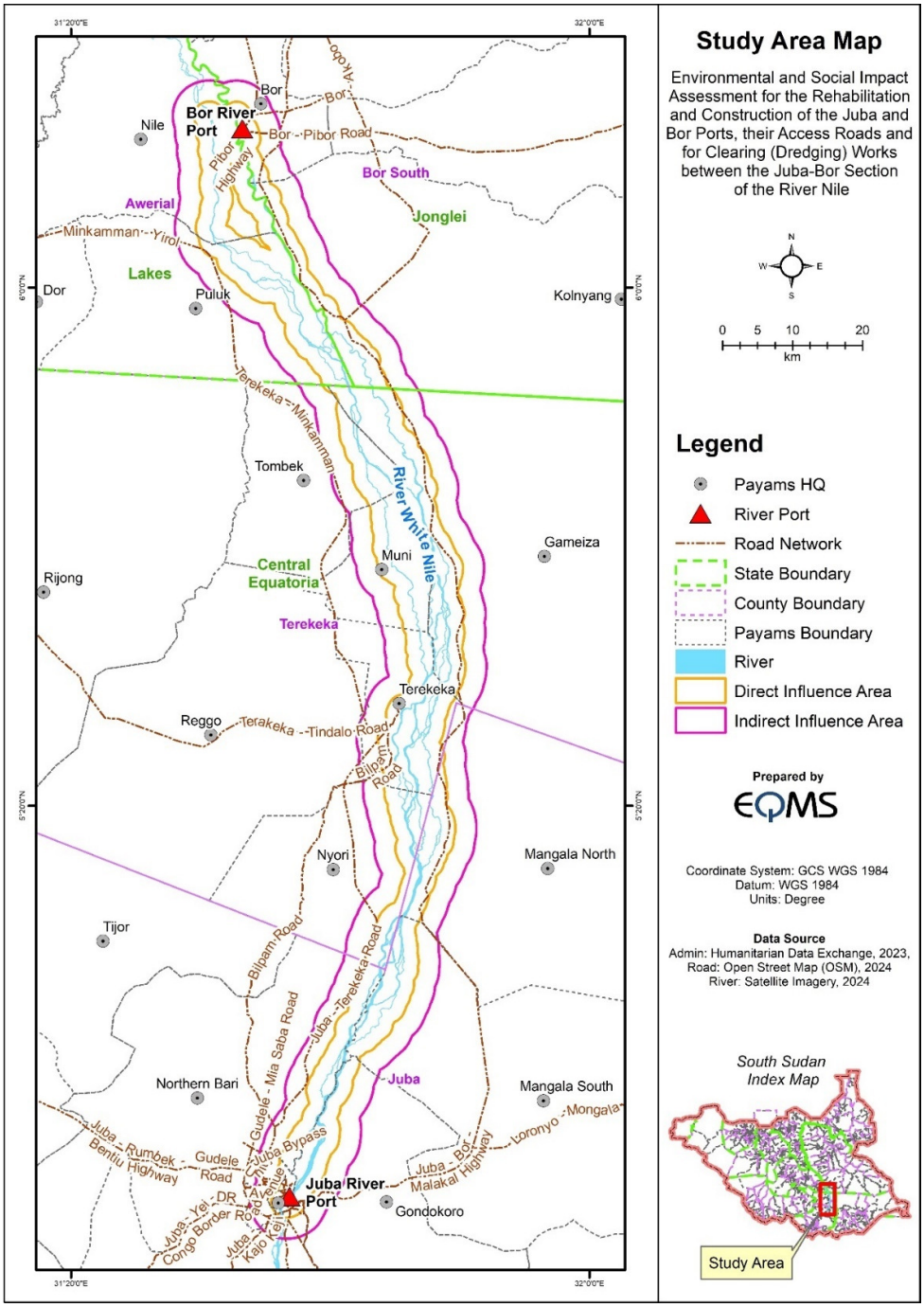
4.1 Study Area

For a good understanding of the process of risks and impacts assessment and management, it is worthwhile to clarify the difference between project area, zone of impacts, and study area (Figure 4-1), as these overlap, but are not identical. This is described below.

- **Project Area (Project Footprint):** an area where the project/development activities are realized. In other words, where construction and operation will take place.
- **Zone of Impacts:** an area where impacts from the project/development activities may manifest, which can be larger than the project area, and considered areas that might be affected by indirect effects.
- **Area of Study:** the area that will be studied for the baseline and impact assessment. It may be justifiable to study only certain parts of the area of influence if these parts are representative of the wider area.

For the ESIA, both the direct and indirect influenced areas are considered. The area that falls within the radius of two km from the proposed Bor Leudier port, access roads in Juba and Bor ports, and clearing (dredging) and disposal area are considered a direct influence area. This area is defined based on the extent of impacts that are anticipated due to the project activities. In addition, the area that falls within the radius of two to five from the proposed Bor port, access roads in Juba and Bor ports, and clearing (dredging) area from where different services will be obtained for the project and will have an impact on the project implementation. It also includes labor, fishing community, business community, water transport services, etc.

Figure 4-1: Map of the Study Area



Source: EQMS, September 2024

4.2 Physical Environment

4.2.1 Climate and Meteorology

The project area experiences a tropical wet and dry climate with two rainy seasons and high humidity (MOE, 2015 & AfDB, 2018). The wet season generally begins as early as April and continues as late as November and the dry season begins in January and continues up to April. Temperature averages are normally above 25°C, with highs exceeding 35°C, particularly during the dry season (January to April). Juba, the capital city, has an average annual high temperature of 34.5°C and an average annual

low of 21.6°C. The rainy season differs by location, but it generally occurs between April and November. The lowland areas of Eastern Equatoria, Jonglei, Upper Nile, and Bahr el Ghazal receive annual rainfall between 700 mm to 1,300 mm. The southeastern tip of Eastern Equatoria receives about 200 mm. The heaviest rainfall occurs in the southern upland areas and lessens towards the north. Western Equatoria and highland parts of Eastern Equatoria receive between 1,200 mm to 2,200 mm of rainfall annually. Precipitation in South Sudan is impacted by the movement of the Inter-Tropical Convergence Zone[1].

4.2.2 Land Use and Land Cover

In the study area, within a 5 km radius covering about 2516.52 sq. km of land, the major share of the land is under the vegetation cover/trees which is about 873.15 sq. km covering 34.70% of the total land cover. The rangeland and aquatic vegetation are also present in the study area, which consists of 718.06 sq. km and 566.10 sq. km respectively, and account for only 28.53% and 22.50% of the total area respectively. The waterbodies and built area cover 8.37% and 5% of the total study area. Besides, the cropping area covers 0.90% (22.73 sq. km). The existing land use pattern of the proposed project study area is given in Table 4-1.

Table 4-1: Existing Land Use Pattern of the Study Area

Land Use/Land Cover Type	Area (sq. km)	Area (%)
Waterbodies	210.65	8.37
Vegetation cover/Trees	873.15	34.70
Aquatic Vegetation	566.10	22.50
Cropping area	22.73	0.90
Built Area	125.82	5.00
Rangeland	718.06	28.53
Total	**2516.52**	**100**

Source: EQMS, September 2024

4.2.3 Topography

The major geographical features of the project area are the White Nile, which flows north from Central Africa's uplands and dominates the center of the country, and the vast Sudd wetland, one of the world's largest wetlands. The Sudd wetland is fed by the White Nile and covers over 100,000 km^2, more than 15 percent of the country's area. Rising out of the northern and central plains are the southern highlands along the border with Uganda and Kenya. The Ethiopian highlands border the country to the east, and the Congo River basin highlands are on the southern and western margins (Fernando & Garvey, 2013).

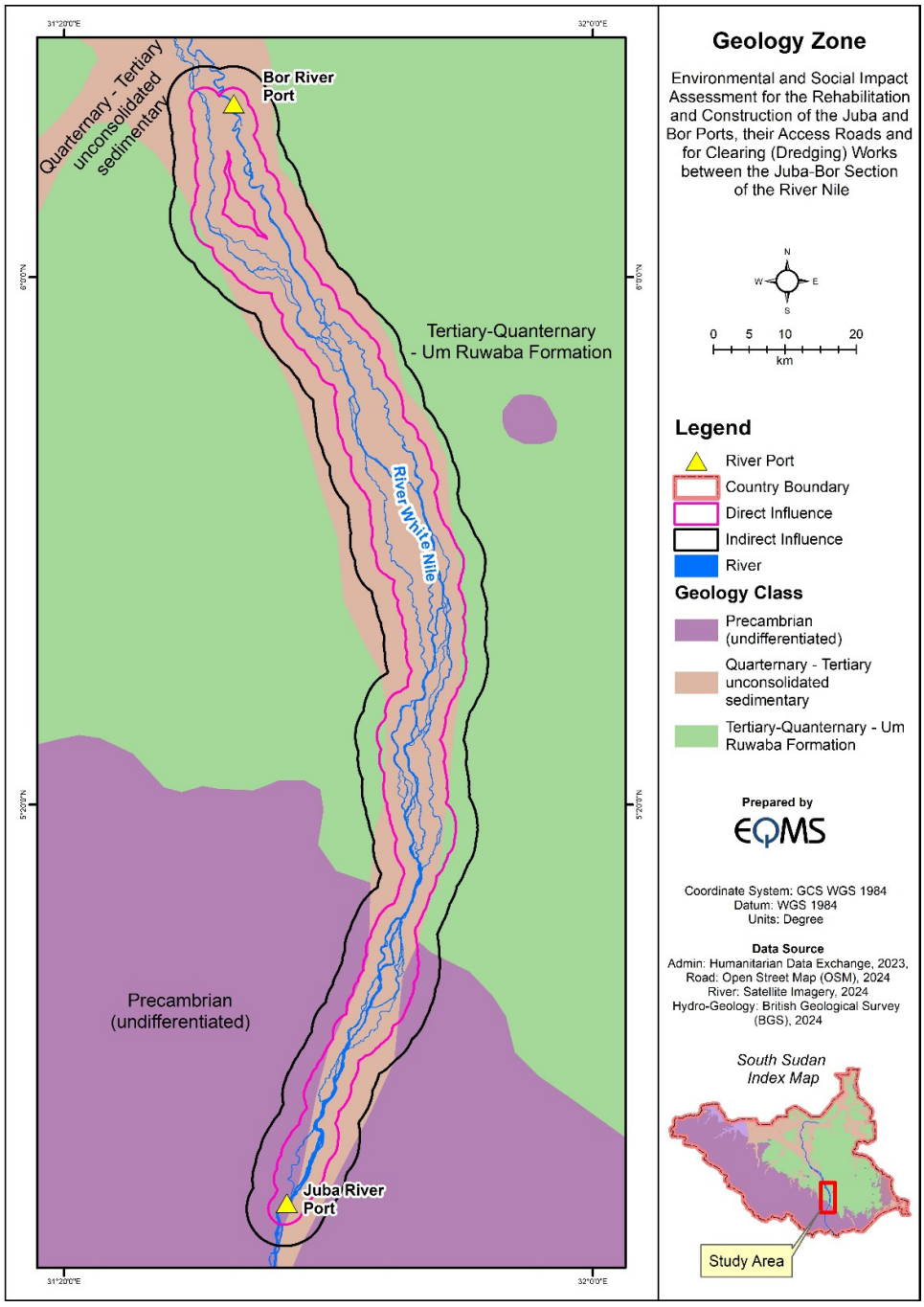
The highest point in South Sudan is Mount Kinyeti at 3,187 meters above sea level (CIA, 2016) and the lowest point is the confluence of the White Nile and Sobat rivers. The elevation of Juba is 550 meters and Bor is 397 meters above sea level[2]. The study area is dominated by the waters of the Nile River and its tributaries, which occupy most of the land. The low-lying areas in the project area are mainly characterized by Savannah grasslands, which are interspersed with marshlands, swamps, and riverine forests.

4.2.4 Geology

[1] https://climateknowledgeportal.worldbank.org/country/south-sudan/climate-data-historical#:~:text=The%20rainy%20season%20differs%20by,occurs%20between%20April%20and%20November.
[2] https://whatismyelevation.net/countries/south-sudan

The geology of South Sudan is extremely diverse with a variety of metamorphic, igneous, and sedimentary rocks. The intensity of deformation and metamorphism varies from place to place. A map showing the geological formation of South Sudan is given in Figure 4-2.

Figure 4-2: Geology Map of South Sudan



Source: https://earthwise.bgs.ac.uk/index.php/File:SouthSudan_Geology3.png

In the study area, three types of geological formations are found i.e., Quaternary-Tertiary Unconsolidated Sedimentary, Precambrian, and Tertiary-Quaternary Um Ruwaba formation. A brief description of the geological formation has been given below:

Quaternary-Tertiary Unconsolidated Sedimentary

These are widely deposited along the Nile River and its tributaries. Ancient and recent terrace deposits consist of well-sorted silts and clays with occasional sandy strata and can be up to 60m thick. The alluvial fill consists of medium to coarse, poorly sorted sands with gravel and lenses of clay in places. Clays and silts up to 30-50m thick can be found around smaller tributaries and in deltaic environments.

Tertiary-Quaternary Um Ruwaba Formation

The Um Ruwaba formation is found in the north of Juba, and it covers a large part of the study area. The formation comprises unconsolidated alluvial and lacustrine sands, silts, and clays (UN, 1988). It contains lenticular sand and clay units which vary significantly vertically and horizontally. Thickness varies depending on the position within the basin. The minimum thickness is around 50m at the edge of the basin and the maximum thickness is around 1,400m along the main axis of the basin. It is thought to overlie older Tertiary and Cretaceous deposits, which may reach a maximum thickness of around 10,000m.

Precambrian Basement

Mainly undifferentiated basement rocks are composed of metamorphosed igneous, sedimentary, and metamorphic rocks and are exposed over almost the area. Rocks include acid gneisses, quartzites, and schists. They are intruded by igneous rocks and ring complexes, mainly granite.

4.2.5 Hydrology and Drainage

South Sudan is rich with its surface water resources. The Nile River is the longest river on the earth having 6700 km long. The Nile water is shared between eleven riparian countries which together populate more than 487 million people (NBI, 2016). There are three major tributaries to the Nile River, which are the Blue Nile, White Nile, and Atbara River (Tariq, 2021). The White Nile is the main river in the proposed project site. The White Nile originates from the Equatorial Lakes region in the central part of Africa (Tariq, 2021). The White Nile enters South Sudan at Nimule town and goes through Juba town, the capital, to spread out in large swamps called the Sudd region. The Sudd wetland is a Ramsar site, and its seasonal coverage ranges between 10,000-35,000 km^2, making it one of the largest in the world (AfDB, 2013).

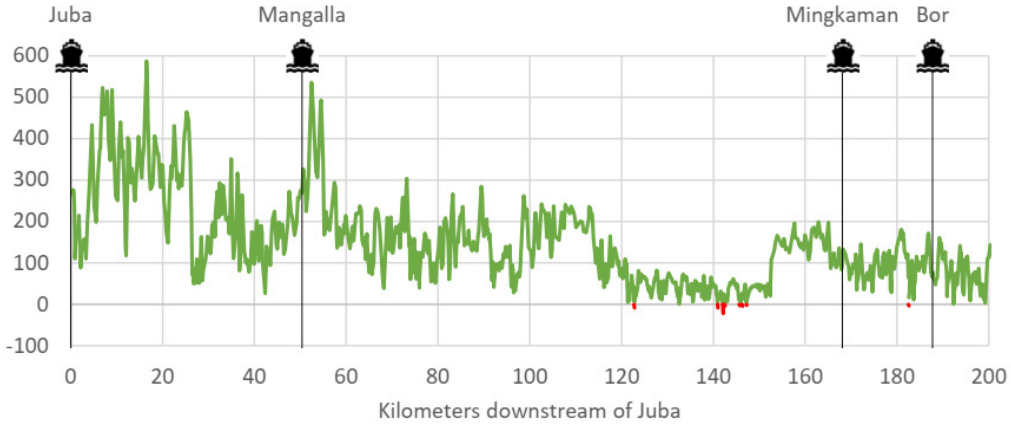
Three major river basins feed into the White Nile, although many of these rivers are highly seasonal (WB, 2013). In the south, Bahr el Jebel discharges approximately 30,000 million cubic meters (MCM) annually into the White Nile and the seasonal Sobat River in the northeast discharges an additional 14,000 MCM per year (UNEP, 2018). Bahr el Ghazal is a seasonal river that discharges 12,000 MCM per year into the White Nile.

HYDROC GmbH carried out a river barge system feasibility study project in South Sudan in 2018 for the United Nations Office for Project Services (UNOPS). According to the report, the section river between Juba to Bor/Mingkaman is characterized by an average slope of 0.17m/km over a distance of 188 km and the average width between banks and islands is 190m (638m maximum and 43m minimum). The average radius of the channel is 1.4 km with a minimum of 54m. Mingkaman is located off the main channel and is currently not directly accessible from the main branch of the Bahr el-Jebel.

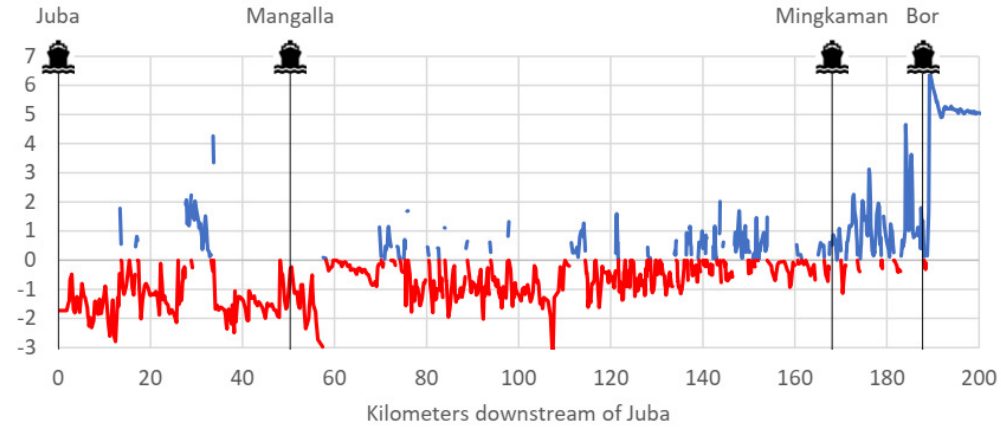
Figure 4-3 shows the remaining river width in meters after having subtracted the shipping channel. In sections around 120-150km and 180-200km from Juba, the Bahr el-Jebel is very narrow and at around 140 km and 185 km not sufficiently wide enough for design barges to pass. Water depths in the Juba to Bor section are low. This was also found by the simulations (Figure 4-3) where the remaining depth for barge traffic is not sufficient in most locations within the first 140 km from Juba. Maximum flow velocities are mostly in the range of 1-4m/s with two locations, at about 75 and 100km downstream of Juba, where velocities are projected to be higher than 4m/s and where barge traffic may encounter difficulties during the highest discharges.

Depths and also flow velocities from Bor downstream are more uncertain than upstream of Bor due to the lack of bathymetric data. In addition, the Sudd is subject to lower-quality elevation data which also impacts depths and flow velocity simulations.

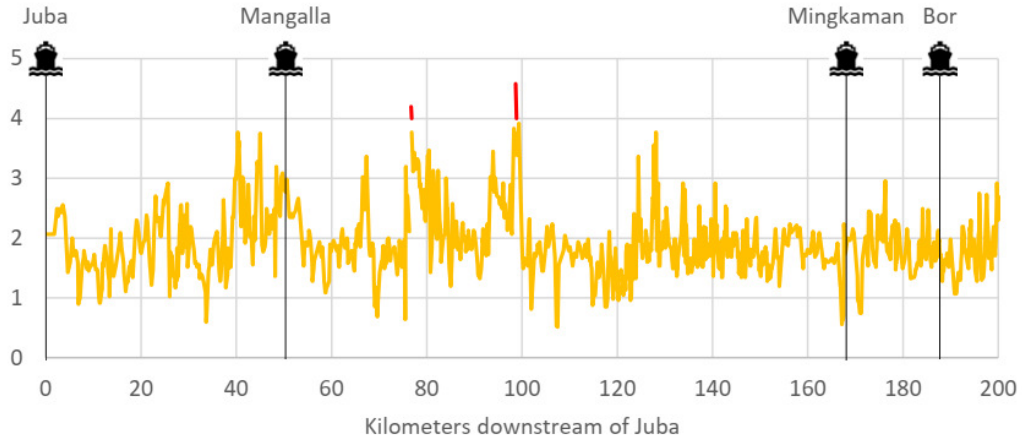
Figure 4-3: Longitudinal Profile Between Juba and Bor



Remaining width in [m] which is calculated from the actual river width subtracted by the calculated shipping channel width



Remaining depth in [m], which is calculated from the simulated water depth for the 5% lowest flows subtracted by the ship draft (1.95m) and freeboard (ground clearance) (0.75m),



Maximum flow velocity in [m/s] which is calculated from the simulated flow velocity for the 5% highest flows. Bor/Mingkaman – Malakal

Source: UNOPS, 2018

The river meanders in one or more channels from one side of the restraining trough to the other, dividing the floodplain into a series of isolated basins or islands. These basins lie below the levels of the alluvial banks of the river, through which a number of small channels carry spill. At the downstream end of each basin, where the river meets the high ground, a large channel carries spill back into the river. Further north, where the basins are not confined, the system of channels becomes more complicated, but the pattern can be visualized as a series of basins receiving spills and discharging some spills back to the river (Sutcliffe, 1974).

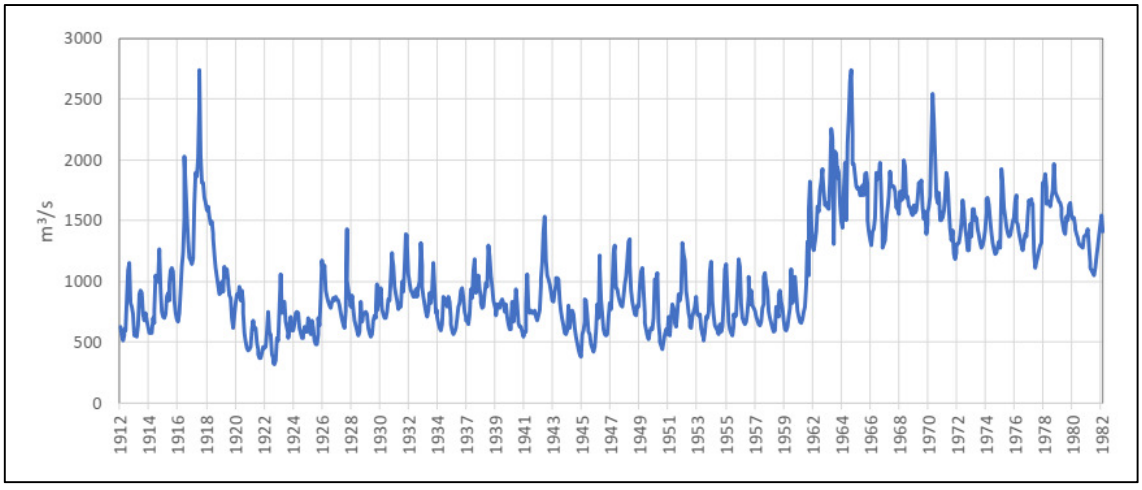
Below Mongalla, the channel capacities are less than the flood flows and the alluvial channels themselves are above the floodplain. Thus, excess flows leave the river through spill channels and inundate wide areas on either side of the river. This inundation is limited by higher ground only in the south of the swamps. Flooding is then controlled by the relative levels of the river and riverbank. The alluvial bank is extremely even in height and falls steadily to the water level from south to north. Therefore, flooding through spill channels and over the bank increases downstream, and spreads upstream as the river rises. At the lower end of the reach, near Bor, spill-through channels are continuous and the bank is submerged at an inflow of about 65x106 m^3/day (around 750m^3/s) (Mott MacDonald, 2019).

Due to the absence of relevant secondary streams crossing Bor, the White Nile is the main source of external (river-based) flood rise. Floods on the White Nile occur due to a combination of high outflows from Lake Albert with lateral inflows from torrents. The mild slope of the river along the Sudd and the presence of dense vegetation in the floodplain also contribute to slowing the current and increasing water levels to a point when overbank flow starts. This would be coherent with the recorded flood history.

Evidence of flooding Bor is scarce and mainly anecdotal, with no systematic records or hydrometric information (Mott MacDonald, 2019). Johnson (1992) through interviews and local administrative reports reconstructed the flood history of South Sudan, including the flood episodes affecting Bor in 2013, 2017, 2018, 2019, 1975, 1970, 1944, 1943, 1933, 1932, 1929, 1927, 1916-19, 1909, etc.

The Mongalla station located upstream of Bor and between the town and Juba offers the only relevant flow series on the White Nile near the area of study. Figure 4-4 shows the available monthly flows series which spans from 1912 to 1982 and has been retrieved from the Global River Discharge (RivDIS) database (Vorosmarty et. al, 1998). One recognizes the presence of the severe floods occurring in 1917 as well as the significant increase in flows after 1961 due to a rise in the outflows from Lake Albert upstream and the decline that occurred afterward.

Figure 4-4: Monthly flows of Nile at Mongalla



Source: RivDIS v1.1

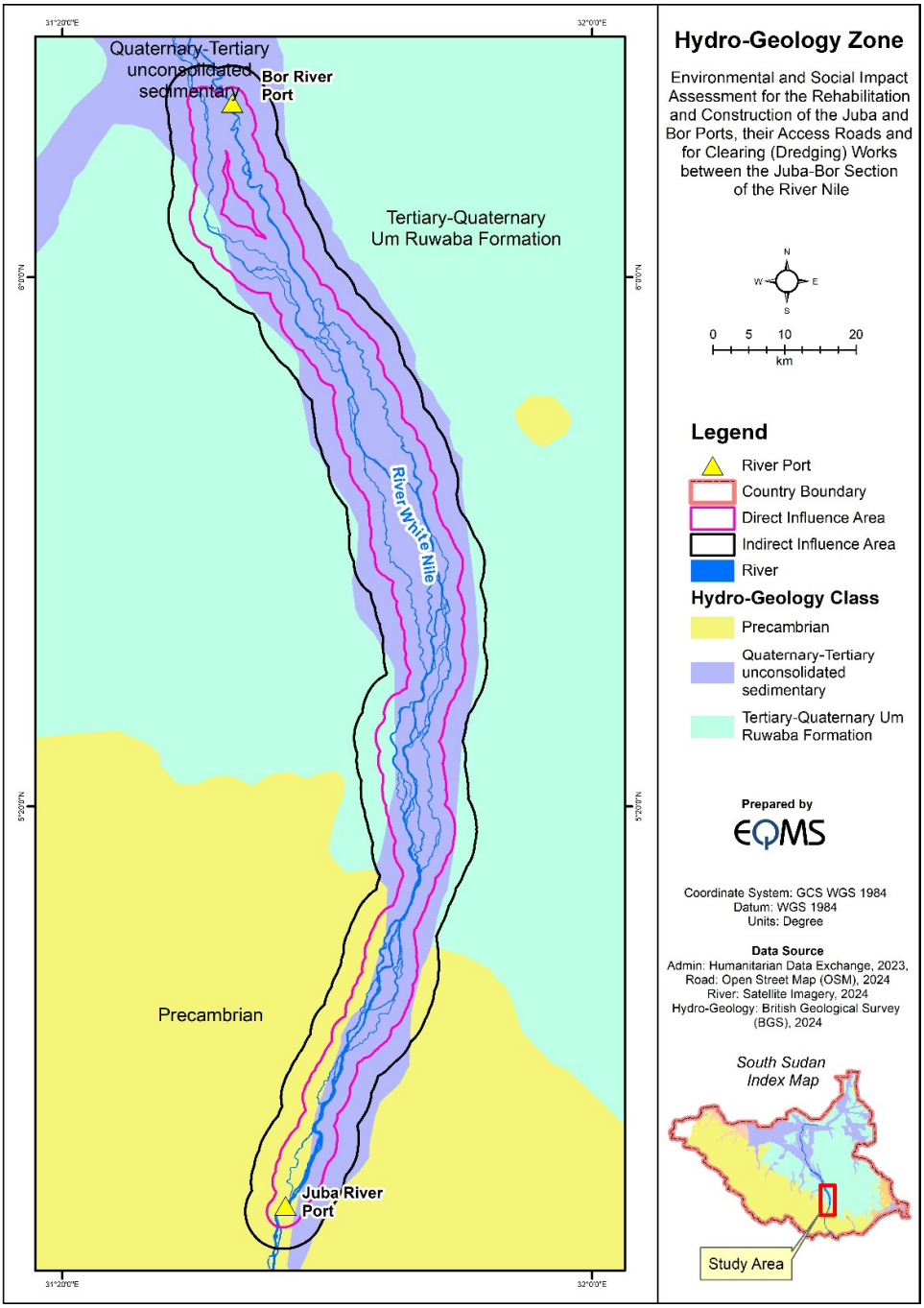
4.2.6 Groundwater Resources

In general, water is not evenly distributed underneath the surface of South Sudan. This is quite understandable since the groundwater supplies depend on the rainfall and on the local geology of the area from which water has to be extracted. Also, depending on interaction (discharge-recharge) with the White Nile and other surface water sources. Any potential contamination of the White Nile in the project area will affect the adjoining groundwater and domestic water supply wells. When the soil has a low absorption capacity a high proportion of the rainfall remains on the surface and is lost by evaporation. It is only in a few places that groundwater supplies depend on the rainfall at some distance from the local underground reservoir.

South Sudan shares three transboundary aquifers with neighboring countries, namely Baggara Basin in the Northern part of the country and across Sudan, Sudd Basin in the east of the country, and Karoo-Carbonate aquifer in the Southwest part of the country.

South Sudan has three main aquifer types: unconsolidated, basement, and consolidated (Upton K, 2020). However, in the study area, two types of aquifers i.e., unconsolidated and basement are found. A map showing the aquifer types of South Sudan is given in Figure 4-5. Spanning 365,268 km^2, the Umm Ruwaba unconsolidated geological formation is located within the Sudd Basin and is the largest source of groundwater (UNEP, 2013). Water tables are shallow, ranging between 10m - 25m, although they can reach over 300 m in the central and northern parts of the aquifer (UNEP, 2013 and MWRI, 2011). Heavy seasonal rainfall and river flooding recharge the Umm Ruwaba aquifer with approximately 341 MCM per year (AfDB, 2013 and UNEP, 2013). The basement complex covers most of the western border with the Democratic Republic of Congo (DRC) and Central African Republic (CAR) (AfDB, 2013). The aquifer generally has low productivity and recharge, limited reserves (Lasagna et al., 2020), and the water table is between 4m - 60m deep (Upton K, 2020). The aquifer is used mostly for small domestic supplies and livestock watering (UN, 1988). The water quality is usually good and fresh.

Figure 4-5: Hydrogeology Map of South Sudan



Source: https://earthwise.bgs.ac.uk/index.php/File:SouthSudan_Hydrogeology3.png

In the basement aquifer, groundwater occurs in fractures and/or in shallow weathered zones in Precambrian bedrock, where permeability has been increased. These aquifer zones are typically between 5m to 20m thick but can be thicker. Water table depths range from 4m to 60m depth, and groundwater is typically unconfined. Abstraction boreholes range from 10m to 701m, and borehole yields are generally low. The fractured/weathered aquifers have low storage potential and do not contain large amounts of groundwater. Groundwater quality ranges from fresh to brackish (UN, 1988).

In Juba town, about 60 % of households are using a public borehole with a hand pump. In addition, the groundwater quality of a borehole in the area is clean. The result of geophysical investigations in Juba

town and its vicinity indicated that deeper fluvial deposits are found in the southern survey area up to a maximum depth of 160 m, but the deposits are shallower in the northern area up to a maximum depth of 100 m below ground level. It was evaluated that the geological formation material in the northern area is clayey, the aquifer thickness is limited and the lateral extent of the paleochannel in the northern area does not exceed 120 m in most areas (JICA, 2009).

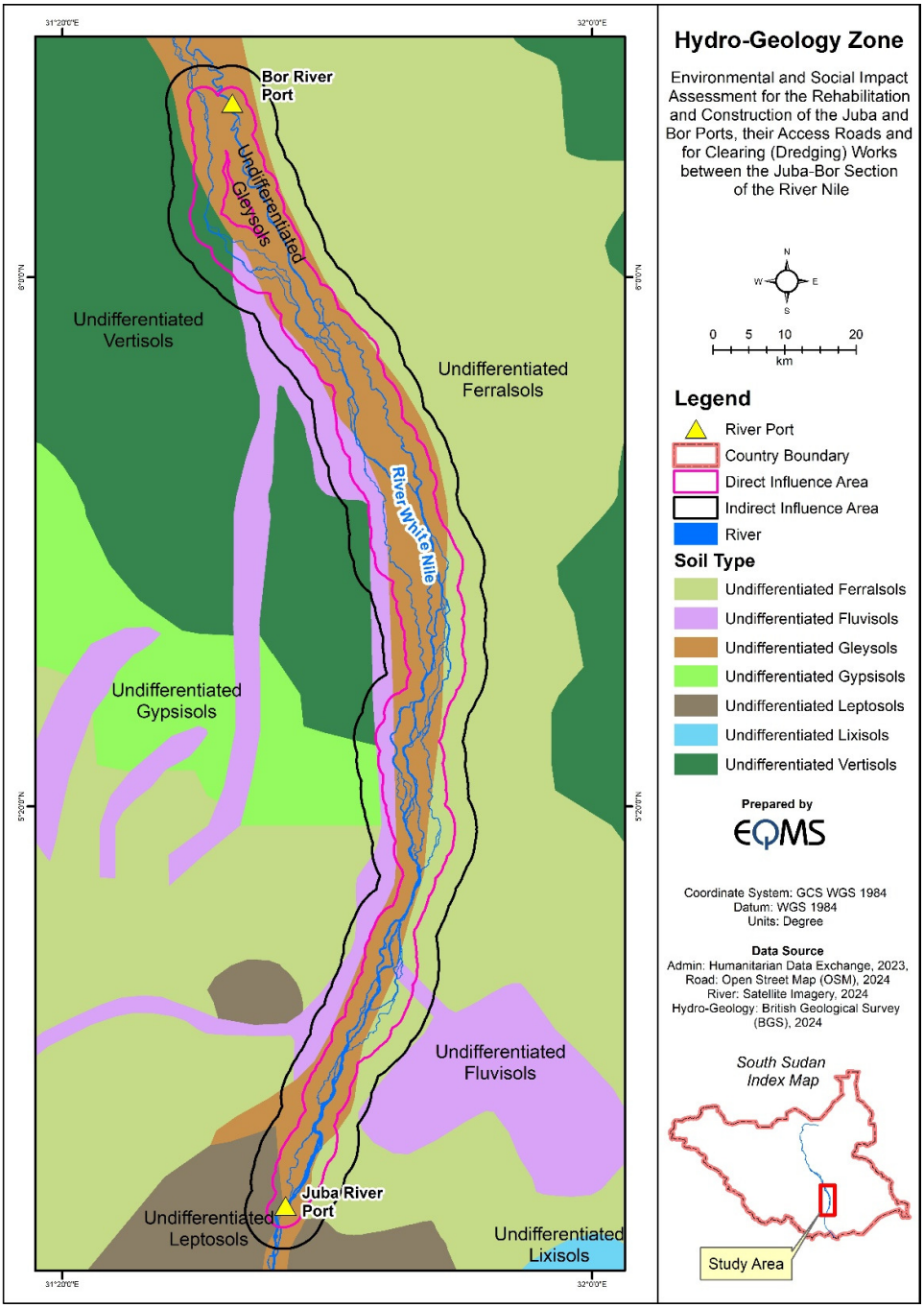
In the Bor area, the community is also using groundwater for drinking and other purposes which is mostly extracted from the shallow depth aquifer. Improper storage and disposal of solid waste, liquid waste, and hazardous waste i.e., oil, lubricants, and chemicals from the port construction site and workers camp and also along the river may leak into the groundwater aquifer and contaminate the water. In addition, spillage of oil and grease from dredgers and disposal of dredge materials and also from operation of vessels may impact groundwater quality.

4.2.7 Soil

Soils are important in influencing the potential for agriculture. Vertisols are a type of clay known as “black cotton soils” that are potentially highly productive but are prone to erosion; they are mostly found in the eastern part of the country (RSS, 2015). Fluvisols, a lowland soil in semi-arid zones that is moderately to highly fertile, is found along rivers, lakes, and alluvial plains (FAO, 1993). Leptosols, characteristic of the southwest, are very shallow soils on top of hard rock or highly calcareous materials; they are subject to drought, runoff, and desertification. Lixisols have an unstable soil structure underlain by clay washed down from the surface. They are found in the western part of the country. Regosols have no significant profile development; they are distributed from the northwest toward the center. Cambisols are composed of medium- and fine-textured materials derived from a wide range of rocks and are found in hilly parts of the southern and central areas (RSS, 2015). The Ironstone Plateau is named for the hard, red lateritic soil called ironstone that covers almost the whole region. Lateritic soils are often thin and unsuitable for agriculture (Beswick, 2004).

In the project area, different types of soil including Ferric Luvisols, Gleyic Luvisols, Eutric fluvisols, and Chromic Vertisols are found. A soil map of South Sudan has been given in Figure 4-6.

Figure 4-6: Soil Map of South Sudan

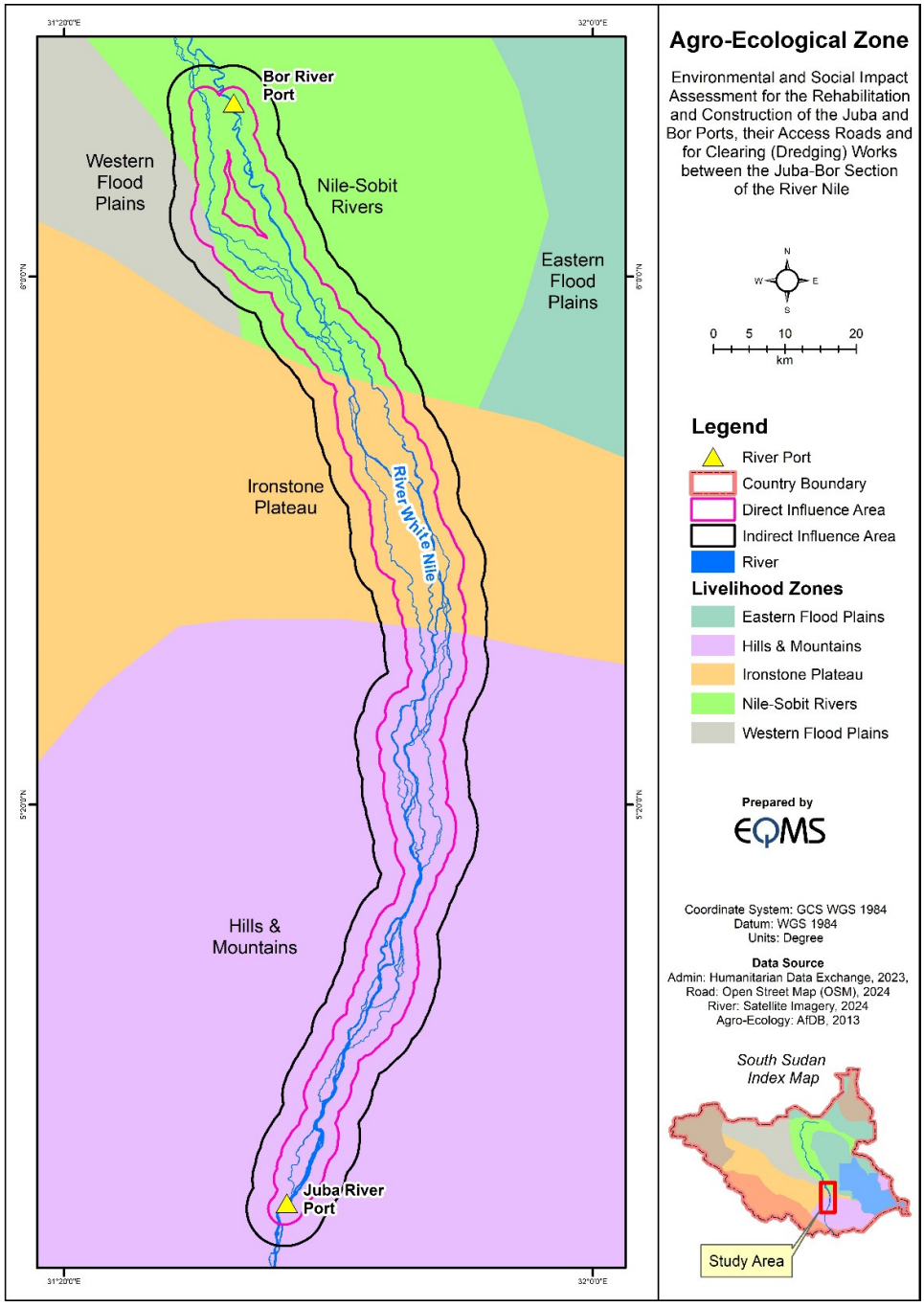


Source: FAO, 2006

4.2.8 Agro-Ecology

South Sudan is divided into seven agroecological zones based on livelihood patterns, physical geography, agroecology, and market access. These include Greenbelt, Ironstone Plateau, Hills and Mountains, Arid pastoral, Nile and Sobat Rivers, Western flood plains, and Eastern flood plains. Figure 4-7 provides an overview of the country's ecological zones.

Figure 4-7: Agro-ecological Zones in South Sudan



Source: AfDB, 2013

The proposed project area falls in three agroecological zones i.e., Nile and Sobat Rivers, Ironstone Plateau, and Hills and Mountains. A brief description of the agroecological zones has been given below:

Nile and Sobat Rivers

The western and eastern plains are separated by the Nile and Sobat River Zone. Apart from crops and livestock, wild foods, and fish contribute significantly to household consumption in this zone. The latter items are collected in varying quantities depending on the season and household location.

Ironstone Plateau

This zone covers parts of Lakes, Warrap, Northern and Western el Ghazal, Western and Central Equatoria. Households in this zone are heavily dependent on crop production, mainly sorghum, groundnuts, sesame, and tobacco. In some areas, honey production is also an important supplementary activity.

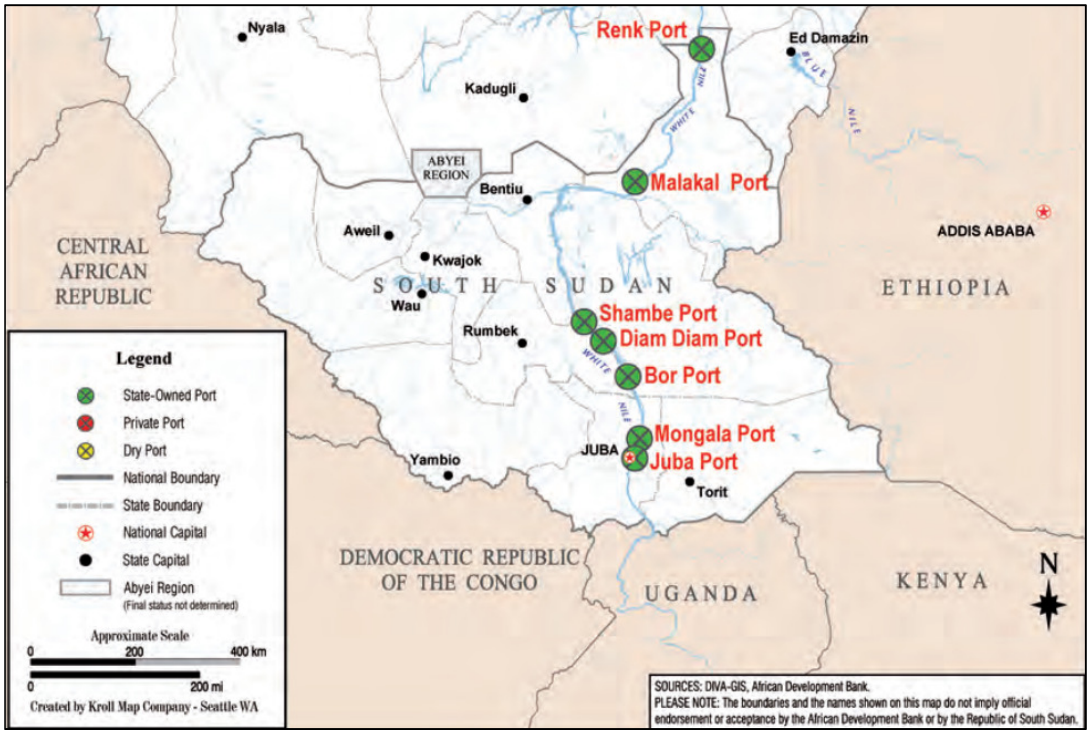
Hills and Mountains

This zone covers parts of Jonglei, Central and Eastern Equatoria. It is characterized by reliance on agriculture and pastoralism. Reliance on casual labor and selling of charcoal, firewood, bamboo, poles, and grass are common coping strategies in times of distress. Most vulnerable were communities in the lowlands that engage in the production of short and long-term sorghum, while communities in the mountains that cultivate cereals, pulses, and vegetables were less affected because of more favorable rain conditions at these higher altitudes. The high reliance in 2009 on the production of firewood and charcoal contributed to a further decline in woodland and forest resources around towns and in more populated areas, forcing households (mainly women) to walk longer distances to fetch firewood.

4.2.9 Traffic and Transport

The transport system in South Sudan consists of four modes including river, rail, air, and road transport - the largest being road transport. South Sudan's main access to the sea is through Mombasa in Kenya and Port Sudan ports. There are seven main river ports in South Sudan located in Juba, Bor, Malakal, Shambe, El Renk, Dhiam dhiam, and Mongala (see Figure 4-8). With the support from JICA, the Juba port rehabilitation activities are ongoing. New river ports have been built in Mongala, Dhiam dhiam, and Shambe. The river port in Bor consists of a natural embankment for offloading fish, fuel, and general cargo. Bor has also privately owned storage facilities. Independent vendors offering mechanized lifting equipment are occasionally available (AfDB, 2013).

Figure 4-8: Main River Ports in South Sudan



Source: AfDB, 2013

There are no railways in the proposed project area. South Sudan does not have an extensive rail system. The total length of the railway line in the country is 248 km, from Wau to the border with Sudan

and Wau is the only rail station in the country. Air transport infrastructure is composed of an international airport in Juba, a domestic airport in each state capital of the other nine states, and around 300 airstrips.

According to the Southern Sudan Roads Authority Provisional Order 2011, all public roads are categorized as Trunk Roads (international and interstate roads), State Roads (primary, secondary, and feeder roads), Urban Roads (urban arterials, urban collectors, urban local roads). Vehicles like trucks, buses, minibuses, motor cars, taxis, auto rickshaws/Tuktuk, tractors, trailers, motorcycles, bicycles, etc. move on the road.

4.2.9.1 Road Traffic

To understand the prevailing traffic volumes on the existing roads, a road traffic survey was conducted during the baseline data collection at two locations (Juba and Bor Port access roads). For the traffic survey, two enumerators were engaged at the monitoring locations and later the record of vehicles was input in an Excel file manually from the recorder file. The vehicles passing through the roads (in both ways) were counted separately at two selected locations from 6 AM to 6 PM. Different types of vehicles were counted such as trucks, buses (more than 25 seats), minibus (not more than 25 seats), motor cars (not more than 8 seats), taxis (any public service vehicle/not more than 7 passengers), auto-rickshaws, tractors (purpose of hauling trailers), trailers, and motorcycles. The details of the road traffic monitoring locations are shown in Table 4-2.

Table 4-2: Road Traffic Monitoring Locations

Monitoring Code	Monitoring Location	Geographical Coordinates
T-1	Access road at Juba port	6°13.145'N and 31°32.904'E
T-2	Access road at Bor port	4°49.926'N and 31°36.824'E

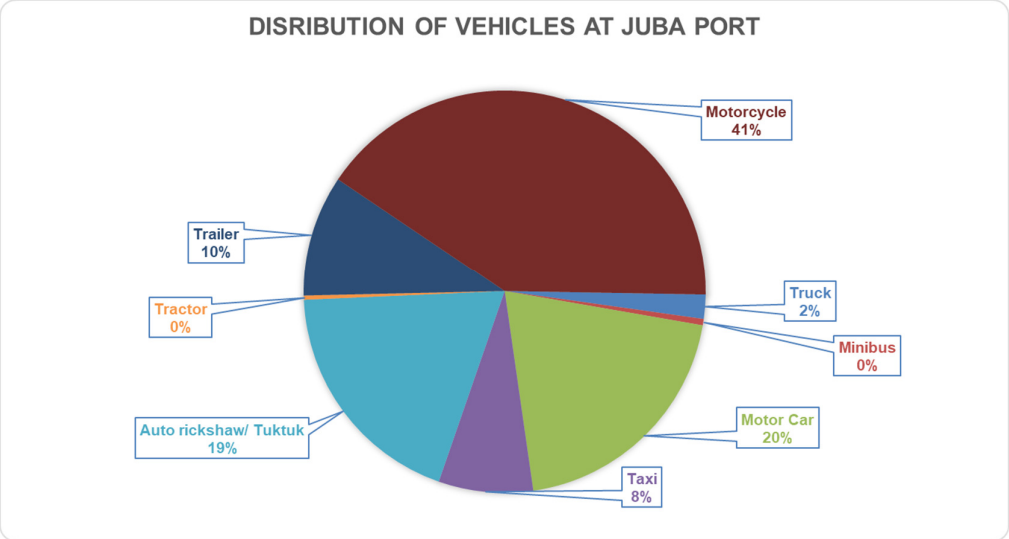
Source: Field Survey, August 2024

4.2.9.1.1 Present Condition of Road Traffic at Juba Port Area

A total of 1185 nos. of vehicles were recorded at the road traffic monitoring station. As per the observation made for traffic density, on average 98.75 nos./hr. was recorded at the location.

It was observed that motorcycles were predominant on the road. The major contributor (41%) of the vehicular traffic was motorcycles followed by motor cars (20%), auto rickshaws (19%), trailers (10%), taxis (8%), and trucks (2%). The distribution of various types of vehicles on the Juba port access road is shown in Figure 4-9.

Figure 4-9: Distribution of Various Types of Vehicles at Juba port access road



Source: Field Survey, August 2024

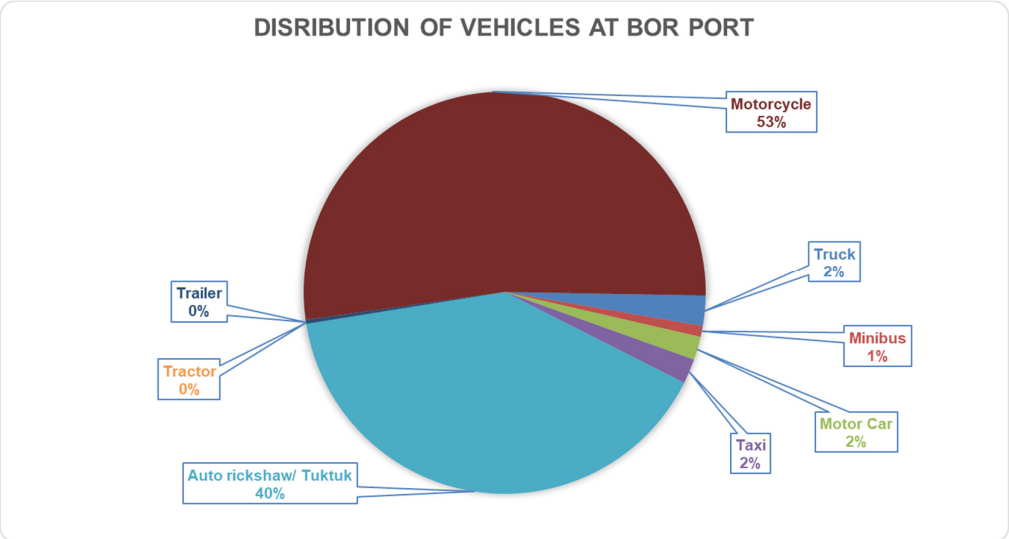
It was observed that vehicle movement increased from 8-9 AM and it was the peak at 10-11 AM. The number of vehicles on the road decreased after 1-2 PM and again increased 3-4 PM. It is expected that the current traffic volume will be increased during the full-fledged operational activities of Juba River port as well as improved existing access roads. The incremental traffic volume in the study area will principally result from the movement of vehicles carrying goods and passengers to/from the Juba port.

4.2.9.1.2 Present Condition of Road Traffic at Bor Port Area

A total of 909 nos. of vehicles were recorded at the road traffic monitoring station. As per the observation made for traffic density, on average 90.9 nos./hr. was recorded at the location.

It was observed that motorcycles were predominant on the road. The major contributor (53%) of the vehicular traffic was motorcycles followed by auto rickshaws (40%), taxis (2%), motor cars (2%), trucks (2%), minibus (1%). The distribution of various types of vehicles on the Bor port access road is shown in Figure 4-10.

Figure 4-10: Distribution of Various Types of Vehicles at Bor Port Access Road



Source: Field Survey, August 2024

It was observed that vehicle movement increased from 8-9 AM and it was the peak at 10-11 AM. The number of vehicles on the road decreased after 11-12 AM and it was a minimum from 4-5 PM. It is expected that the current traffic volume will be increased during the full-fledged construction and operational activities in the proposed Bor port. The incremental traffic volume in the study area will principally result from the movement of vehicles carrying goods and passengers to/from the Bor port, overall improved access road conditions, business opportunities, etc.

4.2.9.2 Boat Traffic

To understand the prevailing boat traffic volumes on the White Nile River, a boat traffic survey was conducted during the baseline data collection at two locations (Juba and Bor Port). The boat traffic was done for both-way movement of vessels/boats and categorized as fishing boat (motorized), fishing boat (non-motorized), speed boat, passenger boat (people and goods carrying), and others. The details of the boat traffic survey locations are shown in Table 4-3.

Table 4-3: Boat Traffic Monitoring Locations

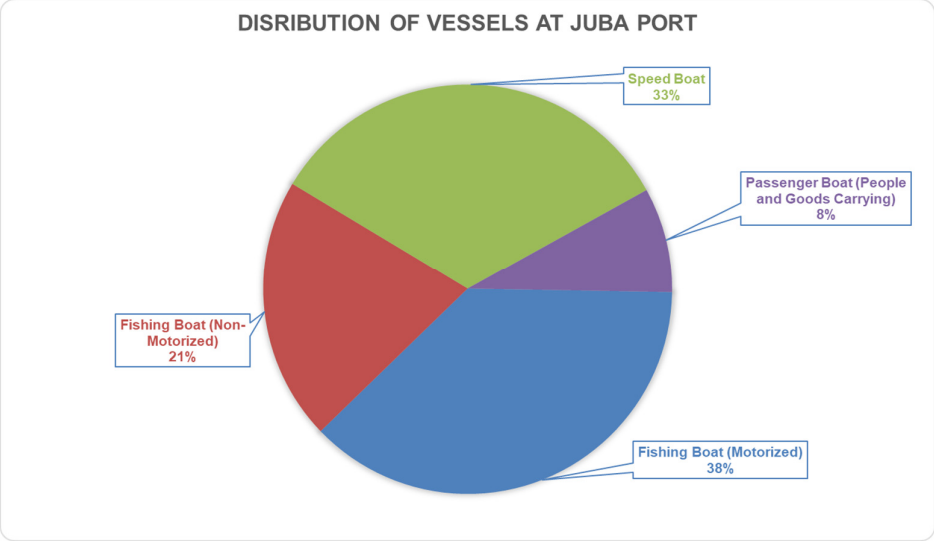
Monitoring Code	Monitoring Location	River Name	Geographical Coordinates
BT-1	Juba river port	White Nile River	6°13.119'N and 31°32.830'E
BT-2	Bor river port	White Nile River	4°49.807'N and 31°36.832'E

Source: Field Survey, August 2024

4.2.9.2.1 Status of Boat Traffic at Juba Port

The total number of vessels recorded at the Juba port was 24 nos. It was observed that fishing boats (motorized) were predominant on the river at the Juba port site. The major contributor (38%) of the river traffic was fishing boats (motorized) followed by speed boats (33%), fishing boats (non-motorized) (21%), and passenger boats (people and goods carrying) (8%). At the Juba port site maximum vessel count of 15 nos. in an hour was recorded during 6-7 AM and a minimum vessel count of 1 no. was recorded during 7-8 AM, 9-10 AM, 12-1 PM, and 3-4 PM respectively. A summary of boat traffic survey results at Juba port is presented in Figure 4-11.

Figure 4-11: Boat Traffic at Juba Port

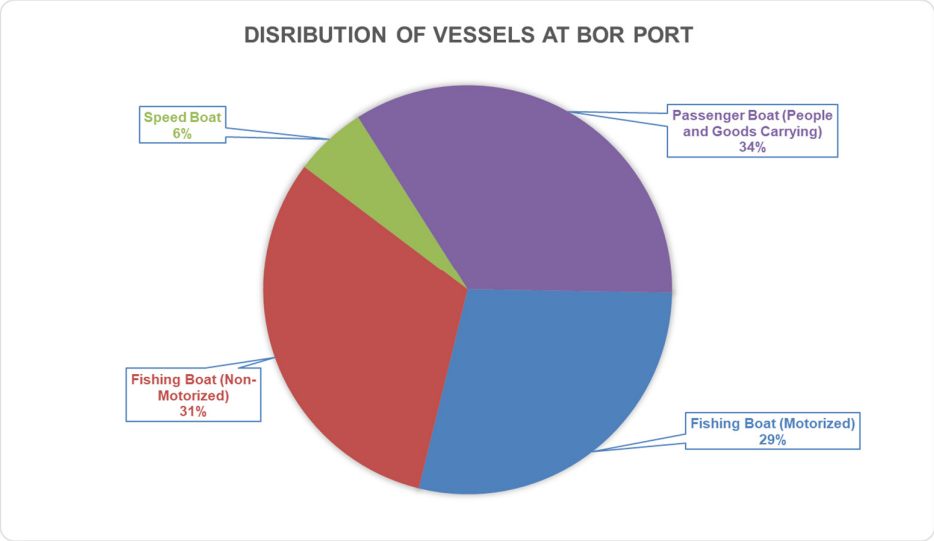


Source: Field Survey, August 2024

4.2.9.2.2 Status of Boat Traffic at Bor Port

The total number of vessels recorded at the Juba port was 70 nos. It was observed that passenger boats (people and goods carrying) were predominant on the river at the Bor port site. The major contributor (34%) of the river traffic was passenger boats (people and goods carrying) followed by fishing boats (Non-Motorized) (31%), fishing boats (motorized) (29%), and speed boats (6%). At the Bor port site maximum vessel count of 19 nos. in an hour was recorded during 8-9 AM and a minimum vessel count of 2 nos. was recorded during 12-1 PM, 3-4 PM, and 5-6 PM respectively. A summary of boat traffic survey results at Bor port is presented in Figure 4-12.

Figure 4-12: Boat Traffic at Bor Port



Source: Field Survey, August 2024

4.2.10 Ambient Air Quality

The objective of the ambient air quality monitoring program was to establish the baseline ambient air quality of the study area. The existing sources of generation of particulate matter and gaseous air pollutants are primarily from the plying of vehicles through the access roads, vessels plying in the river, waste burning, use of small gasoline-powered generators, charcoal production and burning, etc. There are no other remarkable sources of air pollution such as heavy industries are observed close to the proposed project site.

Ambient air quality was measured using portable devices such as real-time air quality detector/SMILEDRIVE 7 in 1 color pollution detector, ozone detector smart sensor AS8908, Carbon Monoxide Meter (HTC Co-01), etc. The monitoring parameters include Particulate Matter ($PM_{1.0}$, $PM_{2.5}$, and PM_{10}), Carbon Monoxide, Ozone, and Total Volatile Organic Compounds. This is to allow a comparison with the present standards mentioned in the WHO Guidelines.

4.2.10.1 Ambient Air Quality Monitoring Locations

The study team has determined ten ambient air quality monitoring locations in and around the Juba and Bor project site based on prevailing wind direction and the importance of the receptors. Logistics such as the consent of household owners, accessibility, security, etc. were also taken into account.

The baseline status of ambient air quality has been established through a scientifically designed ambient air quality monitoring network. The ambient air quality monitoring locations were selected taking into account the following:

- Meteorological conditions of the project area.
- Topography of the project area.

- Location of sensitive receptors such as major settlements, education institutes, etc.
- Representativeness of area background air quality for obtaining baseline status.
- Representativeness of likely impact areas by the proposed project.

Details of the ambient air quality monitoring locations are presented in Table 4-4 and sample photographs of ambient air monitoring are presented in Figure 4-13.

Table 4-4: Ambient Air Quality Monitoring Locations

Monitoring Code	Monitoring Locations	Geographical Coordinates
AAQ-1	Existing port site at Bor	6°13.154'N and 31°32.820'E
AAQ-2	Leudier area (Settlement area)	6°13.340'N and 31°32.779'E
AAQ-3	Royal Junior School	6°13.011'N and 31°33.409'E
AAQ-4	Settlement area on the south of the port	6°13.030'N and 31°32.907'E
AAQ-5	Settlement area on the south-east of the port	6°12.942'N and 31°33.258'E
AAQ-6	Inside of the Juba port	4°49.845'N and 31° 36.855'E
AAQ-7	Entry gate of the Juba port	4° 49.932'N and 31°36.825'E
AAQ-8	Residential & commercial area on the north of the Juba port	4° 50.105'N and 31°36.872'E
AAQ-9	Access road on the south of the Juba port	4° 49.688'N and 31°36.665'E
AAQ-10	Access road at konyo-konyo market area	4° 49.983'N and 31°36.644'E

Source: Field Survey, August 2024

Figure 4-13: Photographs of Ambient Air Quality Monitoring



Ambient air quality monitoring in the study area

Source: Field Survey, August 2024

4.2.10.2 Summary of Primary Ambient Air Quality Monitoring Result

The ambient air quality monitoring results of the study area are presented in Table 4-5 along with the ambient air quality standard of WHO Guidelines. The laboratory test report has been presented in Appendix-A.

Table 4-5: Ambient Air Quality Analysis Results

Monitoring Code	Parameters					
	$PM_{2.5}$	$PM_{1.0}$	PM_{10}	CO	O_3	TVOC
	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	mg/m^3
AAQ-1	12.1	6.5	23.5	0.01	7.4	0.012
AAQ-2	9.8	5.2	16.3	0.00	5.2	0.004
AAQ-3	9.5	5.1	16.5	0.00	8.1	0.001
AAQ-4	8.2	5.9	14.5	0.00	3.6	0.158
AAQ-5	13.9	6.2	22.6	0.00	5.8	0.023
AAQ-6	8.5	3.3	12.4	0.00	5.2	0.001
AAQ-7	14.4	8.6	28.1	0.01	11.5	0.086
AAQ-8	17.6	9.0	31.2	0.00	9.1	0.020
AAQ-9	18.2	10.9	34.8	0.01	8.3	0.011
AAQ-10	21.7	12.3	42.9	0.01	10.2	0.164
WBG EHS Guidelines /WHO Guidelines	15	-	50	4	100	-

Source: Field Survey, August 2024

4.2.10.3 Results and Discussion

The results for the ambient air quality were compared with the WHO standards as there are no national air quality standards for comparison.

- **Concentration of Particulate Matter ($PM_{2.5}$):** $PM_{2.5}$ concentration in ambient air in the study area was recorded in the range of 9.5 $\mu g/m^3$ to 21.7 $\mu g/m^3$. At three locations (AAQ-8, AAQ-9, and AAQ-10) the observed values exceeded the $PM_{2.5}$ standards, and other locations were within the WHO standard (15 $\mu g/m^3$).
- **Concentration of Particulate Matter ($PM_{1.0}$):** $PM_{1.0}$ concentration in ambient air in the study area was recorded in the range of 3.3 $\mu g/m^3$ to 10.9 $\mu g/m^3$. There are no standards for $PM_{1.0}$ in WHO Guidelines.
- **Concentration of Particulate Matter (PM_{10}):** PM_{10} concentration in ambient air in the study area was recorded in the range of 12.4 $\mu g/m^3$ to 42.9 $\mu g/m^3$. Observed values in all locations were within the WHO standard (50 $\mu g/m^3$).
- **Concentration of Carbon Monoxide (CO):** CO concentration in ambient air in the study area was recorded in the range of 0.00 mg/m^3 to 0.01 mg/m^3. All the observed values were within the WHO standard (4 mg/m^3).
- **Concentration of Ozone (O_3):** O_3 concentration in ambient air in the study area was recorded in the range of 3.6 $\mu g/m^3$ to 11.5 $\mu g/m^3$). All the observed values were within the WHO standard (100 $\mu g/m^3$).
- **Concentration of Total Volatile Organic Compounds (TVOC):** TVOC concentration in ambient air in the study area was recorded in the range of 0.001 mg/m^3 to 0.164 mg/m^3. There are no standards for TVOC in the WHO Guidelines.

4.2.11 Ambient Noise Quality

The study area is located in Juba Town in the Central Equatorial State and Bor in Jonglei State. Presently main source of ambient noise in the study area is from the people's residences, human

activities including the operation of generators, vessels plying in the river, and vehicles movement on the access roads such as trucks, trailers, motorbikes, etc. No other perceptible sources of noise generation such as factories, industries, etc. are found near the project site.

4.2.11.1 Ambient Noise Level Monitoring Locations

Ambient noise levels were monitored at ten different locations considering the different categories of area/receptor in the study area using a sound level meter. Noise levels were recorded in the form of sound pressure levels with the help of a digital sound level meter. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. These locations were chosen in such a way that representative data can be recorded all over the study area. The sound level was recorded in the form of A-weighted equivalent continuous sound pressure level values with the use of A-weighting filters in the noise measuring instrument. The ambient noise level monitoring locations were selected taking into account the following:

- Location of sensitive receptors such as major settlements, educational institutes, etc.
- Representativeness of area background noise level for obtaining baseline status.
- Representativeness of likely impact areas by the proposed project.

The environment setting of each noise level monitoring location is given in Table 4-6 and sample photographs of noise level monitoring are presented in Figure 4-14.

Table 4-6: Ambient Noise Level Monitoring Location

Monitoring Code	Monitoring Location	Geographical Coordinates	Receptor
ANL-1	Existing port site at Bor	6°13.155'N and 31°32.824'E	Commercial
ANL-2	Leudier area	6°13.338'N and 31°32.785'E	Residential
ANL-3	Royal Junior School	6°13.019'N and 31°33.409'E	Educational
ANL-4	Settlement area on the south of the port	6°13.029'N and 31°32.910'E	Residential
ANL-5	Settlement area on the south-east of the port	6°12.944'N and 31°33.260'E	Residential
ANL-6	Inside of the Juba port	4°49.838'N and 31°36.856'E	Commercial
ANL-7	Entry gate of the Juba port	4°49.930'N and 31°36.825'E	Commercial
ANL-8	North of the Juba port	4°50.103'N and 31°36.875'E	Mixed
ANL-9	Access road on the south of the Juba port	4°49.687'N and 31°36.667'E	Commercial
ANL-10	Access road at konyo-konyo market area	4°49.983'N and 31°36.646'E	Commercial

Source: Field Survey, August 2024

Figure 4-14: Photographs of Ambient Noise Level Monitoring



Ambient noise level monitoring in the study area

Source: Field Survey, August 2024

4.2.11.2 Summary of Primary Ambient Noise Level Monitoring Result

The results of the ambient noise level monitoring in the study area are presented in Table 4-7 along with the ambient noise level standards of WHO guidelines. The laboratory test report has been presented in Appendix-A.

Table 4-7: Ambient Noise Level Analysis Results

Monitoring Code	Category of Area/Receptor	Parameters			WBG EHS Guidelines/ WHO Standards
		Leq_{day}	L_{max}	L_{min}	
ANL-1	Commercial	54.6	69.4	45.7	70
ANL-2	Residential	47.2	58.1	41.5	55
ANL-3	Educational	44.8	65.8	40.4	55
ANL-4	Residential	46.3	67.4	40.1	55
ANL-5	Residential	44.1	62.7	40.0	55
ANL-6	Commercial	42.9	54.2	38.8	70
ANL-7	Commercial	52.6	71.2	45.9	70
ANL-8	Mixed	55.2	70.5	48.2	-
ANL-9	Commercial	51.7	68.4	44.8	70
ANL-10	Commercial	57.5	74.6	48.9	70

Source: Field Survey, August 2024

4.2.11.3 Results and Discussion

The results for the ambient noise level were compared with the WHO standards. The daytime noise levels at all the locations ranged between 44.1 dB(A) to 57.5 dB(A). The maximum value of 57.5 dB(A) was recorded in the commercial area in Juba (ANL-10) and the minimum value of 44.1 dB(A) was recorded in the residential area in Bor (ANL-5). All the observed values were within the WHO standards for the respective zone.

4.2.12 Surface Water Quality

Selected water quality parameters of surface water resources within the study area have been studied for assessing the water environment and evaluating the anticipated impacts of the proposed project construction and operation. Understanding water quality is essential in the preparation of the ESIA and in identifying critical issues to suggest appropriate mitigation measures for implementation. The purpose of this study was to assess the water quality characteristics for critical parameters and predict the impact of water quality by proposed project construction and operation-related activities.

4.2.12.1 Surface Water Sampling Locations

Five surface water samples were collected and analyzed during the baseline survey from the study area. Surface water samples were collected from the White Nile River. The samples were analyzed in the Analabs Limited laboratory.

The surface water quality monitoring locations were selected taking into account the following:

- Need for samples upstream and downstream of the proposed jetty location.
- Location of sensitive receptors such as fish, mammals, birds, and invertebrates in the aquatic environment.
- Representativeness of regional surface water quality for obtaining baseline status.
- Representativeness of likely impact areas by the proposed project.

The surface water sampling location is given in Table 4-8 and sample photographs of surface water sampling are presented in Figure 4-17.

Table 4-8: Surface Water Sampling Locations

Sampling Code	Sampling Location	Geographical Coordinates
SWQ-1	Upstream of the proposed Bor port	6° 12.763'N and 31° 32.691'E
SWQ-2	Downstream of the proposed Bor port	6° 13.449'N and 31° 32.530'E
SWQ-3	Sudd Wetland	6° 14.478'N and 31° 31.560'E
SWQ-4	Upstream of the Juba port	4° 49.999'N and 31° 36.952'E
SWQ-5	Downstream of the Juba port	4° 49.489'N and 31° 36.624'E

Source: Field Survey, August 2024

Figure 4-15: Photographs of Surface Water Sampling



Surface water sample collection from the study area

Source: Field Survey, August 2024

4.2.12.2 Summary of Primary Surface Water Quality Result

The results of the surface water quality analysis in the study area are presented in Table 4-9. The laboratory test report has been presented in Appendix-A.

Table 4-9: Surface Water Quality Analysis Results

Parameters	Unit	Sampling Code					East African Standard[3]	NEMA Standard[4]
		SWQ-1	SWQ-2	SWQ-3	SWQ-4	SWQ-5		
Ammonium	mg/l	0.06	0.89	0.09	<0.001	0.78	-	-
Biological Oxygen Demand	mg/l	10.3	11.30	13.70	10.10	13.60	-	30
Chemical Oxygen Demand	mg/l	31.0	34.10	32.60	29.60	37.10	-	50
Electrical Conductivity	MS cm-1	0.15	0.15	0.15	0.14	0.14	2500	-
Nitrate	mg/l	3.65	2.09	4.12	2.97	3.08	45	20
Nitrite	mg/l	0.12	0.13	0.24	0.12	0.08	-	-
Oil and Grease	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	-	Nil
pH	-	6.91	6.78	6.80	7.04	7.17	5.5-9.5	6.5-8.5
Phosphorus	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	-	2
Total Dissolved Solids	mg/l	77.0	76.90	77.10	72.40	72.00	1500	2000
Total Suspended Solids	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	-	30
Turbidity	NTU	24.90	33.30	6.90	2.98	7.01	25	-
Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	-
Color	CU	11.80	10.40	9.54	10.40	11.90	50	-
Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	-
Lead	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	-
Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.003	0.5
Chromium	mg/l	0.03	0.06	0.04	0.03	0.04	0.05	2
Copper	mg/l	0.01	<0.01	0.01	<0.01	<0.01	1	1
Total Organic Carbon	ppm	3.78	1.08	3.98	4.66	4.12	-	-
Total N	mg/l	3.83	3.11	4.45	3.09	3.94	-	-
Available Oxygen, (as H2O2)	w/v	3.08	2.98	4.11	2.09	3.93	-	2.8
Chloride	mg/l	14.76	7.38	7.38	14.76	7.38	-	250

[3] KS EAS (Kenya Standard-East African Standard) 12:20 2018 used by the South Sudan National Bureau of Standards
[4] NEMA 3rd and 4th Schedule

Source: Laboratory Analysis in Analabs Limited, August 2024

4.2.12.3 Results and Discussion

The results for the water quality were compared with the East African Standard used by the South Sudan National Bureau of Standards.

- Ammonium concentrations in the water samples were in the range between <0.001 to 0.89 mg/l.
- Biological Oxygen Demand concentrations in the water samples were in the range between 10.10 to 13.70 mg/l.
- Chemical Oxygen Demand concentrations in the water samples were in the range between 29.60 to 37.10 mg/l.
- Electrical Conductivity concentrations in the water samples were in the range between 0.14-0.15 MS cm-1. All samples complied with East African Standards (2500 MS cm-1).
- Nitrate concentrations in the water samples were in the range between 2.97-4.12 mg/l. All samples complied with East African Standards (45 mg/l).
- Nitrite concentrations in the water samples were in the range between 0.08-0.24 mg/l.
- Oil and Grease concentrations in all the water samples were observed as <0.01 mg/l.
- pH concentrations in the water samples were in the range between 6.78 to 7.17. All samples complied with the East African Standard (5.5-9.5).
- Phosphorus concentrations in all the water samples were observed as <0.01 mg/l.
- Total Dissolved Solids concentrations in the water samples were in the range between 72.00 to 77.10 mg/l. All samples complied with the East African Standard (1500 mg/l).
- Total Suspended Solids concentrations in all the water samples were observed as <0.01 mg/l.
- Turbidity concentrations in the water samples were in the range between 2.98 to 33.30 NTU. All samples except SWQ-2 complied with the East African Standard (25 NTU).
- Arsenic concentrations in all the water samples were observed as <0.001 mg/l. All samples complied with the East African Standard (0.01 mg/l).
- Color concentrations in the water samples were in the range between 9.54 to 11.90 CU. All samples complied with the East African Standard (50 CU).
- Mercury concentrations in all the water samples were observed as <0.001 mg/l. All samples complied with the East African Standard (0.001 mg/l).
- Lead concentrations in all the water samples were observed as <0.001 mg/l. All samples complied with the East African Standard (0.01 mg/l).
- Cadmium concentrations in all the water samples were observed as <0.01 mg/l. All samples complied with the East African Standard (0.003 mg/l).
- Chromium concentrations in the water samples were in the range between 0.03 to 0.06 mg/l. All samples except SWQ-2 complied with the East African Standard (0.05 mg/l).
- Copper concentrations in the water samples were in the range between <0.01 to 0.01 mg/l. All samples complied with the East African Standard (1 mg/l).
- Total Organic Carbon concentrations in the water samples were in the range between 1.08 to 4.66 ppm.
- Total N concentrations in the water samples were in the range between 3.09 to 4.45 mg/l.
- Available Oxygen (as H2O2) concentrations in the water samples were in the range between 2.09 to 3.93 w/v.
- Chloride concentrations in the water samples were in the range between 7.38 to 14.76 mg/l.

4.2.13 Groundwater Quality

Groundwater is most important for drinking, household uses, commercial activities, etc. Five groundwater samples were collected from the study area. After collection, the groundwater samples were sent to the laboratory for further examination of the groundwater parameters.

4.2.13.1 Groundwater Sampling Locations

The groundwater quality monitoring locations were selected taking into account the following:

- Location of sensitive receptors such as major settlements.
- Future use of groundwater in different upcoming projects in the area.
- Representativeness of regional groundwater quality for obtaining baseline status.
- Representativeness of likely impact areas by the proposed project.

The groundwater sampling locations are presented in Table 4-10 and sample photographs of the groundwater sample collection are shown in Figure 4-16.

Table 4-10: Groundwater Sampling Locations

Sampling Code	Sampling Location	Geographical Coordinates
GWQ-1	Royal Junior School	6°13.018'N and 31°33.437'E
GWQ-2	Leudier area	6°13.259'N and 31°32.843'E
GWQ-3	Settlement area on the south of the port	6°12.896'N and 31°33.221'E
GWQ-4	North of the Juba Port	4°49.550'N and 31°36.623'E
GWQ-5	South of the Juba Port	4°49.557'N and 31°36.607'E

Source: Field Survey, August 2024

Figure 4-16: Photographs of Groundwater Sampling





Groundwater sample collection from the study area

Source: Field Survey, August 2024

4.2.13.2 Summary of Primary Groundwater Quality Result

The results of the groundwater quality analysis in the study area are presented in Table 4-11 along with the groundwater standards of WHO guidelines. The laboratory test report has been presented in Appendix-A.

Table 4-11: Groundwater Quality Analysis Results

Parameters	Unit	Sampling Code					WHO Standard	NEMA Standard[5]
		GWQ-1	GWQ-2	GWQ-3	GWQ-4	GWQ-5		
Aluminum	mg/l	<0.01	<0.01	<0.01	<0.01	0.22	-	-

[5] NEMA 3rd and 4th Schedule

Parameters	Unit	Sampling Code					WHO Standard	NEMA Standard[5]
		GWQ-1	GWQ-2	GWQ-3	GWQ-4	GWQ-5		
Ammonium	mg/l	<0.001	<0.001	0.67	<0.001	<0.001	-	-
Arsenic	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	-
Chloride	mg/l	51.67	14.76	14.76	14.76	14.76	-	250
Fluoride	mg/l	0.62	0.74	0.33	0.41	0.31	1.5	1.5
Electrical Conductivity	MS Cm-1	0.67	0.25	0.27	0.16	0.16	-	-
Lead	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	-
Color	CU	12.40	8.67	7.54	8.44	10.10	-	-
Boron	mg/l	1.30	1.38	1.34	1.42	1.81	-	1
Mercury	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	-
Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.003	0.5
Chromium	mg/l	0.03	0.04	0.04	0.03	0.03	0.05	2
Copper	mg/l	0.05	0.12	0.15	0.08	0.01	2	1
Nickel	mg/l	0.880	0.82	0.85	0.51	1.09	0.02	3
Nitrate	mg/l	2.13	1.99	2.67	3.08	1.98	50	20
Nitrite	mg/l	0.45	0.19	0.07	0.32	0.05	3	-
pH	-	6.94	6.89	7.00	6.99	7.49	6.5-8.5	6.5-8.5
Escherichia coli	n/100 ml	11	1	<1	11	35	0	Nil
Fecal Coliform	n/100 ml	<1	<1	<1	1	2	0	-

Source: Laboratory Analysis in Analabs Limited, August 2024

4.2.13.3 Results and Discussion

The results for the groundwater quality were compared with the WHO standards.

- Aluminum concentrations in the groundwater samples were in the range between <0.01 mg/l to 0.22 mg/l.
- Ammonium concentrations in all the groundwater samples were observed as <0.001 mg/l.
- Arsenic concentrations in all the groundwater samples were observed as <0.001 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 0.01 mg/l for As.
- Chloride concentrations in the groundwater samples were in the range between 14.76 mg/l to 51.67 mg/l.
- Fluoride concentrations in the groundwater samples were in the range between 0.31 to 0.74 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 1.5 for fluoride.
- Electrical Conductivity concentrations in the groundwater samples were in the range between 0.16 to 0.67 MS cm-1.
- Lead concentrations in all the groundwater samples were observed as <0.001 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 0.01 mg/l for lead.
- Color concentrations in the groundwater samples were in the range between 7.54 to 12.40 CU.
- Boron concentrations in the groundwater samples were in the range between 1.30 mg/l to 1.81 mg/l.

- Mercury concentrations in all the groundwater samples were observed as <0.001 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 0.001 mg/l for mercury.
- Cadmium concentrations in all the groundwater samples were observed as <0.01 mg/l. All the sampling results exceeded the permissible limit of the WHO Guidelines of 0.003 mg/l for cadmium.
- Chromium concentrations in the groundwater samples were in the range between 0.03 to 0.04 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 0.05 mg/l for chromium.
- Copper concentrations in the groundwater samples were in the range between 0.01 mg/l to 0.15 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 2 mg/l for copper.
- Nickel concentrations in the groundwater samples were in the range between 0.51 mg/l to 1.09 mg/l. All the sampling results exceeded the permissible limit of the WHO Guidelines of 0.02 mg/l for nickel.
- Nitrate concentrations in the groundwater samples were in the range between 1.98 mg/l to 3.08 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 50 mg/l for nitrate.
- Nitrite concentrations in the groundwater samples were in the range between 0.05 mg/l to 0.45 mg/l. All the sampling results were within the permissible limit of the WHO Guidelines of 3 mg/l for nitrate.
- pH concentrations in the groundwater samples were in the range between 6.89 to 7.49.
- Escherichia coli was present in all the groundwater samples.
- Fecal Coliform was present in all the groundwater samples.

4.2.14 Soil Quality

Five soil samples were collected from the project site during the baseline data collection. After collecting soil samples, it was packed in plastic bags. The samples were sent to the Cropnuts Laboratory Services Ltd. and SGS laboratory for analysis.

4.2.14.1 Soil Sampling Locations

The soil sampling locations were selected taking into account the following:

- Representativeness of area soil quality for obtaining baseline status.
- Representativeness of likely impact areas by the proposed project.

The soil sampling locations are presented in Table 4-12 and sample photographs of the soil sample collection are shown in Figure 4-17.

Table 4-12: Soil Sampling Locations

Sampling Code	Sampling Location	Geographical Coordinates
SQ-1	Leudier area	6°13.256'N and 31°32.848'E
SQ-2	Settlement area on the south of the port	6°13.033'N and 31°32.925'E
SQ-3	Settlement area on the south-east of the port	6°12.953'N and 31°33.250'E
SQ-4	Main road to the port, Konyokonyo market	4°49.978'N and 31°36.662'E
SQ-5	Access road comes from south to Juba port	4°49.731'N and 31°36.694'E

Source: Field Survey, August 2024

Figure 4-17: Photographs of Soil Sampling





Soil sample collection from the study area

Source: Field Survey, August 2024

4.2.14.2 Summary of Primary Soil Quality Result

The analysis results of the soil samples are presented in Table 4-13. The laboratory test report has been presented in Appendix-A.

Table 4-13: Soil Quality Analysis Results

Parameters		Unit	Sampling Code					USEPA Standards	
			SQ-1	SQ-2	SQ-3	SQ-4	SQ-5	Common Range	Average Concentration
Aluminium		mg/kg	22100	20900	9970	17900	6850	-	-
Arsenic		mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	-	-
Barium		mg/kg	137	178	118	97.6	113	-	-
Cadmium		mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.01-0.7	0.06
Chromium		mg/kg	28.1	30.2	16.1	34.7	33.5	1-1000	100
Cobalt		mg/kg	7.24	7.87	3.19	6.92	6.77	-	-
Lead		mg/kg	6.92	9.20	7.69	11.5	11.5	2-200	10
Mercury		mg/kg	Not Detected					-	-
Molybdenum		mg/kg	0.49	0.32	0.28	0.44	0.63	-	-
Nickel		mg/kg	13.9	16.8	6.88	12.4	7.22	5-500	40
Tin		mg/kg	1.04	5.39	2.85	3.35	5.15	-	-
Particle Size Distribution	Sand	%	70.7	68.7	80.7	76.7	90.7	-	-
	Silt	%	9.28	7.28	11.3	7.28	5.28	-	-
	Clay	%	20.0	24.0	8.0	16.0	4.0	-	-

Source: Laboratory Analysis in Cropnuts Laboratory Services Ltd. and SGS, August 2024

4.2.14.3 Results and Discussion

The results for the soil samples were compared with the USEPA standards.

- Aluminium concentrations in the soil samples were in the range between 9970 to 22100 mg/kg.
- Arsenic concentrations in all the soil samples were observed as <0.20 mg/kg.
- Barium concentrations in the soil samples were in the range between 97.6 to 178 mg/kg.

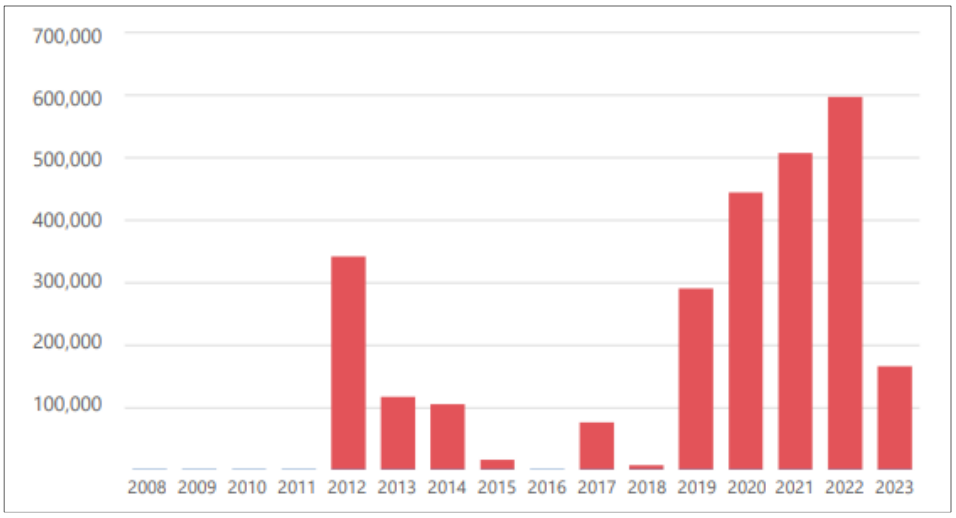
- Cadmium concentrations in all the soil samples were observed as <0.20 mg/kg. All the soil sampling results exceeded the permissible limit of USEPA standards – common range (0.01-0.7 mg/kg), as well as average concentration (0.06 mg/kg).
- Chromium concentrations in the soil samples were in the range between 16.1 to 34.7 mg/kg. All the soil sampling results were within the permissible limit of USEPA standards – common range (1-1000 mg/kg), as well as average concentration (100 mg/kg).
- Cobalt concentrations in the soil samples were in the range between 3.19 to 7.87 mg/kg.
- Lead concentrations in the soil samples were in the range between 6.92 to 11.5 mg/kg. All the soil sampling results were within the permissible limit of USEPA standards - common range (2-200 mg/kg) however the SQ-4 and SQ-5 exceeded the average concentration (10 mg/kg).
- Mercury concentration in the soil samples was not detected.
- Molybdenum concentrations in the soil samples were in the range between 0.28 to 0.63 mg/kg.
- Nickel concentrations in the soil samples were in the range between 6.88 to 16.8 mg/kg. All the soil sampling results were within the permissible limit of USEPA standards –common range (5-500 mg/kg), as well as average concentration (40 mg/kg).
- Tin concentrations in the soil samples were in the range between 1.04 to 5.39 mg/kg.

4.2.15 Natural Hazards

4.2.15.1 Flood

South Sudan is located in the Nile River basin and its low-lying topography makes it highly vulnerable to floods. The proposed project site (port and access road) has extremely high exposure to flood hazards due to its proximity to the river. Flooding occurs naturally during every rainy season from May to October. Floods in South Sudan as well as the project site have been recorded since the 1960s, and their impacts have become increasingly severe in recent years due to climate change and poor drainage infrastructure (Barber, 2023). The most severe floods occurred in 1963, 1978, 1983, 1998, 2012, 2019, 2020, 2021, and 2022. In recent years, floods have become more frequent and severe, affecting millions of people and causing significant damage to infrastructure, homes, and crops (ICG, 2022). The floods in 2020 are considered the worst in three decades with more than 875,000 people affected and impacts across all sectors. In 2021, the flooding destroyed 161,055 acres (65,177 hectares) of agricultural land and killed 795,558 livestock. In 2022, flooding affected over 900,000 people, displacing 140,000 people across 29 counties[6]. The number of people displaced by flooding in South Sudan from 2008 to 2023 has been given in Figure 4-18.

Figure 4-18: Number of People Displaced by Flooding in South Sudan (2008 - 2023)



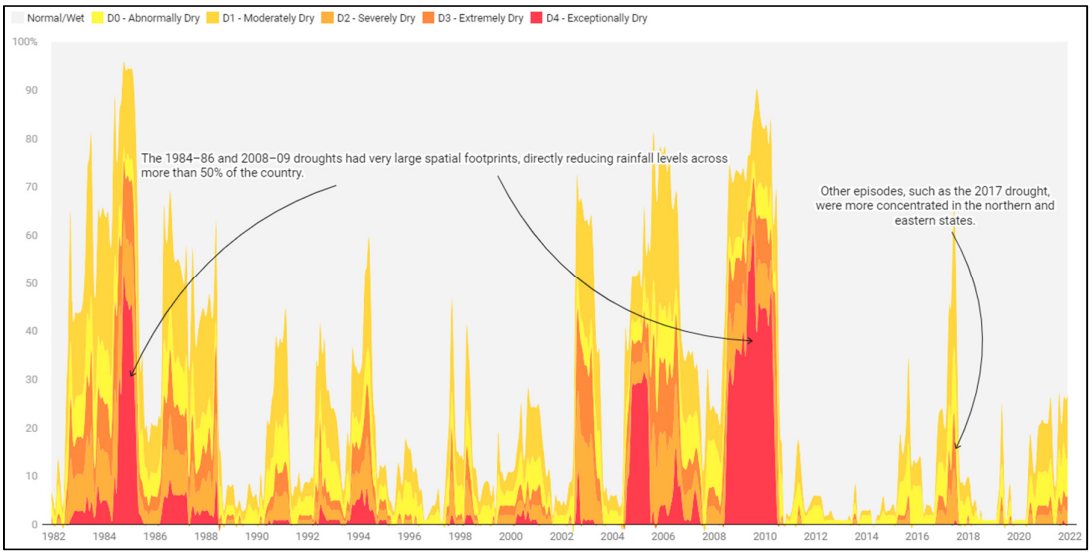
[6] https://disasterphilanthropy.org/disasters/south-sudan-humanitarian-crisis/

Source: Internal Displacement Monitoring Center

4.2.15.2 Drought

Droughts are also regular events in South Sudan, but now the country is generally experiencing substantially warmer and drier weather. Warmer temperatures due to climate change decrease evapotranspiration, which can lead to more frequent droughts (USAID, 2011). From the historical record, it was observed that drought occurred in 1989, 1990, 1997, 1998, 2000, 2008-2009, 2010-2011, and 2014. Drought mainly occurs in the season around May/June. From the analysis of the drought events from 1982 to 2021 it was observed that the southeast states i.e., Jonglei, Eastern Equatoria, and Lakes faced more than 10 drought events. The northern and western states i.e., Northern Bahr el Ghazal, Warrap, and Upper Nile states recorded fewer drought episodes. However, these droughts have tended to last longer and have been more intense. The percentage of South Sudan territory facing drought conditions is shown in Figure 4-19.

Figure 4-19: Percentage of South Sudan Territory Facing Drought Conditions



Source: World Bank - using CHIRPS data[7]

4.2.15.3 Seismic Activities and Earthquakes

South Sudan shows seismic activity in the southernmost part of the country due to the presence of several systems, such as the Aswa Fault, the East African Rift System, Afro-Arabian Fault, and Afar Depression. One of the largest earthquakes ever recorded in Africa (magnitude Ms 7.2) occurred about 100 km northeast of Juba on 19 May 1990. Four days later, two more large earthquakes (Ms 6.4 and Ms 7.0) occurred about 75 km northwest of Juba, in the Nile Valley. These earthquakes were associated with two fault systems: one east of the Nile with azimuth southeast and one along the Nile Valley with azimuth north-northeast. The hazard area covers Central and Eastern Equatoria and the southern part of Jonglei. Juba is located within the high-category hazard area. A list of recorded strongest earthquakes in South Sudan is given in Table 4-14.

Table 4-14: List of Strongest Earthquakes in South Sudan

Date	Magnitude	Location	Depth (km)
20/05/1990	7.2	69.2 km from Juba	14
24/05/1990	7.1	63.2 km from Juba	16
09/07/1990	6.6	60.2 km from Juba	12

[7] https://shorthand.worldbankgroup.org/water-security-and-fragility-in-south-sudan/

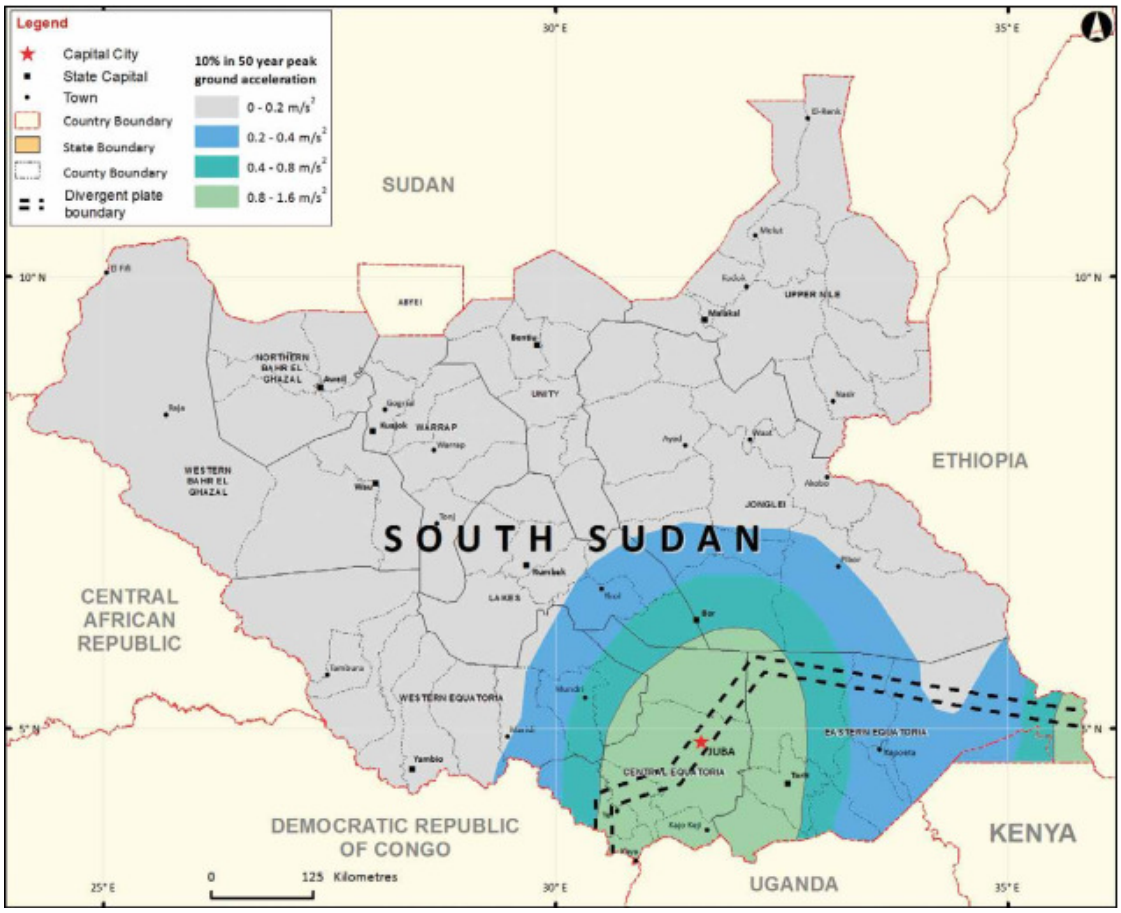
24/05/1990	6.5	54.2 km from Juba	16
19/07/1912	6.1	80 km from Juba	10

Source: Earthquake Track[8]

South Sudan is part of the East African Rift system, a 3,000 km long continental rift originating in the Cenozoic Era. It extends from the Afar triple junction, between the horn of Africa and the Middle East, to western Mozambique. Earthquakes and volcanic eruptions occur throughout the East African Rift system and are characterized by mainly shallow earthquakes due to the earth's crust rupturing and tearing apart, and volcano-tectonic earthquakes.

South Sudan is situated in the northern part of the western branch of the Afar triple junction, comprising the West Nile Region. Figure 4-20 shows the risk of seismic activity in South Sudan.

Figure 4-20: Risk of Seismic Activity in South Sudan



Source: Hayes, et al., 2014

4.2.15.4 Extreme Heat

In South Sudan, extreme heat hazard is classified as high[9] , and related health impacts are a common hazard. Evidence from Sub-Saharan Africa suggests increased mortality with temperatures over 31°C for children under 5 years and adults over 65 years. Juba's average temperature ranges between 26°C and 32°C and it is warming at 0.4°C per decade, a rate faster than almost anywhere else on earth (Lamanna 2019). Developing towns and informal settlements (for example, emergency camps) are

[8] https://earthquaketrack.com/
[9] https://thinkhazard.org/en/report/74-south-sudan/EH

especially vulnerable to heat-related illness as people are ill-equipped to adapt to increasing temperatures.

4.2.15.5 Forest Fire

Forest fire is classified as high[10] in South Sudan. The peak fire season typically begins in late October. From 2001 to 2023, South Sudan lost 707 ha of tree cover from fires and 137 kha from all other drivers of loss. The year with the most tree cover loss due to fires during this period was 2005 with 88 ha lost to fires - 0.83% of all tree cover loss for that year. Two of the fastest-spreading fires in 2006 and 2016 were located in the South Sudan savanna. In 2007, one of the largest wildfires spread from the Central African Republic, affecting the region of Western Bahr el Ghazal.

4.2.15.6 Erosion

During the site visit in the project area, riverbank erosion along the White Nile River was observed. Riverbank erosion is one of the most serious problems in river morphology. It is a natural phenomenon governed by many factors including rainfall amount and intensity, soil types and geological formation, ground cover, land use, topography, water level, river velocity, sediment characteristics, channel hydraulics, human practices, etc. The significant flows cause floods, bank overflow, and surface drainage difficulties during the rainy season (generally June to October), which cause bank erosion.

4.3 Biological Environment

The biological environment encompasses both the ecosystems and biodiversity of an area, including all living organisms such as plants, animals, and microorganisms like bacteria, algae, and fungi. Nowadays, industrialization is a major driver of ecological, environmental, and socio-economic change worldwide. It plays a central role in land transformation processes and fundamentally alters land use and landscape patterns globally, particularly in developing countries.

Juba and Bor river ports are crucial hubs for riverine transport in South Sudan. Rehabilitation and construction of port facilities would significantly enhance trade by providing better access to markets, reducing transportation costs, and facilitating the movement of goods both within South Sudan and neighboring countries. The project will include environmental safeguards that promote the sustainable use of the Nile's resources. The clearing (dredging) works aim to maintain its navigability and ecological health. However, the project site and its surrounding area hold significant value due to their rich biodiversity and diverse ecological habitats. Therefore, it is essential to establish a baseline assessment of biodiversity and evaluate the potential impact of the project on these vital ecosystems along the White Nile River.

4.3.1 Bioecological Zone

The MOEF along with the USAID has classified South Sudan into five major ecological zones i.e., Mountain Vegetation, River and Flood Region, High Rainfall Woodland Savanna, Low Rainfall Woodland Savannah, and Semi-arid with Grasslands and Shrubby Woodlands in the context of physiographic and biological diversity. These zones are crucial for understanding the country's biodiversity, natural resources, and environmental management (USAID, 2007). The study area, which encompasses both terrestrial and aquatic ecosystems falls under one ecological zone namely the River and Flood Region. Table 4-15 shows the ecological zones of South Sudan as well as the study area.

[10] https://thinkhazard.org/en/report/74-south-sudan/WF

Table 4-15: Ecological Zones

SL#	Ecological Zones	Average Annual Rainfall	Common Tree Species
1.	Mountain Vegetation	Up to 2500 mm	African mahogany *(Khaya grandifoliola),* African teak *(Chlorophora excelsa),* and Tiama *(Entandrophragma angolense)*
2.	River and Flood Region	Variable	Dominant vegetation is Papyrus sedge *(Cyperus papyrus)* and Cattails *(Typha dominguensis)*
3.	High Rainfall Woodland Savanna	900 to 1300 mm	Senegal mahogany *(Khaya senegalensis),* Abogo tree *(Isoberlinia doka),* Shea tree *(Vitellaria paradoxa)*
4.	Low Rainfall Woodland Savannah	400 to 800 mm	Red acacia *(Acacia seyal),* Senegal acacia *(Acacia Senegal),* Desert date *(Balanites aegyptiaca),* Tamarind *(Tamarindus indica),* African myrrh *(Commiphora spp.),* and Bushwillows *(Combretum spp.).*
5.	Semi-arid with Grasslands and Shrubby Woodlands	75 to 400 mm	Israeli babool *(Acacia tortilis), Maerua crassifolia,* Blackthorn *(Acacia mellifera),* African myrrh *(Commiphora spp.),* Knife-leaf wattle *(Acacia glaucophylla), Acacia etbaica* desert scrub

Source: USAID, 2007

4.3.2 Ecosystem and Habitat

The project area is located along a critical section of the White Nile River, which supports a diverse range of ecosystems and habitats. Due to the river's ecological significance and the surrounding geographical features, this region is home to a variety of aquatic life, wetlands, and riparian ecosystems that thrive in the unique climatic and hydrological conditions. The project area includes key habitats, such as riverine floodplains, marshlands, swamps, and adjoining terrestrial areas, all of which contribute to the rich biodiversity of the Nile River. However, these ecosystems are highly sensitive to human interventions, which can lead to habitat disturbance, altered water flow, and increased sedimentation. The area is already subject to other human activities, such as agricultural expansion, urbanization, and pollution, further stressing the natural environment. A comprehensive assessment is crucial to safeguard the region's biodiversity and ensure the long-term sustainability of these ecosystems.

4.3.2.1 Aquatic Ecosystems

South Sudan is blessed with a vast network of rivers, lakes, and wetlands that form the backbone of its aquatic ecology. These water bodies play a crucial role in supporting biodiversity, providing resources for local communities, and regulating the country's climate. The aquatic ecosystem of the project area includes the diverse life forms and habitats within the river, such as aquatic plants, fish species, and microorganisms.

4.3.2.1.1 Habitat

Primarily, the project area includes a combination of modified and natural aquatic habitats along the White Nile River between Juba and the Bor stretch. According to ESS6, the aquatic habitat near the proposed Juba and Bor port areas is classified as modified, as human activity has significantly altered the primary ecological functions and species composition. In contrast, areas outside the proposed ports and human settlements especially the waterways adjacent to Bandingilo National Park are classified as natural habitats under ESS6, as they support viable populations of mostly native species, with minimal modification to the area's ecological functions and species composition. The White Nile River in South

Sudan, particularly along the project area between Juba and Bor stretch, supports several important aquatic habitats that contribute to the region's rich biodiversity. These habitats include:

Riverine Habitat: The river itself provides a dynamic aquatic environment where various species of fish, invertebrates, and microorganisms thrive. The flowing waters of the White Nile serve as a vital habitat for migratory and resident fish species, including Nile tilapia *(Oreochromis niloticus),* Nile perch *(Lates niloticus),* and African catfish *(Heterobranchus bidorsalis).* Fisheries activity was also observed in this stretch of the river. The river's flow regime, seasonal flooding, and sediment transport play a critical role in shaping this habitat.

Floodplain Wetlands: The White Nile is surrounded by extensive floodplains, particularly in areas near Bor, where seasonal flooding creates large expanses of wetland habitat. These floodplains are highly productive ecosystems, supporting diverse plant species like Papyrus *(Cyperus papyrus),* Reed mace *(Typha latifolia),* and grasses, which in turn provide food and shelter for fish, birds, amphibians, and other wildlife. During the rainy season, these wetlands expand and become critical spawning grounds for fish, while also supporting migratory bird species.

Swamps and Marshlands: The White Nile runs through portions of the Sudd, one of the largest swamps in the world. The Sudd and other marshlands along the river are rich in aquatic vegetation such as water lilies and floating plants, which provide essential habitat for aquatic birds, fish, amphibians, and invertebrates. These swamp areas are important for maintaining water quality and act as natural filters, trapping sediments and pollutants.

Riparian Zones: The riverbanks and adjacent floodplains host riparian vegetation, including trees, shrubs, and grasses. These riparian zones provide critical habitat for semi-aquatic species such as hippos, crocodiles, and various bird species. The trees and vegetation along the banks also help stabilize the riverbanks, reducing erosion, and providing shade that helps regulate water temperature.

Photographs of different types of aquatic habitats within the study area have been presented in Figure 4-21.

Figure 4-21: Different Aquatic Habitats in the Study Area



Aquatic Vegetation in the Sudd Wetland



Floodplain Wetland is filled with Aquatic Vegetation

Source: EQMS Field Survey, August 2024

4.3.2.1.2 Aquatic Flora

The White Nile River is home to a diverse range of aquatic plants that contribute significantly to the river's ecosystem. These plants provide habitat for aquatic animals, help filter water, and play a crucial role in nutrient cycling. During baseline data collection, a total of 16 aquatic species from 12 families were identified. Major species identified in the study area include emergent plants such as Papyrus *(Cyperus papyrus),* Reed Mace *(Typha latifolia),* and Common water Hyacinth *(Eichhornia crassipes).* Notable submerged plants observed were Water lettuce *(Pistia stratiotes),* Canadian waterweed

(Elodea canadensis), and Spiny water nymph *(Najas marina),* as well as floating plants included Water lily *(Nymphaea spp.),* Duckweed *(Lemna minor),* and Water Lettuce *(Pistia stratiotes).* Blue-green algae *(Cyanobacteria sp.)* were also observed during the study. Among these species, Common water hyacinth *(Eichhornia crassipes)* is an invasive species that adversely affects the aquatic ecosystems of the White Nile River. A checklist of all recorded aquatic flora has been provided in Appendix B-1 and photographs of the notable aquatic flora have been provided in Appendix B-2.

4.3.2.1.3 Aquatic Wildlife

The aquatic ecosystem of the White Nile River in South Sudan is home to a variety of aquatic and semi-aquatic wildlife, which are large aquatic animals that play significant roles in the river's ecosystem. The major aquatic and semiaquatic wildlife species identified in the study area include Nile Crocodile *(Crocodylus niloticus),* Nile softshell turtle *(Trionyx triunguis),* and Nile Monitor Lizard *(Varanus niloticus)*. Among the identified species, Nile softshell turtle *(Trionyx triunguis)* is categorized as Vulnerable (VU) and the other two species are categorized as Least Concern (LC) as per the global IUCN Red List of Threatened Species (ver. 3.1).

4.3.2.1.4 Fisheries Resources

The White Nile River is home to a diverse range of fish species, many of which are endemic to the region. These fish play important roles in the river's ecosystem, serving as a food source for both aquatic and terrestrial predators. During baseline data collection, a total of 17 fish species from 10 families were identified. The major fish species identified in the study area include African carp *(Labeo cylindricus),* Nile tilapia *(Oreochromis niloticus),* Nile perch *(Lates niloticus),* Nile carp *(Labeo niloticus),* African sharptooth catfish *(Clarias gariepinus),* Sudan squeaker *(Synodontis frontosus),* Senegal bichir *(Polypterus senegalus),* Nile arowana *(African arowana),* and Wahrindi *(Synodontis schall).* According to the global IUCN Red List of Threatened Species (Ver. 3.1), all these fish species are classified as Least Concern (LC). A checklist of all recorded fish species has been provided in Appendix B-3.

4.3.2.2 Terrestrial Ecosystems

The terrestrial ecosystems along the Juba to Bor stretch of the White Nile River are diverse and ecologically significant, comprising various habitat types that support a rich array of flora and fauna. The region features riparian forests that thrive in water-rich environments, woodland, and shrubland that house larger mammals, agricultural lands vital for subsistence farming, and homestead vegetation that fulfills both functional and cultural roles for local communities. Additionally, roadside vegetation provides essential habitats for wildlife, while the grassland and fallow land play a critical role in maintaining biodiversity and supporting local livelihoods. Together, these ecosystems contribute to the environmental health and economic stability of the region.

4.3.2.2.1 Habitat

Our primary observation suggests that the project area includes a combination of modified and natural terrestrial habitats along the White Nile River between Juba and the Bor stretch. According to ESS6, the terrestrial habitat near the proposed Juba and Bor port areas is classified as modified, as human activity has significantly altered the primary ecological functions and species composition. In contrast, project areas outside the proposed ports and human settlements especially the terrestrial habitat adjacent to Bandingilo National Park are classified as natural habitats under ESS6, as they support viable populations of mostly native terrestrial species, with minimal modification to the area's ecological functions and species composition. The terrestrial ecosystem, particularly along the project area between Juba and Bor, supports several important terrestrial habitats that contribute to the region's rich biodiversity. These habitats include:

Riparian Forests: The forested portion of Bandingilo National Park, which exists along the stretch of the White Nile River from Juba to Bor, is riparian in nature. The riparian zone in the park is characterized by a variety of tree species, such as Babul *(Vachellia nilotica),* Tamarind Tree *(Tamarindus indica),* Sycamore Fig *(Ficus sycomorus),* African Mahogany *(Khaya senegalensis),* Doum Palm *(Hyphaene*

thebaica), and others, that thrive in water-rich environments. These trees contribute to the stability of the riverbanks and provide habitats for wildlife.

Woodland and Shrubland: These habitats consist of denser vegetation, including trees and shrubs, often more drought-tolerant species such as Babul *(Vachellia nilotica).* Woodland areas may support large mammals like African bush elephant *(Loxodonta Africana),* Common patas monkey *(Erythrocebus patas),* Mongalla gazelle *(Eudorcas albonotata),* and others. Woodland and shrubland areas contribute to soil stability, act as windbreaks, and provide habitats for a variety of mammals and bird species.

Agricultural Land: Much of the land along the Juba-Bor stretch is used for subsistence agriculture. Various types of agricultural practices were observed within the study area. Local communities cultivate these lands for crops such as sorghum *(Sorghum bicolor),* maize *(Zea mays),* Okra *(Abelmoschus esculentus),* Amaranth *(Amaranthus spp.),* Pumpkins *(Cucurbita spp.)* and other vegetables. These agricultural lands provide food and livelihoods for local populations and support different bird species.

Homestead Vegetation: Homestead vegetation in the project area plays a significant role in the lives of rural communities, serving both functional and cultural purposes. Typically found around homes in villages and rural areas, this vegetation includes a mix of cultivated plants, trees, and shrubs, often selected for their utility, nutritional value, and environmental benefits. Common homestead vegetation recorded near villages and settlements includes Mango *(Mangifera indica),* Guava *(Psidium guajava),* Papaya *(Carica papaya),* Shea tree *(Vitellaria paradoxa),* Neem *(Azadirachta indica),* and Acacia *(Vachellia spp.),* and others. This vegetation supports many urban wildlife species, such as birds, herpetofauna, and mammals, in the project and its adjacent areas.

Roadside Vegetation: The major roadside vegetation consists of grasses, shrubs, and scattered trees, influenced by both semi-arid conditions and the riparian zones near the White Nile River. Along the roadsides, a variety of grasses and ground cover plants can be seen, including Speargrass *(Imperata cylindrica),* Elephant grass *(Pennisetum purpureum),* and Bermuda grass *(Cynodon dactylon).* Trees found along the roadside include Babul *(Vachellia nilotica),* Jatropha *(Jatropha curcas),* Sesbania *(Sesbania sesban),* Neem *(Azadirachta indica),* Sycamore Fig *(Ficus sycomorus),* Tamarind *(Tamarindus indica),* and African Mahogany *(Khaya senegalensis).* This vegetation provides an additional habitat for many birds, reptiles, and small mammal species.

Grassland and Fallow Land: The regions surrounding the White Nile River are characterized by a mix of grassland and fallow land, each playing a crucial role in the local ecosystem and the livelihoods of surrounding communities. These areas are home to a variety of grasses, herbs, and occasionally shrubs. Common species include Speargrass *(Imperata cylindrica),* Elephant grass *(Pennisetum purpureum),* Guinea grass *(Megathyrsus maximus),* and Bermuda grass *(Cynodon dactylon).* The fallow land supports a number of bird species, such as the African jacana *(Actophilornis africanus),* African openbill *(Anastomus lamelligerus),* African sacred ibis *(Threskiornis aethiopicus),* Senegal Thick-knee *(Burhinus senegalensis),* Cattle egret *(Bubulcus ibis),* Hooded vulture *(Necrosyrtes monachus)*, etc.

Photographs of different types of terrestrial habitats within the study area have been presented in Figure 4-22.

Figure 4-22: Different Terrestrial Habitats in the Study Area



Grassland and Fallow Land



Roadside Vegetation

Source: EQMS Field Survey, August 2024

4.3.2.2.2 Terrestrial Flora

The study area comprised homestead vegetation, riparian vegetation, roadside vegetation, fallow land, and grassland. During the baseline data collection process, a total of 35 species of flora from 23 families were recorded. The most common floral species identified in the study area include Neem *(Azadirachta indica),* Desert date *(Balanites aegyptiaca),* Sausage tree *(Kigelia Africana),* Mango *(Mangifera indica),* Borassus palm *(Borassus aethiopum),* Papaya *(Carica papaya),* East African doum palm *(Hyphaene compressa),* Tamarind *(Tamarindus indica),* Senegal mahogany *(Khaya senegalensis),* Abogo tree *(Isoberlinia doka),* Buffalo thorn *(Ziziphus sp.),* Shea butter nut tree *(Butyrospermum Paradoxum),* Jackal berry *(Diospyros mespiliformis),* Karira *(Capparis decidua),* Shepherd's tree *(Boscia senegalensis),* Yellow oleander *(Cascabela thevetia),* Giant Milkweed *(Calotropis procera),* Kokilasha *(Hygrophila auriculata),* Israeli babool *(Acacia tortilis),* etc. A checklist of all recorded terrestrial flora has been provided in Appendix B-4 and photographs of the notable terrestrial flora have been provided in Appendix B-5.

4.3.2.2.3 Avifauna

During the baseline survey, a total of 54 bird species were identified from 30 different families. The notable identified avifaunal species in the study area include Red-cheeked cordonbleu *(Uraeginthus bengalus),* Northern red bishop *(Euplectes franciscanus),* Common bulbul *(Pycnonotus barbatus),* Mourning collared dove *(Streptopelia decipiens),* Hooded vulture *(Necrosyrtes monachus),* Grey-backed fiscal *(Lanius excubitoroides),* Black-headed gonolek *(Laniarius erythrogaster),* Greater blue-eared starling *(Lamprotornis chalybaeus),* Western cattle egret *(Bubulcus ibis),* Black-headed heron *(Ardea melanocephala),* Grey-headed kingfisher *(Halcyon leucocephala),* Pied crow *(Corvus albus),* Spur-winged lapwing *(Vanellus spinosus),* Eastern chanting goshawk *(Melierax poliopterus),* African openbill *(Anastomus lamelligerus),* African sacred ibis *(Threskiornis aethiopicus),* Hamerkop *(Scopus umbretta),* African jacana *(Actophilornis africanus),* Purple heron *(Ardea purpurea),* White-faced whistling duck *(Dendrocygna viduata),* Little bee-eater *(Merops pusillus),* Black crake *(Zapornia flavirostra),* House sparrow *(Passer domesticus),* Fawn-breasted waxbill *(Estrilda paludicola),* African pygmy kingfisher *(Ispidina picta),* Vitelline masked weaver *(Ploceus vitellinus),* Moustached grass warbler *(Melocichla mentalis),* Village weaver *(Ploceus cucullatus),* Water thick-knee *(Burhinus vermiculatus),* Goliath heron *(Ardea goliath),* African fish eagle *(Icthyophaga vocifer),* Indian pond heron *(Ardeola grayii),* etc. According to the global IUCN Red List of Threatened Species (ver. 3.1), Hooded vulture *(Necrosyrtes monachus)* is classified as Critically Endangered (CR), and other species are categorized as Least Concern (LC). A checklist of all recorded avifauna has been provided in Appendix B-6 and photographs of the avifauna have been provided in Appendix B-7.

4.3.2.2.4 Herpetofauna

During the baseline survey, a total of 16 reptile species from the study area were recorded. The notable reptilians identified in the study area include African five-lined skink *(Trachylepis quinquetaeniata),* African striped skink *(Trachylepis striata),* Finch's Agama *(Agama finchi),* Nile Monitor *(Varanus niloticus),* Nile crocodile *(Crocodylus niloticus),* etc. According to the global IUCN Red List of Threatened Species (Ver. 3.1), African Rock Python *(Python sebae)* is classified as Near Threatened (NT), Nile softshell turtle *(Trionyx triunguis)* is classified as Vulnerable (VU), and other species are categorized as Least Concern (LC).

A total of seven amphibian species were recorded from the study area during the baseline survey. Common amphibian species identified in the study area include Crowned bullfrog (Hoplobatrachus occipitalis), Nile Grass Frog (Ptychadena nilotica), African common toad (Sclerophrys regularis), etc. According to the IUCN Red List of Threatened Species (ver. 3.1), all amphibian species found in the study area are categorized as Least Concern (LC). A checklist of all recorded herpetofauna has been provided in Appendix B-8 and photographs of the herpetofauna have been provided in Appendix B-9.

4.3.2.2.5 Mammals

During baseline data collection, a total of 16 mammals from 9 different families were recorded. Among the recorded mammals, the most common species identified in the study area included the Common patas monkey *(Erythrocebus patas),* Sitatunga *(Tragelaphus spekii),* Four-toed hedgehog *(Atelerix albiventris),* Mongalla gazelle *(Eudorcas albonotata),* Marsh mongoose *(Atilax paludinosus),* White-tailed mongoose *(Ichneumia albicauda),* etc. According to the global IUCN Red List of Threatened Species (Ver. 3.1), African buffalo *(Syncerus caffer)* is classified as Near Threatened (NT), African bush elephant *(Loxodonta africana),* Nile lechwe *(Kobus megaceros)* is classified as Endangered (EN), Cheetah *(Acinonyx jubatus),* Giraffe *(Giraffa camelopardalis),* Leopard *(Panthera pardus),* Lion *(Panthera leo)* is classified as Vulnerable (VU), and other species are categorized as Least Concern (LC). A checklist of all recorded mammal species has been provided in Appendix B-10.

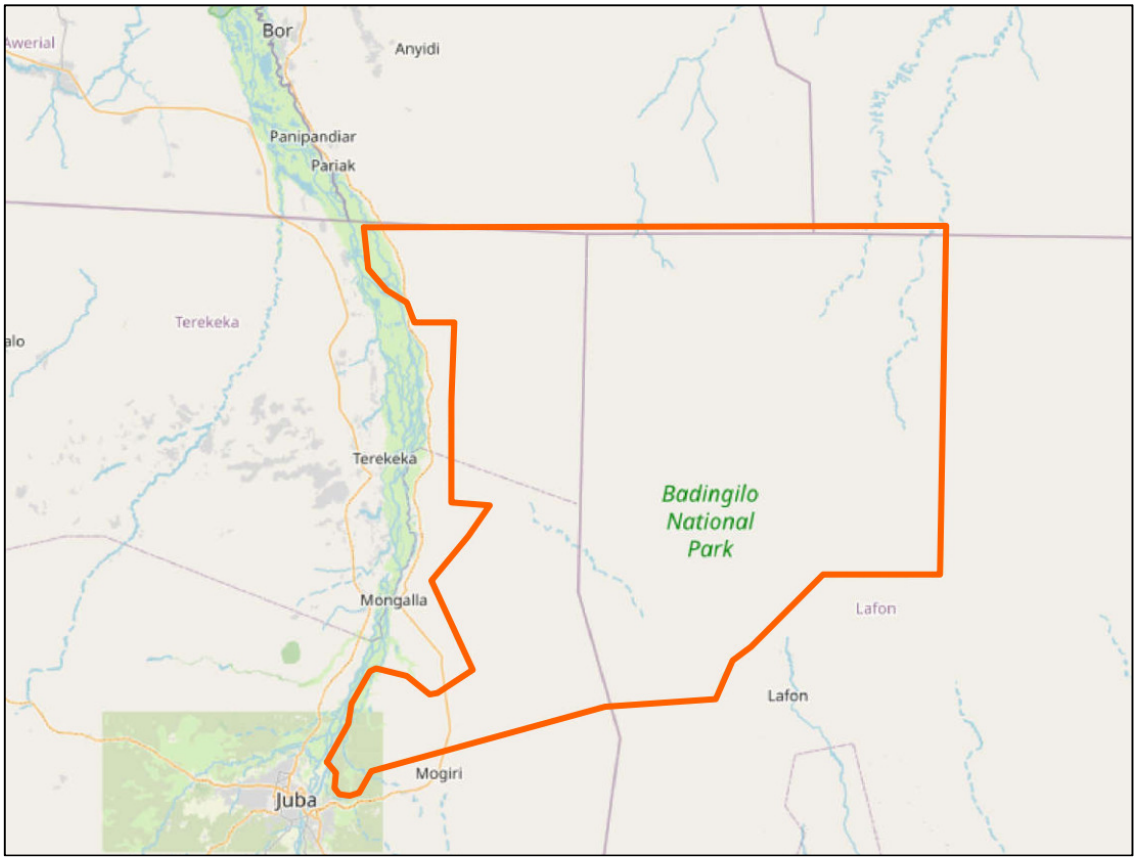
4.3.3 Protected Areas

The Ministry of Environment and Forestry for South Sudan defines a protected area as "an area of land or water in South Sudan specifically protected for the maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means including national parks and game reserves" (MOE, 2015). According to Schedule IV of the Wildlife Conservation and National Parks Act, 2003, South Sudan has 19 wildlife protected areas, comprising 7 national parks (including Southern, Boma, Dinder, Bandingilo, Lantonto, Shambe, and Nimule) and 12 game reserves (including Zeraf, gelkou, Mushra, Kidepo, Ashana, Boro, Numatina, Fanyikang, Juba, Bangangai, Mbarizunga, and Bire Kpatous). From the literature review, it was observed that two protected areas i.e., Bandingilo National Park and Juba Game Reserve are located in the study area. A short description of these protected areas is discussed below:

4.3.3.1 Bandingilo National Park

Bandingilo National Park is located in the Jonglei, Central Equatoria, and Eastern Equatoria states of South Sudan. The national park was established in 1992. It is situated near the White Nile River and covers an area of approximately 10,000 square kilometers. It is the place where the earth's largest annual animal migration takes place, involving multiple species of antelope including reedbuck, tiang, and white-eared kob. It is also the home of iconic African megafauna like the Nubian giraffe and contains large marshlands stretching up into Jonglei state. Predators like the African wild dogs, cheetahs, caracals, lions, and spotted hyenas are also living in the national park. The location of the Bandingilo National Park is shown in Figure 4-23.

Figure 4-23: Location of Bandingilo National Park

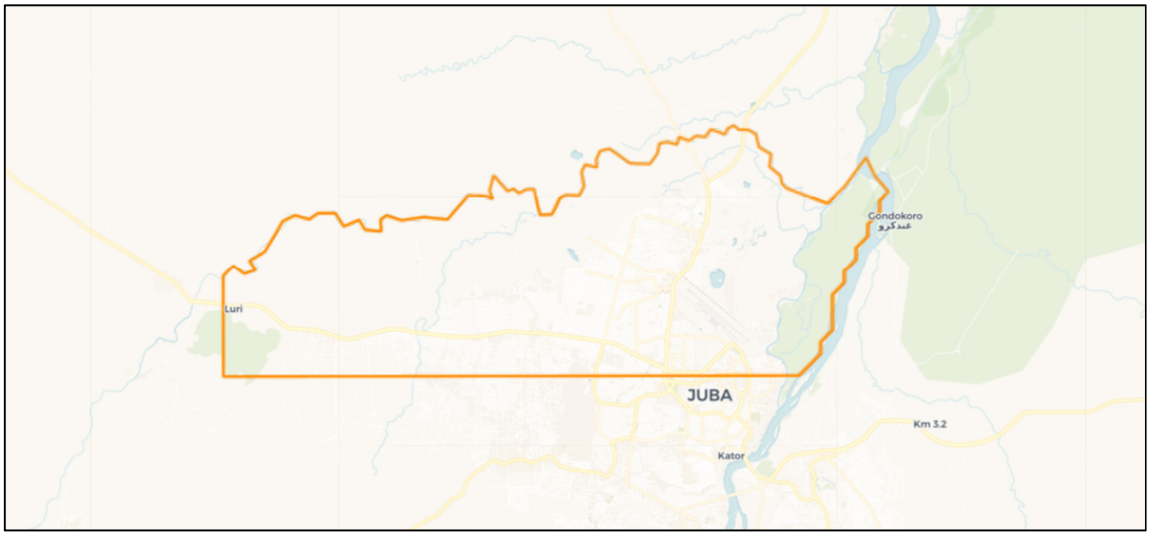


Source: https://www.openstreetmap.org/relation/2314986/history/#map=9/5.6091/32.2531

4.3.3.2 Juba Game Reserves

Juba Game Reserve is located in the central equatorial state of South Sudan. It was designated as a Game Reserve at the national level in 1939. The game reserve covers an area of 200 square kilometers of savannah grassland and woodland habitat. According to the discussion with the Ministry of Wildlife Conservation and Tourism, now the game reserve area is developed as an urban area. There is no existence of this game reserve in reality but officially it is a declared game reserve. The location of the Juba game reserve is shown in Figure 4-24.

Figure 4-24: Location of Jube Game Reserves



Source: UNEP-WCMC, 2024

4.3.4 RAMSAR Site

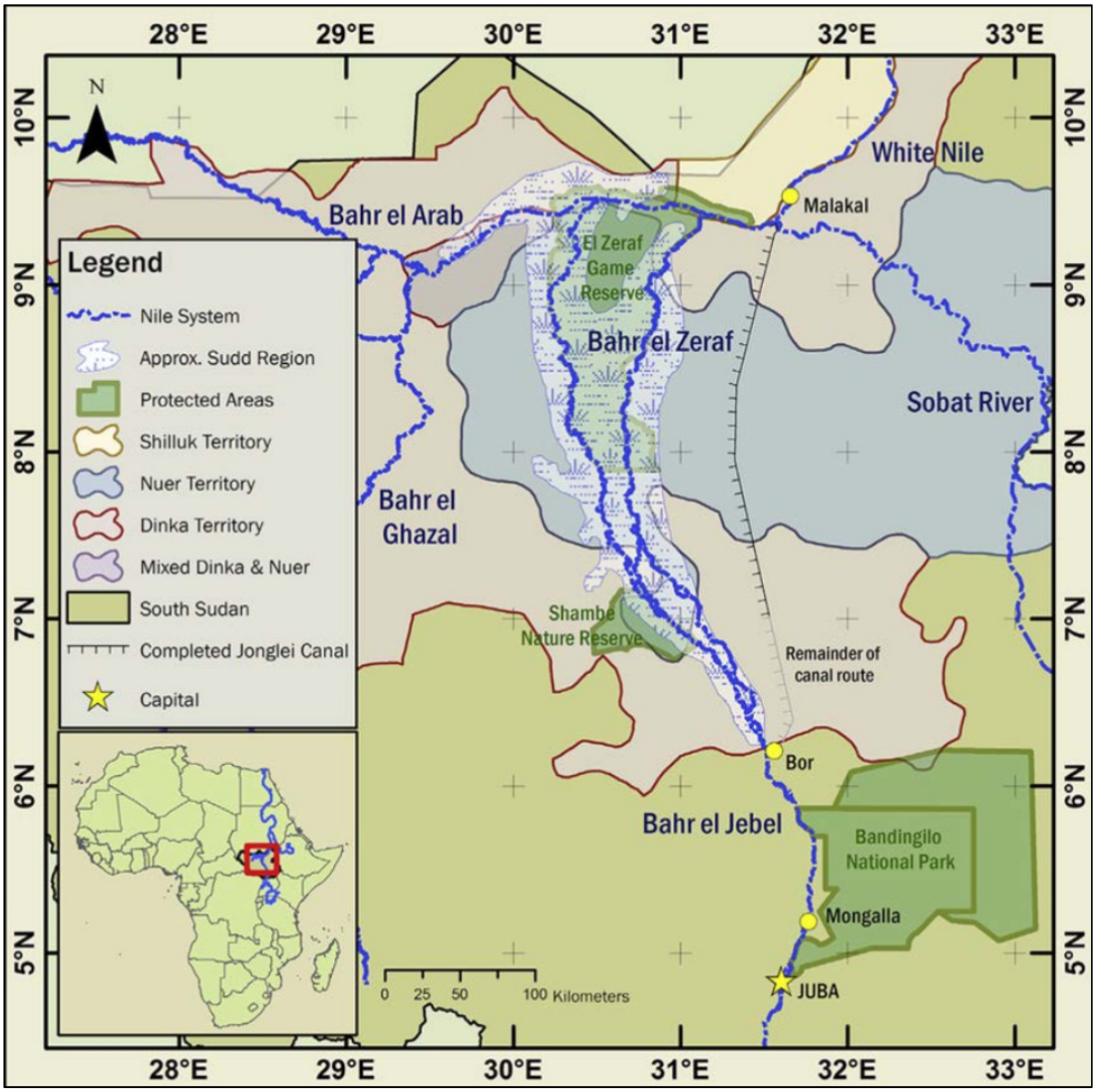
The Sudd wetland, with an estimated area of approximately 57,000 square kilometers represents one of the largest freshwater ecosystems in the world. The extent of the Sudd wetlands is between 57,000 to 90,000 square kilometers[11], and it depends largely on the seasons and years respectively. It is sustained by the flow of the White Nile from Lake Victoria in Uganda, in addition to rainfall runoff from its surrounding areas. Habitats exhibit strong environmental gradients with pronounced short and long-term variations in biomass production and distribution.

This wetland is internationally recognized for its unique ecological attributes that include various endangered mammalian species, antelope migrations, millions of Palaearctic migratory birds, and large fish populations. Notable wildlife species include the African elephants *(Loxodonta africana),* Nile lechwe *(Kobus megaceros)* endemic to South Sudan, tiang migration *(Damaliscus lunatus tiang),* white-eared kob migration *(Kobus kob thomasi),* buffalo *(Syncerus caffer),* and bird species include the shoebill *(Balaeniceps rex).* The wetland is an important wintering ground for some of the migratory birds such as the Great White Pelican *(Pelecanus onocrotalus),* Black Crowned Crane *(Balearica pavonina),* White Stork *(Ciconia ciconia)*, Sitatunga *(Tragelaphus Spekii),* and Black Tern *(Chlidonias niger).* A large number of inter-African bird migrants also rely on the Sudd and surrounding habitats as a dry-season refuge.

The wetland has rich and abundant fish populations, a response to the favorable environmental conditions for recruitment and survival offered by its mosaic of habitat types. There are eight endemic Nile dwarf fish species found in this wetland, which are *Cromeria nilotica, Nannaethiops unitaeniatus, Barbus stigmatopygus, Chelaethiops bibie, Andersonia leptura, Aplocheilichthys loati, Epiplatys marnoi, and Electris nanus.* The location of the Sudd Wetland is shown in Figure 4-25.

[11] https://whc.unesco.org/en/tentativelists/6276/

Figure 4-25: Location of Sudd Wetland



Source: Sosnowski A. et al., 2016

4.3.5 Important Bird and Biodiversity Areas

Important Bird and Biodiversity Areas (IBAs) are areas designated as critical for bird populations based on internationally agreed criteria. According to BirdLife International[12], there are twelve Important Bird & Biodiversity Areas in South Sudan, and the total area covers approximately 162,590 km^2. These are Ashana, Bandingilo, Bengangai, Boma, Imatong mountains, Juba, Kidepo, Lake Abiad, Nimule, Radom, Southern National Park, and Sudd (Bahr-el-Jebel system). Two important birds and biodiversity areas (IBAs) namely Bandingilo and Sudd (Bahr-el-Jebel system), are located in and around the project area. Bandingilo site is located between the towns of Bor in the north and Juba in the south, to the east of the White Nile. Sudd (Bahr-el-Jebel system) is located adjacent to the proposed Bor port site.

4.4 Socio-economic Environment

The socio-economic characteristics of the communities surrounding the project area are detailed in terms of land area, administration, and governance, demographics, ethnicity, agriculture, trade, tourism,

[12] BirdLife International (2024) Country profile: South Sudan. Downloaded from https://datazone.birdlife.org/country/south-sudan on 07/09/2024.

infrastructure, social services (including education and health), access to institutions, as well as water and energy supply facilities, among other factors.

4.4.1 Administrative Structures

South Sudan's administrative structure operates on several levels. At the national level, the President serves as head of state and government, supported by a bicameral National Legislature, which includes the National Legislative Assembly and the Council of States. The sub-national level consists of ten states, each led by a governor appointed by the President and governed by a state legislative assembly. At the county level, counties, which are subdivisions of states, are overseen by county commissioners. Below counties are payams, administered by payam administrators, and the smallest units are bomas, managed by boma chiefs or administrators. This hierarchy helps manage the country's governance across different regions.

4.4.2 Project Area

The proposed Juba and Bor ports are located in Central Equatoria and Jonglei states, respectively. The Juba port is situated in Juba Town, Juba County, Central Equatoria State, on the west bank of the White Nile. The Bor port is in the Bor Town area, Bor South County, Jonglei State, on the east bank of the White Nile. Bor, the second most developed city in central South Sudan, is approximately 190 kilometers north of Juba, the capital, and serves as the capital of Jonglei State. For the scoping study, both direct and indirect influence areas have been considered.

4.4.3 Demographic Profile

4.4.3.1 Population Composition

As of 1st January 2024, the population of South Sudan was estimated at 13,058,117 reflecting an increase of 4.08% (511,766 people) compared to the previous year's population of 12,546,351. In 2023, the country experienced a natural population increase of 317,925, as the number of births surpassed the number of deaths. Additionally, external migration contributed to a population rise of 193,841 people. South Sudan's population density is 21.1 people per square kilometer (54.6 per square mile) as of September 2024. The density of the population is calculated as the permanently settled population of South Sudan divided by the total area of the country. Total area is the sum of land and water areas within international boundaries and coastlines of South Sudan. The total area of South Sudan is 619,745 km^2 (239,285 mi^2) according to the United Nations Statistics Division[13].

Additionally, the 2008 census of South Sudan presents a comprehensive demographic profile. Table 4-16 provides demographic data for counties and payams in South Sudan, detailing the total population, gender distribution, and number of households (HHs). For example, Munuki Payam of Juba County represents the highest population size of 83,719, with 45,707 males and 38,012 females, and 13,404 households. Considering the size of the population, Juba Town has the second highest population size of 82,346, with 48,747 males and 33,599 females, and 11,753 households. In contrast, Nile Payam represents the lowest population size of 2,768, with 1,457 males and 1,311 females in 340 households. A total of 503,562 population in 85,132 indicates an average household size of 5.9.

Table 4-16: Papulation by County and Payam

State	County	Payam	Total Population	Male	Female	Total HHs
Jonglei	Bor South	Bor	61,716	32,644	29,072	8,959
		Kolnyang	40,058	21,188	18,870	6,158
Lakes	Awerial	Nile	2,768	1,457	1,311	340

[13] https://countrymeters.info/en/South_Sudan#population_2022 accessed September 2024

State	County	Payam	Total Population	Male	Female	Total HHs
		Puluk	10,270	4,938	5,332	1,985
Central Equatoria	Terekeka	Gameiza	7,558	4,380	3,178	1,690
		Muni	18,073	8,540	9,533	4,058
		Nyori	11,234	5,451	5,783	2,233
		Reggo	19,832	9,566	10,266	4,372
		Terekeka	20,770	10,540	10,230	3,856
		Tombek	8,136	4,155	3,981	1,689
		Mangala North	3,977	2,181	1,796	946
	Juba	Munuki	83,719	45,707	38,012	13,404
		Kator	64,130	34,973	29,157	11,018
		Gondokoro	6,522	3,205	3,317	1,457
		Juba Town	82,346	48,747	33,599	11,753
		Mangala South	7,039	3,842	3,197	1,493
		Northern Bari	39,810	23,019	16,791	6,517
		Rejaf	15,604	8,232	7,372	3,204
Total			**503,562**	**272,765**	**230,797**	**85,132**

Source: Statistical Yearbook for Southern Sudan, 2010

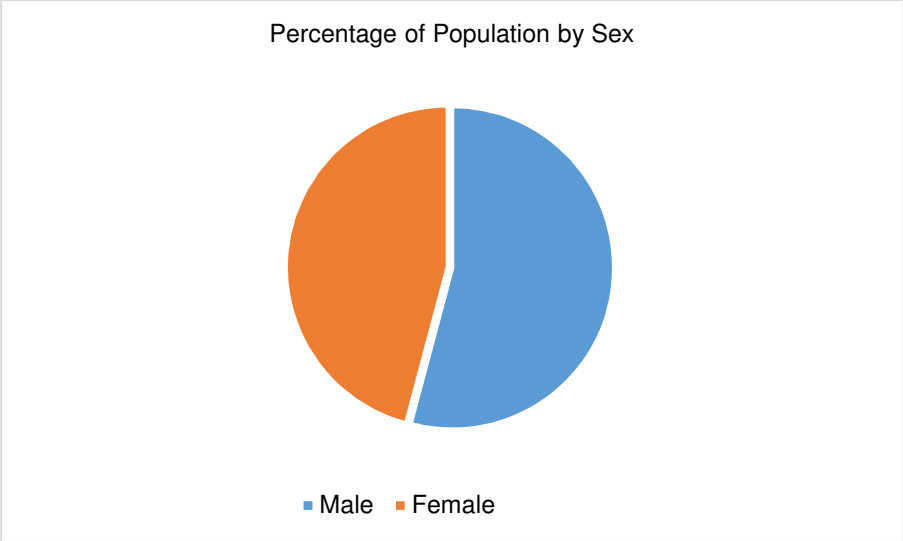
4.4.3.2 Sex Distribution of Population

As of 2024, the sex ratio of the population of South Sudan was 1.015 (1,015 males per 1,000 females), which is slightly lower than the global sex ratio of 1.016 males per 1,000 females, as recorded in 2023[14].

Figure 4-26 illustrates the percentage of sex distribution among the population which shows that the percentage of the male population is some higher (54.2%) than their counterpart female population (45.2%) of the 5th Sudan Population and Housing Census in 2008. Although the distribution across the Payams shows a higher size of males, some areas like Puluk, Nyori, Muni, Reggo, and Gondokoro have slightly more females than males (Table 4-16). However, the sex distribution in the total population varies, highlighting the diverse demographic landscape of South Sudan's counties and payams.

[14] https://countrymeters.info/en/South_Sudan#population_2022 accessed in September 2024

Figure 4-26: Population by Sex



Source: Statistical Yearbook for Southern Sudan, 2010

4.4.4 Ethnic Background

South Sudan is home to diverse ethnolinguistic groups, mainly categorized into three subgroups of Nilo-Saharan language speakers such as West Nilotic speakers, including the Dinka, Nuer, and Atuot; Western Nilotic/Luo speakers, such as the Shilluk, Anuak, Maban, Acholi, and Jur-Luo; and Eastern Nilotic speakers such as the Bari, Lotuho, and Teso. Additionally, there are speakers of the Niger-Congo language family, notably the Zande people in Western Equatoria.

The project area represents a diverse ethnic background across the counties such as Dinka Bor and Aliab Dinka are the main ethnic groups respectively in Bor South and Awerial while the Mundari are dominant in Terekeka. Juba, on the other hand, presents the most diverse ethnic backgrounds where the main ethnic groups are Bari, Lokoya, Lulubo, and Nyangwara. In addition to these groups, some other ethnic groups also live in Juba namely Pajulu, Kakwa, Kuku, Mundari, Dinka, and Nuer.

4.4.5 Educational Background

As of April 2024, South Sudan's literacy rate remains among the lowest globally, with only 35% of the population over the age of 15 able to read and write. This low literacy rate is attributed to the country's ongoing conflicts, economic challenges, and educational disparities, especially in rural areas. South Sudan also has one of the highest numbers of out-of-school children, with millions of students, particularly girls, facing significant barriers to education, such as child marriage and poverty, which represents the percentage of people aged 15 and above who can read and write, which is 26.8 percent[15].

South Sudan faces significant challenges in education, with one of the lowest literacy rates in the world. Approximately half of its population cannot read or write, underscoring the urgent need for educational reforms and initiatives[16].

The literacy rate among adult males stands at 38.62% (1,365,294 individuals), leaving 2,169,538 males illiterate. For adult females, the literacy rate is 25.34% (892,846 individuals), with 2,630,756 remaining illiterate. Youth literacy rates, covering the population aged 15 to 24, are 46.89% for males and 41.74% for females, with an overall youth literacy rate of 44.33%.

[15] https://data.worldbank.org/indicator/SE.ADT.LITR.ZS?locations=SS
[16] https://www.voaafrica.com/a/africa_south-sudan-promoting-adult-literacy-maintain-peace/6179024.html

South Sudan's General Education Act of 2012 defines the formal education system with three levels: pre-school (two years for ages 3-5), primary (eight years starting at age six), and secondary education (four years of general education or technical/vocational training). Tertiary education includes university programs offering diplomas, bachelor's, or master's degrees, and teacher training institutes (TTIs) for certification.

As per the 5th Sudan Population and Housing Census in 2008, Table 4-17 compares the Net Attendance Ratio (NAR) for primary and secondary education in three South Sudanese states: Jonglei, Lakes, and Central Equatoria of the project area. Central Equatoria has the highest NAR for primary education at 64.4%, significantly outperforming Jonglei (24.2%) and Lakes (20.4%), indicating better access and attendance in primary schools, particularly in Terekeka. For secondary education, the NAR is low across all states, with Central Equatoria again leading at 11%, followed by Lakes (2.5%) and Jonglei (1.3%), highlighting difficulties in transitioning from primary to secondary education.

Table 4-17: Net Attendance Ratio

State	Primary	Secondary
Jonglei	24.2	1.3
Lakes	20.4	2.5
Central Equatoria	64.4	11

Source: 5th Sudan Population and Housing Census, 2008

4.4.6 Economic Activities and Employment Status

South Sudan's economy is primarily driven by agriculture, oil production, and informal trade. Agriculture, particularly subsistence farming, employs over 80% of the population, though the sector faces significant challenges from conflict and climate issues. Oil production remains the dominant contributor to government revenue, accounting for around 90%, but fluctuating oil prices and instability hinder its full potential. Informal trade is widespread, providing livelihoods through local markets.

Unemployment in South Sudan stands at around 12% as of 2023, with most of the workforce employed in the informal sector. Youth and women face barriers to employment, highlighting the need for vocational training and skills development to boost formal employment opportunities.

However, considering the project area as per the 5th Sudan Population and Housing Census of 2008, the labor force participation rate for the population of Southern Sudan aged 15 years and above is 74% - 77% for males and 72% for females. Some 13% of those aged 15 years and above who are currently working or who worked previously were paid employees, 37% were own account workers and 42% were unpaid family workers. On the other hand, the unemployment rate for the population aged 15 and above is 12%: 11% for males and 13% for females[17].

Table 4-18 presents the distribution of occupational background of the people population aged "10 and above" and "15 and above" who worked previously. Data shows that "Skilled Agricultural, Forestry and Fishery" was the most common occupation among people of both age groups from all counties indicating a strong reliance on agriculture. In contrast, some occupations such as "Craft and other trades workers", "Plant/machine operators, and assemblers", and "Clerical support workers" represent the lower participation of people from both age groups of all regions.

[17] Southern Sudan Counts: Tables from the 5th Sudan Population and Housing Census, 2008

Table 4-18: Percentage of Population Aged 10 -15 and above who worked previously

Occupations by Type	Population aged 10 and above who worked previously			Population aged 15 and above who worked previously		
	Bor South	Awerial	Terekeka	Bor South	Awerial	Terekeka
Managers	0.9	1.3	1.1	1.1	1.5	1.2
Professionals	2.5	1.6	4.1	3	1.9	4.7
Technicians and associate professionals	1.9	1.2	3	2.2	1.4	3.4
Clerical support workers	1.1	0.6	1.1	0.5	0.7	1.3
Service and sales workers	21.4	33	18.1	20.9	29.9	17.6
Skilled agricultural, forestry, and fishery	60.3	52.4	59.3	64.7	55.8	58.1
Craft and other trades workers	0.6	1.4	3.9	0.6	1.3	4.2
Plant/machine operators, and assemblers	0.2	0.2	1.5	0.2	0.2	1.8
Elementary occupations	10.1	6.6	4.7	5.5	5.3	4.2
Armed forces occupations	1.1	1.7	3.2	1.3	2	3.6
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: 5th Sudan Population and Housing Census, 2008

The industry aggregated data in Table 4-19 shows that “Agriculture, forestry, fishing and mining” was the common industrial background where the highest percentage of the population from both age groups of all regions were employed. “Household production for own use/Domestic personnel” was the second common area. In contrast, “Accommodation, food service, transportation and storage”, “Construction and utility supply”, and “Manufacturing” represent the lowest percentage of population employment in these areas.

Table 4-19: Industry Aggregates by Background Characteristics/Percentage of Population Aged “10 and above” and “15 and above” who worked previously by Industry Backgrounds

Industry	Population aged 10 and above who worked previously			Population aged 10 and above who worked previously		
	Jonglei	Lakes	Central Equatoria	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka	Bor South	Awerial	Terekeka
Agriculture, forestry, fishing and mining	67.1	55.2	51.9	68.2	57.9	51.4
Manufacturing	0.3	0.5	1.9	0.3	0.5	2.1
Construction and utilities supply	0.2	0.8	2.2	0.2	0.7	2.3

Industry	Population aged 10 and above who worked previously			Population aged 10 and above who worked previously		
	Jonglei	Lakes	Central Equatoria	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka	Bor South	Awerial	Terekeka
Wholesale, retail trade, and repair of motor vehicles	9	5.5	7.8	8.9	4.9	7.8
Accommodation, food service, transportation and storage	0.7	0.5	1.9	0.2	0.5	1.9
Other service and professional/technical activities	1.3	1.9	5.1	1.4	1.5	5.3
Public administration and defense; compulsory social security	6.7	6.2	8.6	5.8	7.2	9.5
Education, health and social work	4	3.5	5.4	4.6	4.1	6
Household production for own use/Domestic personnel	10.9	26	15.2	10.4	22.8	13.6
Total	**100**	**100.1**	**100**	**100**	**100**	**100**

Source: 5th Sudan Population and Housing Census, 2008

4.4.7 Livelihood Activities

Basic livelihood activities in South Sudan primarily include subsistence agriculture, livestock rearing, fishing, and informal trade. Most of the population depends on small-scale farming of crops such as sorghum and maize, as well as raising cattle, goats, and sheep for food and economic security. Fishing is also crucial in regions near rivers and lakes, while informal markets support local trade. However, these activities are constrained by ongoing conflict, climate challenges, and underdeveloped infrastructure.

Moreover, as per the 5th Sudan Population and Housing Census of 2008 livelihood options in Jonglei, Lakes, and Central Equatoria states of the project area subsistence crop farming is the primary livelihood in all regions, especially in Lakes (85.3%) and Jonglei (75.4%). Central Equatoria shows comparatively more income diversity with a contribution from wages and salaries (17.4%) and owned business enterprises (9.8%). Subsistence animal husbandry is more common in Jonglei (9%) compared to Lakes (5.7%) and Central Equatoria (1.8%). Property income, remittances, pensions, and humanitarian aid are minor sources across all regions, with Central Equatoria having slightly higher remittances (3%). This data highlights the reliance on agriculture in Lakes and Jonglei, while Central Equatoria has a more varied economic structure.

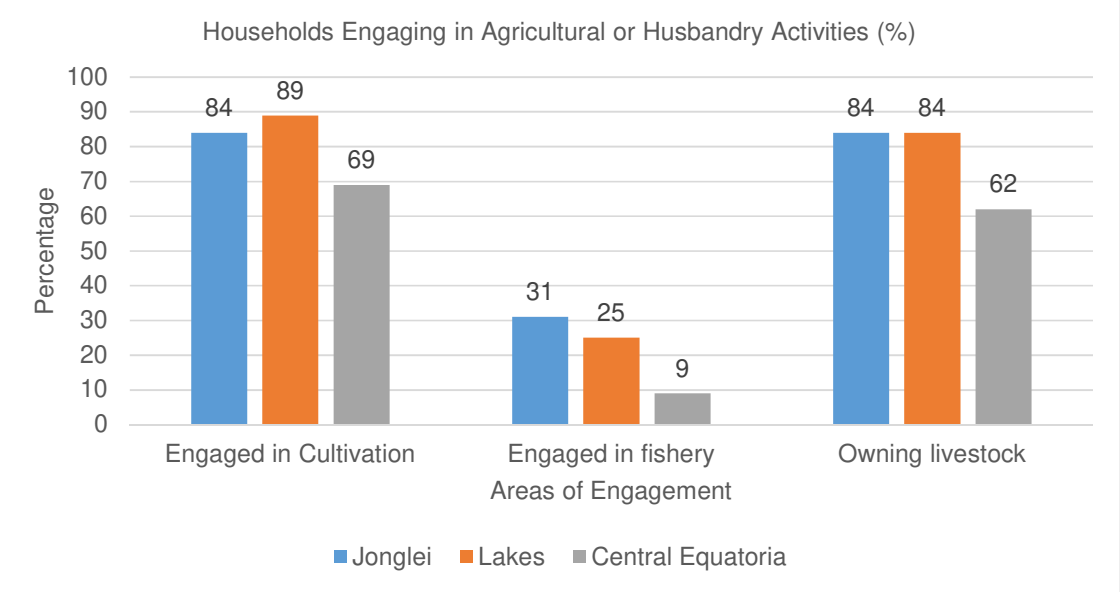
Table 4-20: Livelihood Activities

Livelihood Options	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka
Subsistence Crop Farming	75.4	85.3	64.6
Subsistence Animal Husbandry	9	5.7	1.8
Wages and Salaries	5.8	3.6	17.4
Owned Business Enterprise	4.7	2.5	9.8
Property Income	0.6	2.3	1.4
Remittances	0.9	0.1	3
Pension	0.2	0.1	0.6
Humanitarian Aid	3.4	0.5	1.4
Total	**100**	**100**	**100**

Source: 5th Sudan Population and Housing Census, 2008

In Jonglei, 84% of households are engaged in cultivation and have livestock ownership, with 31% involved in fishery. Lakes show the highest engagement in cultivation (89%) and similar livestock ownership (84%), but lower fishery involvement (25%). Central Equatoria has the lowest engagement in cultivation (69%) and fishery (9%), with 62% owning livestock (Figure 4-27). This data highlights the reliance on cultivation and livestock across all states, with significant variation in fishery activities, particularly low in Central Equatoria.

Figure 4-27: Households Engaging in Agricultural or Husbandry Activities



Source: 5th Sudan Population and Housing Census, 2008

Table 4-21 presents the tenure status of land used for cultivation. In Jonglei, 90.6% of the land is owned, 0.9% is rented, 2.5% is partially owned, and 5.9% is communal. Lakes show a higher percentage of owned land at 94%, with the same rental and partial ownership rates as Jonglei, but a lower communal land percentage at 2.6%. Central Equatoria has 89.4% owned land, the lowest among the three, with 0.6% rented, the highest partial ownership at 5.6%, and 4.4% communal land. This data highlights the

predominance of owned land for cultivation across all states, with Lakes having the highest ownership rate and Central Equatoria showing slightly higher diversity in land tenure types.

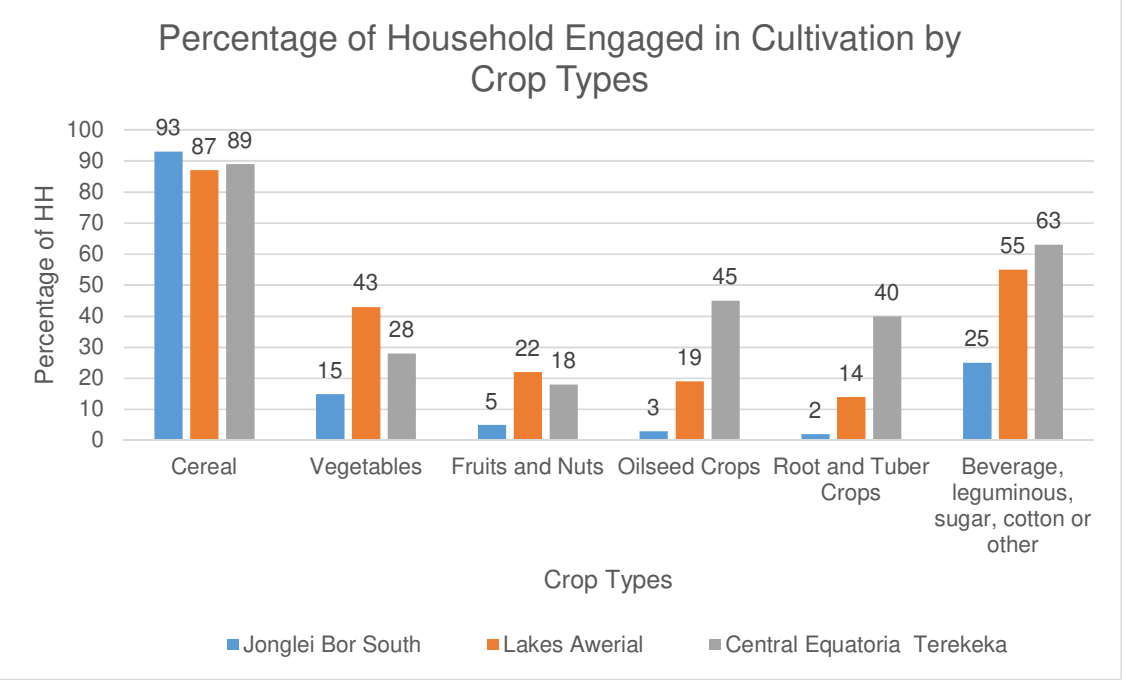
Table 4-21: Tenure Status of Land Used for Cultivation (%)

State	County	Owned	Rented	Partially owned	Communal	Total
Jonglei	Bor South	90.6	0.9	2.5	5.9	100
Lakes	Awerial	94	0.9	2.5	2.6	100
Central Equatoria	Terekeka	89.4	0.6	5.6	4.4	100

Source: 5th Sudan Population and Housing Census, 2008

Figure 4-28 presents the percentage of households engaged in various types of cultivation across three states. In Jonglei, 93% of households cultivate cereals, with lower engagement in vegetables (15%), fruits and nuts (5%), oilseed crops (3%), root and tuber crops (2%), and a combined category (25%). Lakes show more diversification, with 87% cultivating cereals, 43% vegetables, 22% fruits and nuts, 19% oilseed crops, 14% root and tuber crops, and 55% in the combined category. Central Equatoria has significant engagement in oilseed crops (45%) and root and tuber crops (40%), with the highest 89% cultivating cereals, 28% vegetables, 18% fruits and nuts, and 63% in the combined category. This data highlights the varying agricultural focuses and diversification levels across the regions, indicating different economic priorities and agricultural practices.

Figure 4-28: Household Engaged in Cultivation by Crop Types



Source: 5th Sudan Population and Housing Census, 2008

Table 4-22 presents data on livestock ownership across three regions: Bor South (Jonglei), Awerial (Lakes), and Terekeka (Central Equatoria). In Bor South, 75% of households own cattle with an average of 52 cattle per household. Sheep ownership is at 45% with an average of 37 sheep, and 61% own goats with an average of 32 goats. Poultry ownership is lower at 32%, with an average of 27 poultry. Awerial shows 65% cattle ownership with an average of 29 cattle, 43% sheep ownership with 12 sheep on average, and 67% goat ownership with 13 goats on average. Poultry ownership is higher at 52%, with an average of 12 poultry. Terekeka has the lowest cattle ownership at 26%, with an average of 27

cattle, 24% sheep ownership with 17 sheep on average, and 52% goat ownership with 14 goats on average. Poultry ownership is 47%, with an average of 10 poultry. Ownership of camels, pigs, horses, or donkeys is minimal across all regions.

Table 4-22: Percentage of Households with Animal Type and Average Holdings of Those Households with Each Animal

Animal Type and Ownership	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka
Percentage of households owning cattle	75	65	26
Mean number of cattle for households owning cattle	52	29	27
Percentage of households owning sheep	45	43	24
Mean number of sheep for households owning sheep	37	12	17
Percentage of households owning goats	61	67	52
Mean number of goats for households owning goats	32	13	14
Percentage of households owning poultry	32	52	47
Mean number of poultry for households owning poultry	27	12	10
Percentage of households owning camels, pigs, horses or donkeys	2	3	2

Source: 5th Sudan Population and Housing Census, 2008

The main livelihood activities in the proposed project area currently include small and large-scale trading of dried or salted fish, working as porters, fishing, operating small vending businesses, loading and unloading goods, working as boat operators, and providing transportation services as boda boda (motorcycle) riders.

4.4.8 Sources of Drinking Water

According to official statistics, 55% of households in South Sudan have access to improved drinking water sources. This includes sources such as protected wells, boreholes, and piped water systems. However, the functionality and reliability of these water sources can vary, with many communities facing challenges in maintaining consistent access[18].

As per the 2010 Southern Sudan Household Survey, the overall access levels to safe water and improved sanitation in South Sudan are 67.7% and 14.6% respectively. However, 30-50% of the existing drinking water facilities are non-functional. This translates to a low coverage rate of about 40%. Further, according to the definition of access to improved sources of water by WHO, which recommends 30 minutes for a round trip to collect water, the access decreases to approximately 34%.

However, focusing on the project areas, Table 4-23 shows that the highest percentage of the population has access to improved water sources in Awerial (78.3%) followed by the population of Bor South (62%) and Terekeka (41.3%). Data further showed that “Hand Pump” was the source of drinking water for the highest percentage population in Bor South (57.4%) and Awerial (72.4%). In Terekeka, several sources of water almost equally served the people.

[18] South Sudan Development Plan (mofep-grss.org) https://www.mofep-grss.org/wp-content/uploads/2013/08/RSS_SSDP.pdf

Table 4-23: Percentage of People Having Access to Improved Water Sources

Access to Water	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka
Proportion of households with access to the improved water source	62	78.3	41.3
Sources of Water			
Mechanical borehole or filtering station	4.6	5.9	20.5
Hand pump	57.4	72.4	20.7
Sand Filter with common network	0.7	0.1	0.9
Shallow Well (dug well)	6.7	13	21.1
Hafeer/Dam (with or without filter)	1.9	1.7	1.4
River or still water	26.6	4.4	30.4
Water Vendor	2.2	2.5	4.8
Total	**100**	**100**	**100**

Source: Southern Sudan Household Survey, 2010

4.4.9 Dwelling Pattern

The dwelling patterns in South Sudan are shaped by cultural norms, economic factors, and historical practices. Traditional households are often large and multigenerational, reflecting the cultural importance of having many children. The types of dwellings vary based on location and resources. In rural areas, traditional huts made from mud, thatch, or grass are common, while urban areas feature more modern housing like brick houses and concrete buildings. Pastoralist communities, which frequently migrate, rely on temporary tents. Extended families in rural regions often live in compounds, with separate huts or rooms for different households within the same family unit.

This mix of traditional and modern living arrangements illustrates the diverse socio-economic landscape of South Sudan, with influences from both cultural traditions and contemporary challenges.

As per the 5th Sudan Population and Housing Census of 2008, Table 4-24 provides an overview of the types of housing in three States of South Sudan: Jonglei, Lakes, and Central Equatoria of the project area. Tukul/Gottiya of Mud is the predominant housing type, especially in Central Equatoria (64.7%) and Jonglei (61.9%), followed by 51.7 (51.7%). These traditional mud houses are a staple in the region, reflecting the local building practices and materials. In contrast, Multi-Storey houses are rare and only mentioned in Lakes State at 0.1%.

The data highlights the predominance of traditional housing types, particularly Tukul/Gottiya of Mud and Sticks, across all three states. Modern housing types like flats, apartments, and villas are rare, indicating limited urban development. The variations in housing types across the regions reflect differences in local building practices, materials, and possibly economic conditions. This information is crucial for planning housing and infrastructure development tailored to the needs and resources of each region.

Table 4-24: Dwelling Pattern (in Percentage)

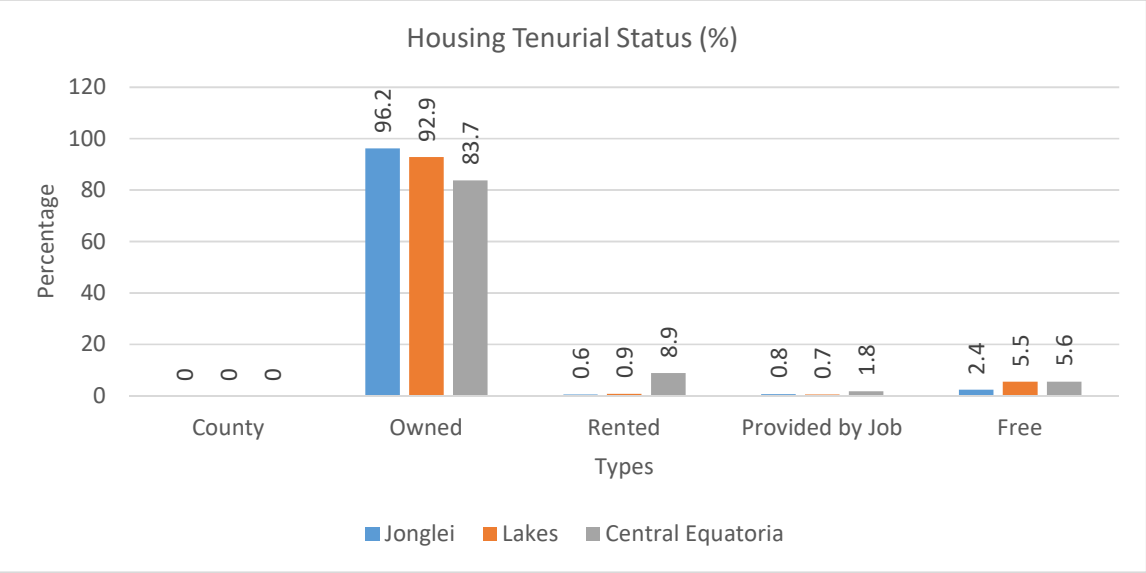
Dwelling Pattern	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka
Tent	0.5	0.8	1.8
Dwelling of Straw Mats	1.2	1	1.4

Dwelling Pattern	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka
Tukul/Gottiya of Mud	61.9	51.7	64.7
Tukul/Gottiya of sticks	18.2	21.9	17
Flat or Apartment	0.1	0.4	0.6
Villa	0.1	0.1	0.1
House of one Floor, Mud	2.6	14	8.1
House of One Floor, Brick/concrete	0.2	3.4	3.9
House constructed of Wood	14.9	6.1	2.1
Multi-storey house	0	0.1	0
Incomplete	0.4	0.6	0.4
Total	**100**	**100**	**100**

Source: 5th Sudan Population and Housing Census, 2008

Figure 4-29 provides a breakdown of housing tenure in three states of South Sudan: Jonglei, Lakes, and Central Equatoria. The vast majority of households in all three states such as Jonglei (96.2%), Lakes (92.9%), and Central Equatoria (83.7%) own their homes. The data highlights a strong preference for homeownership across all three states, with Jonglei having the highest percentage of owned homes. Central Equatoria shows more diversity in housing tenure compared to the other two regions, with a mentionable presence of rented and employer-provided housing. The presence of free housing is notable in Lakes and Central Equatoria.

Figure 4-29: Housing Tenure Status by Region



Source: 5th Sudan Population and Housing Census, 2008

4.4.10 Lighting and Energy Sources

A recent study reveals that only 5.4% of South Sudan's population has access to electricity, reflecting a slight improvement from 4.2% in 2017. Despite this, most households-94.7%-lack any access to electricity. Additionally, only 1.8% are connected to mini-grids, while a mere 0.03% use diesel

generators. These figures highlight the country's severe energy infrastructure challenges, particularly in rural areas, where electrification is almost nonexistent[19].

However, as per the 5th Sudan Population and Housing Census of 2008, Table 4-25 provides a detailed breakdown of the lighting sources used in three states of South Sudan: Jonglei, Lakes, and Central Equatoria project area. Firewood is the most common lighting source in Jonglei (53.7%) and Lakes (37.9%), while Central Equatoria has a lower usage rate of this (21.1%). The common source in Central Equatoria is Paraffin Lamp (49.45). On the other hand, a mentionable portion of households in Lakes (32.2%), Jonglei (17.1%), and Central Equatoria (3.45%) have no lighting, indicating limited access to any form of artificial light. The limited use of modern lighting sources like public electricity and solar power indicates the need for improved infrastructure and access to sustainable energy solutions in these regions.

Table 4-25: Lighting Sources by Regions (in Percent)

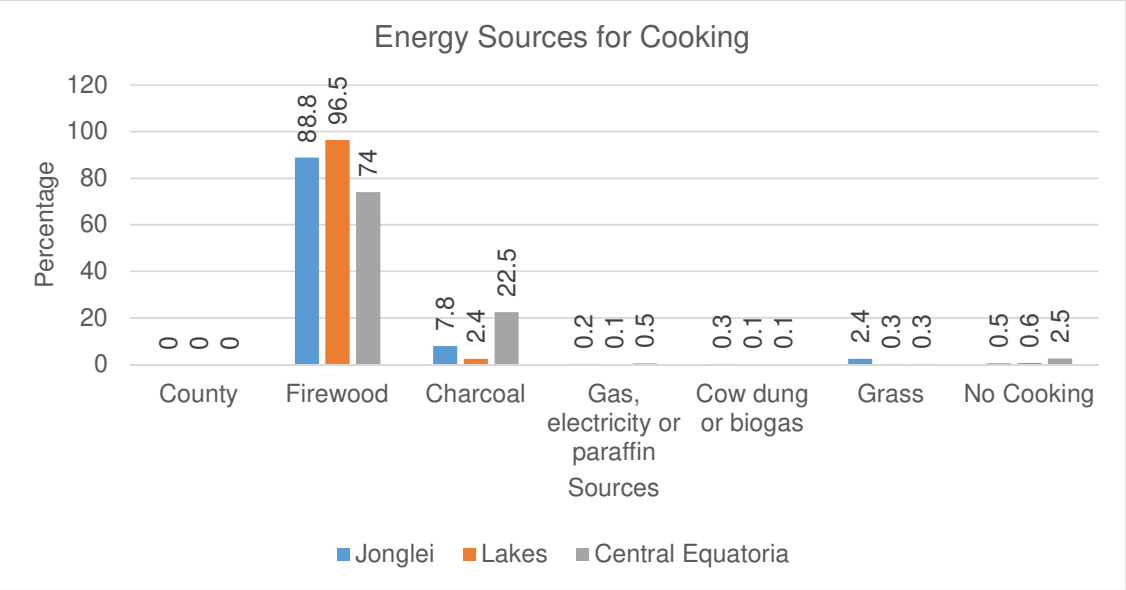
Lighting Sources	Jonglei	Lakes	Central Equatoria
	Bor South	Awerial	Terekeka
No Lighting	17.1	32.2	3.4
Public Electricity	0.3	0	2.7
Generator	1.4	2.4	2
Gas	0.6	0.3	0.1
Paraffin Lantern	0.5	0.9	4.5
Paraffin Lamp	5.2	4.6	49.4
Firewood	53.7	37.9	21.1
Grass	15	17.6	11.6
Candle Wax	5	2.8	4.8
Solar Power	1.1	1.4	0.4
Total	**100**	**100**	**100**

Source: 5th Sudan Population and Housing Census, 2008

The percentage of households in Southern Sudan using solid fuels is 98% indicating a high dependency on solid fuels. Figure 4-30 provides a detailed breakdown of the primary cooking fuels used in three states of South Sudan: Jonglei, Lake), and Central Equatori). Data shows that firewood is the most common energy source in all regions such as Lakes (96.5%), Jonglei (88.8%), and Central Equatoria (74%). However, the data highlights a predominant reliance on traditional fuels like firewood and charcoal for cooking across all three states. Firewood is comparatively the most common fuel, especially in Lakes. Central Equatoria shows a higher usage of charcoal compared to the other regions. The minimal use of modern fuels like gas, electricity, or paraffin indicates limited access to these resources.

[19] Pathways to Electricity Access Expansion in South Sudan: Off-Grid and Mini-Grid Market Assessment

Figure 4-30: Main Sources of Energy for Cooking



Source: 5th Sudan Population and Housing Census, 2008

4.4.11 Sanitation Facilities

The water, sanitation, and hygiene (WASH) situation in South Sudan remains critical, with only 41% of the population having access to basic water supply and just 11% with basic sanitation coverage. Additionally, 63% of the population still practices open defecation, according to the 2019 UNICEF-WHO Joint Monitoring Programme.

According to the 2008 Sudan Population and Housing Census, only 24% of households in South Sudan had sustainable access to improved sanitation, such as pit latrines or flush toilets. This means that nearly three-quarters of the population still lacked basic sanitation facilities. Focusing on the project area, a breakdown of sanitation facilities across three regions highlights significant disparities. In Lakes, 85.7% of the population lacked access to any toilet facilities, while 77.9% of households in Jonglei and 43.2% in Central Equatoria also faced similar challenges. Notably, Central Equatoria demonstrated better access to private and shared pit latrines as well as modern sanitation options, whereas Jonglei and Lakes had a much higher percentage of households without any toilet facilities. This variation underscores regional differences in access to sanitation infrastructure.

Table 4-26: Main Type of Toilet

States	County	Pit Latrine Private	Pit Latrine Shared	Flush Toilet Private	Flush Toilet Shared	Bucket Toilet	No Toilet Facility	Total
Jonglei	Bor South	16.1	5.7	0	0	0.3	77.9	100
Lakes	Awerial	10	4.1	0.1	0	0	85.7	100
Central Equatoria	Terekeka	37.1	18.6	0.9	0.1	0	43.2	100

Source: 5th Sudan Population and Housing Census, 2008

4.4.12 Gender and Gender-Based Violence

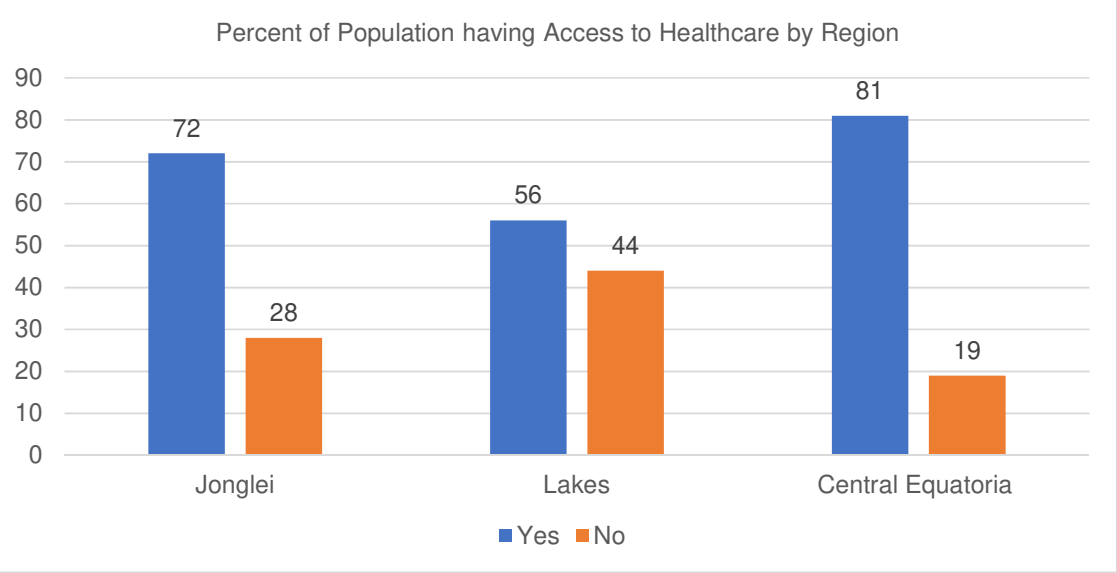
Gender-based violence (GBV) in South Sudan is a pervasive issue, deeply rooted in the country's prolonged conflict and socio-cultural norms. Approximately 65% of women in South Sudan experience

some form of GBV, including child marriage and sexual violence[20]. The ongoing conflict has exacerbated these issues, making women and girls particularly vulnerable. Efforts by organizations like UNICEF and the United Nations aim to address GBV through prevention, response, and risk mitigation services[21]. These initiatives include providing psychosocial support, skills-building courses, and safe spaces for women and girls. Despite these efforts, challenges such as floods, food insecurity, and social stigma continue to hinder progress[22]. Comprehensive strategies involving community engagement, education, and policy reforms are essential to combat GBV and support survivors in South Sudan.

4.4.13 Community Health

According to Figure 4-31, in Jonglei, 72% of the population has access to health care, while 28% do not. In Lakes, 56% have access, and 44% do not. Central Equatoria shows the highest access rate, with 81% of the population having access to health care and only 18% without. This data highlights regional variation in healthcare access, with Central Equatoria being the most well-served and Lakes having the highest percentage of the population without access to healthcare.

Figure 4-31: Percent of Population Having Access to Healthcare by Region



Source: Statistical Yearbook for Southern Sudan, 2010

4.4.14 Vulnerable Peoples

Recent vulnerability data for South Sudan shows that significant portions of the population are affected by multiple stressors. As of 2024, about 46% of the population, or 5.83 million people, face acute food insecurity, largely driven by climate shocks (such as floods and droughts), the ongoing economic crisis, and continued conflict. Some areas, like Jonglei and Unity States, are particularly hard-hit, with more than 50% of their populations facing high levels of food insecurity[23].

Vulnerabilities in areas such as Juba and Bor are similarly driven by these factors, with displaced populations, including returnees from Sudan, exacerbating the crisis. Children and women are especially vulnerable to malnutrition, and the lack of stable economic opportunities increases the risk of gender-based violence and other forms of exploitation.

[20] https://www.undp.org/south-sudan/stories/govt-un-donors-elevate-awareness-and-response-gender-based-violence-south-sudan
[21] https://www.unicef.org/southsudan/media/7646/file/GBV%20Briefing%20note_2021%20Q1_FINAL.pdf%20.pdf
[22] https://www.unicef.org/southsudan/media/7646/file/GBV%20Briefing%20note_2021%20Q1_FINAL.pdf%20.pdf
[23] https://fscluster.org/south-sudan-rep/document/south-sudan-ipc-finding-202324

In the context of the port development project in Bor and Juba, vulnerable groups, as defined by the World Bank, would include communities and individuals who are at risk of facing disproportionate negative impacts due to their socio-economic circumstances. These could include low-income populations reliant on informal economic activities, women, especially in patriarchal settings who are at risk of gender-based violence or economic exclusion, children, the elderly, and people with disabilities who may struggle to adapt to displacement or loss of livelihoods. Internally displaced persons (IDPs) in South Sudan are also particularly vulnerable, as they often lack secure land rights and access to services. The port development could exacerbate these vulnerabilities by displacing communities, disrupting informal economic activities, or limiting access to essential resources. Therefore, tailored support, such as livelihood restoration programs and protection from exploitation, will be essential to mitigate the adverse effects on these vulnerable groups.

4.4.15 Ecosystem services

Jonglei, Lakes, and Central Equatoria provide crucial ecosystem services, including water filtration, flood regulation, and habitat for diverse wildlife. These regions support fisheries, agriculture, and pastoralism, which are vital for local livelihoods. Additionally, they offer recreational and cultural benefits, enhancing community well-being. However, environmental degradation and climate change pose significant threats to these ecosystem services, jeopardizing food security and economic stability for the populations relying on them.

4.4.16 Tourist Spot/Tourism

Jonglei, Lakes and Central Equatoria are emerging as attractive tourist spots, offering stunning natural landscapes, rich biodiversity, and cultural experiences. Key attractions include fishing, birdwatching, and eco-tourism activities centered around the lakes. Cultural interactions with local communities provide visitors with insight into traditional practices and lifestyles. Additionally, the region's unique wildlife and scenic views contribute to its appeal to nature enthusiasts. However, tourism development faces challenges such as infrastructure limitations and security concerns.

4.4.17 Cultural Sites

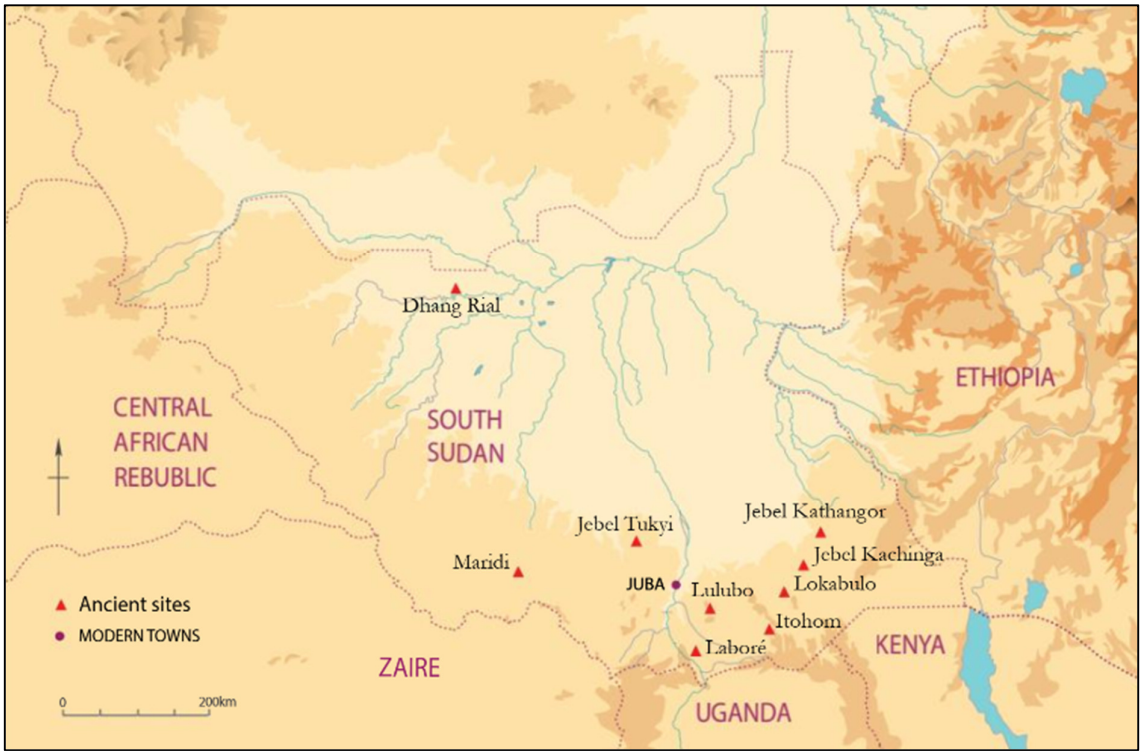
Jonglei, Lakes, and Central Equatoria are home to several cultural sites that reflect the rich heritage of South Sudan. These include traditional villages showcasing local crafts, ancient burial grounds, and significant historical landmarks. The region’s diverse ethnic groups, such as the Dinka and Nuer, contribute to a vibrant cultural landscape, with practices like dance, music, and storytelling playing key roles in community life. Preservation of these cultural sites is vital for maintaining the identity and history of the local populations.

In terms of the proposed project, the Bor port area consists of 3 graves which will be impacted by the intervention of the proposed project at the Bor port area.

4.4.18 Archaeological Sites

Archaeological sites such as Lulubo, Labore, Jebel Tukyi, Itohom, Lokabulo, Jebel Kachinga, Jebel Kathangor, Dhang Rial, and Maridi are located in South Sudan. Lulubo is the nearest archaeological site from the project site which is located approximately 80 km southeast of Juba and Jebel Tukyi is located approximately 110 km northwest of Juba. A map showing the archaeological sites in South Sudan is given in Figure 4-32.

Figure 4-32: Location of Archaeological Sites in South Sudan



Source: https://issuu.com/sudarchrs/docs/s_n18_davies_m

4.4.19 UNESCO World Heritage Sites

As of now, there are no UNESCO World Heritage Sites specifically designated in Jonglei, Lakes, or Central Equatoria. However, the region is rich in cultural and natural heritage, making it a potential candidate for future designation. The local biodiversity, traditional lifestyles, and cultural practices highlight the importance of preserving these areas.

5 ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

5.1 Impact Assessment Methodology

The impact assessment has involved the prediction, evaluation, and mitigation of impacts and reporting on impacts including residual impacts and cumulative impacts. The main environmental and social impact assessment steps are summarized below and comprise:

- **Potential Impact Prediction:** determination of what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- **Impact Evaluation:** evaluation of the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value, and/or importance of the affected resource/receptor.
- **Mitigation and Enhancement Measures:** identification of appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual Impact Evaluation:** evaluation of the significance and scale of the environmental impacts predicted to remain after the application of mitigation measures.

5.1.1 Potential Impact Prediction

Prediction of environmental and social impacts is the most important component in the impact assessment study as it provides quantitative information on likely environmental impacts from a project well in advance. The diverse range of potential impacts considered in the impact assessment process typically results in a wide range of prediction methods being used, including quantitative, semiquantitative, and qualitative techniques.

5.1.2 Impact Evaluation

Once the identification of potential impacts is completed, each potential impact is described in terms of its various relevant characteristics (e.g., nature, extent, duration, intensity/severity, irreplaceable loss of resources, and probability).

5.1.2.1 Nature of Impacts

The nature of impact is an assessment of the type of effect the activity is likely to have on the surrounding affected environment. The description includes what is being affected and its magnitude. The nature of the impact will be classified as positive or negative and direct, indirect, and induced.

Direct	Potential/possible Impacts will be generated directly from the project activities and their associated facilities which are directly linked with the project. (e.g., loss of land due to project development or air emission)
Indirect	Potential/possible Impacts will be generated from secondary sources which are induced by the project activities. (e.g., loss of any species' habitat due to the project activities)
Cumulative	Impacts that act together with other impacts (including those from concurrent or planned future third-party activities) to affect the same resources and/or receptors as the Project.

5.1.2.2 Extent and Location of Impacts

Extent and location indicate the spatial area that may be affected by the proposed project activities or its associated facilities (Table 5-1).

Table 5-1: Geographical Extent of the Impact

Extent	Description
Project Site (1)	Potential/possible Impacts' area only at or within the project site/project boundary
Local (2)	Potential/possible Impacts' area is not only limited to the site but also its immediate surrounding areas/receptors.
Regional (3)	Potential/possible Impacts area extends to the immediate surrounding areas along with adjacent areas.
National (4)	Potential/possible Impacts area considered at the national level.
Transboundary (5)	Impact is considered not only at the national level but also within the neighboring country. Impact is considered at a global level.

5.1.2.3 Duration of Impacts

Duration measures the lifetime/existence/continuation of the impact (Table 5-2).

Table 5-2: Duration of Impact

Duration	Description
Short Term (1)	Potential/possible Impact duration is a very limited time or length of construction/ decommissioning period.
Medium-Term (2)	Potential/possible Impact duration will continue after the construction period but stop/discontinue/cease within a tenure of 10 years.
Long Term (3)	Potential/possible Impact duration will continue for more than 10 years or the entire operational life of the project.
Permanent Mitigated (4)	Potential/possible Impact will remain after the operational life of the project, but appropriate mitigation measures reduce the impact.
Permanent-No Mitigation (5)	Potential/possible Impact will remain after the operational life of the project. No mitigation measures will reduce the impact after implementation.

5.1.2.4 Intensity/Severity of Impacts

Intensity/severity is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts (Table 5-3).

Table 5-3: Intensity of Impact

Intensity	Description
Insignificant (1)	Changes due to Potential/possible impact are minor, not visible/ noticeable, natural functioning of the environment is not affected.
Low (2)	Natural functioning of the environment is minimally affected. Natural, cultural, and social functions and processes can be reversed to their original state if mitigation measures are taken.
Medium (3)	Environment remarkably distorted/disturbed/impacted, still functions, if in a modified way. Negative impacts cannot be fully reversed.
High (4)	Cultural and social functions and processes are distorted/ disturbed/ impacted.

Intensity	Description
	Potentially ceasing to Environmental function temporarily. Negative impacts cannot be fully reversed.
Very High (5)	Natural, cultural, and social functions and processes permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected. Negative impacts cannot be reversed.

5.1.2.5 Potential for Irreplaceable Loss of Resources

The potential for irreplaceable loss of resources is the degree to which the project will cause a loss of irreplaceable resources (Table 5-4).

Table 5-4: Potential for Irreplaceable Loss of Resources

Potential for irreplaceable loss of resources	Description
Low (1)	No Irreplaceable/unique resources will be impacted.
Medium (3)	Irreplaceable/unique resources can be replaced, with mitigation measures/efforts and will be replaced after a certain period of time.
High (5)	Potential/possible Impact replaces a particular/vulnerable resource.

5.1.2.6 Probability

Probability is the likelihood or the chances that the impacts will occur (Table 5-5).

Table 5-5: Probability of Impact

Probability	Description
Unlikely (1)	Under normal conditions, no potential/possible impact is expected.
Low (2)	The probability of the impact occurring is low due to its design or historic experience.
Medium (3)	There is a distinct probability of the impact occurring.
High (4)	It is most likely that the impact will occur.
Definite (5)	The impact will occur regardless of any prevention measures.

5.1.2.7 Magnitude

The magnitude is calculated as extent + duration + intensity + potential impact on irreplaceable resources.

Magnitude essentially describes the intensity of the change that has the potential to occur in the resource/receptor as a result of the potential impact. The magnitude designations themselves are universally consistent, but the definitions for these designations vary depending on the resource/receptor.

In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the ESIA to indicate that the project has the potential to result in a potential positive impact, without characterizing the exact degree of positive change that may occur.

5.1.2.8 Significance

The significance will be rated by multiplying the consequence of the impact and the probability of occurrence (i.e., Magnitude × Probability = Significance) (Table 5-6).

Table 5-6: Significance of Issues

Significance	Description
Positive Impact	• Potential impacts that have a beneficial impact on affected media.
Very Low (4-14)	• No action is required. • Potential impacts that are practically indistinguishable from the social baseline, with little to no potential impacts to or concerns from affected external stakeholders. • No impact on the public.
Low (15-29)	• Impacts are within the acceptable range. • Potential impacts such as localized or short-term effects on habitat, species, or environmental media. • Potential impacts that are short-term nuisance or inconvenience; potentially affected external stakeholders concerned but likely able to adapt with relative ease. • Potential illness or adverse effect with limited or no impacts on the ability to function and medical treatment is limited or not necessary.
Medium-Low (30-44)	• Impacts are within the acceptable range but should be mitigated to lower significance levels wherever possible. • Potential impacts such as localized, long-term degradation of sensitive habitat or widespread, short-term impacts on habitat, species, or environmental media. • Potential impacts such as localized or short-term effects. • Potentially affected stakeholders are concerned but likely able to adapt with relative ease. • Potential illness or adverse effects with mild to moderate functional impairment requiring medical treatment or management.
Medium-High (45-59)	• Potential impacts are significant and require attention. • Mitigation is required to reduce the negative impacts to acceptable levels. • Potential impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species, or environmental media. • Potential impacts such as local-to-regional or medium-term effects. • Potentially affected stakeholders are concerned and raised the issue as a high priority but may be able to adapt with some targeted support or assistance. • Potential serious illness or severe adverse health effects requiring a high level of medical treatment or management.
High (60-80)	• Impacts are of great importance, and mitigation is crucial. • Potential impacts such as significant, widespread, and persistent changes in habitat, species, or environmental media. • Potential impacts such as persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species. • Potential/possible impacts such as local-to-national or long-term effects; potentially affected stakeholders concerned and raised as a high priority; may not be able to adapt without targeted support or assistance to maintain a preimpact livelihood. • Potential serious illness or chronic exposure of a few resulting in life-shortening effects.

Significance	Description
Very High (81-100)	• Impacts are unacceptable. • Potential impacts such as loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale. • Potential impacts such as local-to-global or irreversible long-term effects; potentially affected stakeholders concerned raised the issue as a high priority and are likely not able to adapt without targeted support or assistance. • Potential/possible serious illness or chronic exposure of many resulting in life-shortening effects.

5.1.3 Mitigation and Enhancement Measures

Once the significance of an impact has been characterized, the next step is to evaluate what mitigation and enhancement measures are defensible. These are commonly incorporated into the project as commitments. Mitigation is aimed at preventing, minimizing, or managing significant negative impacts to as low as practicable and optimizing and maximizing any potential benefits of the project, where applicable.

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated project activities) and then to address the resultant effect on the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude.

5.1.4 Residual Impact Assessment

Once mitigation and enhancement measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures.

5.1.5 Cumulative Impacts

Cumulative impacts result from the combination of an impact from the project with an impact from another activity/project. How the impacts and effects are assessed is strongly influenced by the status of the other activities (e.g., already in existence, approved, or proposed) and how much data is available to characterize the magnitude of their impacts.

The approach for assessing cumulative impacts is to screen potential interactions with other projects based on:

- Projects that are already in existence and are operating.
- Projects that are approved but not as yet built or operating.
- Projects that are a realistic proposition but are not yet built.

5.2 Impact Identification and Evaluation

The potential impacts have been identified through a systematic process whereby the activities associated with the project have been considered with respect to their potential to interact with environmental and social resources or receptors.

The interaction matrix enables a methodical identification of the potential interactions each project activity may have on the range of resources/receptors within the area of influence i.e., the study area of the project. The interaction matrix for the project activities and likely impacted resources/receptors is presented in Table 5-7.

Table 5-7: Impact Identification Matrix for the Proposed Project

Project Phase and Activities	Environmental and Social Attributes/Resources/Receptors																								
	Topography	Ambient Air Quality	Ambient Noise Level	Surface water quality	Groundwater Quality	Soil Quality	Land Use/Resources	Hydrology and Drainage	Aesthetic & Visual Impact	Vegetation/Terrestrial Flora	Fish Fauna	Avifauna	Herpetofauna	Terrestrial Mammals	Aquatic Flora	Aquatic Mammals	Demographic Changes	Economy and Employment	Physical & Economic displacement	Occupational Health and Safety	Community Health and Safety	Traffic (Road & Boat)	Labor Influx	Social infrastructures & services	Cultural Resources
Pre-construction/Planning and Design Phase																									
Preliminary survey and study i.e., bathymetric survey, soil investigation, topography survey, and ESIA study		■	■	■														■		■		■	■		
Land acquisition and resettlement of existing communities							■										■	■	■					■	■
Obtaining required permits/licenses/no objections																		■							
Appointment of EPC Contractor																		■							
Preparation of detailed design and layout requirements																		■		■					
Construction Phase																									
Site clearance and site preparation	■	■	■	■	■	■	■	■	■	■								■		■	■	■	■		
Setting up of site office, workers camp, and operation of camp, workers facilities, laydown area, etc.	■	■	■	■			■		■											■	■				
Transportation of construction materials and storage to the project site		■	■									■	■	■				■		■	■	■	■		
Construction work to include civil work, mechanical, and electrical works for the development of the river port		■	■	■		■		■	■	■	■	■	■				■	■		■	■	■	■		
Civil work for the construction and development of access roads		■	■						■								■	■		■	■	■	■		
Clearing (dredging) in the river and transportation & disposal of dredge materials	■	■	■	■				■	■		■	■	■		■	■	■	■		■	■	■	■		
Operation of Diesel generator set		■	■																	■					
Solid waste handling and disposal		■																		■	■				
Sewage generation and handling				■	■															■	■				
Storage and handling of hazardous waste (fuel, oil, grease) and handling				■		■														■	■				
Maintenance & Replacement of dredgers, equipment, machinery, etc.				■	■						■				■	■		■		■					

Removal of construction machinery and labor camp		■	■				■		■								■						■		
Operation and Maintenance Phase																										
Operation of the port and access roads		■	■	■							■	■	■	■		■	■	■		■	■	■	■	■		
Transportation of materials/products		■	■														■	■			■	■	■			
Generation of solid waste and management				■		■														■	■					
Generation of liquid waste and management				■	■															■	■					
Storage and handling of fuels and chemicals				■	■															■	■					
Decommissioning and Dismantling Phase																										
Remove and disposal of surface structures				■		■	■	■	■										■		■	■		■		
Movement of vehicles, equipment, and personnel		■	■	■								■	■	■								■	■	■		
Storage and handling of fuels and chemicals				■	■	■														■	■					
Treatment and disposal of wastes				■	■		■													■	■					
Reinstatement and restoration of the affected sites	■							■	■										■		■	■	■			

5.3 Positive Impacts

5.3.1 Pre-construction/Planning and Design Phase

5.3.1.1 Employment Opportunities

During the pre-construction/planning and design phase, employment opportunities will be created in the form of skilled and unskilled persons in the local community to conduct different surveys and studies. A majority of unskilled and semiskilled workers will be sourced from the residents. Indirect employment will be in the form of suppliers and other forms of subcontracted works that will be required for the planning and design of project components.

There will be employment opportunities, especially for professionals such as engineers, surveyors, environmentalists, health and safety, public health experts, and sociologists among others. Those employed will improve their living standards from the fees they will be paid for their services.

5.3.1.2 Skills Transfer

During the pre-construction/planning and design phase, the local technical workforce will work with the experts. The process of working together will transfer design and planning tools and other useful guidelines. Technical and planning skills will also be gained by the local people that will be employed by the project, and this is likely to contribute to capacity building. Among them include local civil engineers who will be working with other civil experts with different expertise. There will be also knowledge of technology transfer among project employees.

5.3.2 Construction Phase

5.3.2.1 Employment Opportunities

During the construction phase, employment opportunities will be created in the form of skilled, semiskilled, and unskilled persons in the local community to conduct different construction activities. They will be economically benefited from the project and as expected, the project will provide a significant number of employment opportunities during the construction phase.

5.3.2.2 Small Business Opportunities

During the construction phase of the proposed project, business opportunities will be created for suppliers, subcontractors, and other small businesses such as food vendors, tea sellers, dry fish sellers, porters, boda-boda riders, etc. that may be set up near the contractor's facilities, construction sites, port area, access roads, and clearing (dredging) area.

5.3.2.3 Skills and Technology Transfer

During the construction phase of the port and access road development project, skills transfer plays a critical role in enhancing local capacity and fostering sustainable development. During the planning and design phases, local technical workers will collaborate closely with international and national experts in various fields, allowing for the exchange of valuable knowledge and practices. Through this collaboration, local workers will gain exposure to advanced design tools, planning methodologies, and industry-standard guidelines that are applicable not only to the project but also to other infrastructure developments in similar topographical and environmental conditions across the country.

This transfer of technical and planning skills will particularly benefit local civil engineers, who will have the opportunity to work alongside experienced professionals in different areas of expertise. By doing so, they will improve their understanding of advanced construction techniques, project management practices, and modern technological applications. This interaction will not only enhance the skillset of the local workforce but also contribute to the long-term capacity building of South Sudan's infrastructure sector. Additionally, the project will serve as a platform for technology transfer, equipping local workers with knowledge of new technologies and innovations that could be applied in future projects, thus promoting sustainability and self-reliance in the region's development initiatives.

5.3.2.4 Economic Growth

The construction phase of the proposed project will stimulate the local economy by increasing demand for construction materials, equipment, and services. Local businesses, including suppliers and service providers, are likely to benefit from this increased economic activity, leading to broader economic growth in the region and being considered as game changers of the economy of South Sudan.

5.3.2.5 Infrastructure Improvement

The construction of the port, access roads, and clearing (dredging) of the river will result in immediate improvements to transportation infrastructure as the necessary groundwork is laid. This process will enhance connectivity within the region by establishing key routes that facilitate the movement of construction materials and workers. The increased activity during the construction phase will also prompt upgrades to existing roads and pathways, improving their condition and capacity. These enhancements will lead to reduced travel times and lower transportation costs for local suppliers and businesses involved in the project, ensuring a smoother logistical flow. Additionally, the construction phase will provide opportunities for local communities to engage with improved transportation routes, making it easier for them to access markets, healthcare, and education during and after the project's implementation.

5.3.2.6 Social Infrastructure Development

The construction of the port and access roads will result in the influx of workers and resources during the construction phase can lead to improvements in social infrastructure, such as housing, transportation, and sanitation services, benefiting the local population and enhancing their living conditions.

5.3.3 Operation Phase

5.3.3.1 Improvement in the Navigability/Drainage of the River Channel

The clearing (dredging) of the river will result in the improvement of the navigability of the channels. At the same time, the catchment will be efficiently drained thereby reducing the incidence and frequency of floods.

5.3.3.2 Improvement in Road Network

There will be a great improvement in the port access road network in Juba and Bor river ports. The road network will improve accessibility between ports and communities, markets, farms, etc. in the state.

5.3.3.3 Increase in Fish Production and Economic Empowerment

As the majority of the population in the port area are fishermen, the provision of good road and river network in the area will lead to an increase in fisher production output as the road will ultimately facilitate easy access to farm inputs, extension services, primary and secondary (urban) markets. Improvement in fish productivity will translate to economic empowerment, poverty reduction, and socio-cultural wellbeing of the benefiting communities.

5.3.3.4 Enhanced Trade and Economic Growth

The operation of the port will serve as a vital hub for trade, facilitating the import and export of goods. This increased trade activity is likely to stimulate economic growth, attract new businesses, and create job opportunities in various sectors, boosting the local economy. Additionally, local businesses will benefit from increased market access, allowing them to expand their operations and reach new customers.

5.3.3.5 Improved Accessibility

The newly constructed access roads to the Juba port and the clearing (dredging) of the Nile River will significantly reduce travel times for residents, boatmen, and fishermen enhancing connectivity within

the region of South Sudan. Fishermen will get access to other parts of the river due to the clearing (dredging) of the river.

Enhanced accessibility will also enable better access to healthcare services, educational institutions, and other essential facilities, leading to improved health and educational outcomes for the community. Improved road infrastructure will facilitate the transportation of agricultural products to markets, boosting local farmers' income and reducing post-harvest losses.

5.3.3.6 Increased Revenue Generation

The operation of the port, access roads, and clearing (dredging) of the Nile River will generate a consistent flow of revenue for both local and national governments through tariffs, docking fees, and taxes on goods and services. This additional revenue can be reinvested in community infrastructure projects, healthcare, education, and social services, promoting overall regional development.

5.3.3.7 Employment Opportunities

The operation and maintenance phase of the proposed project will create permanent employment opportunities across multiple sectors, including port management, logistics, transportation, maintenance, and support services. These jobs will help lower unemployment rates and strengthen economic stability by offering reliable income sources to local families. Priority will be placed on hiring local residents, empowering them economically, and fostering the development of a skilled local workforce.

5.3.3.8 Capacity Building

Operations of the port, access road, and clearing the river will allow local workers to gain valuable experience and develop their skills in logistics, port operations, and transportation management. Training programs will take place to ensure that local workers are equipped with the necessary skills and knowledge to excel in their roles, contributing to their professional development. Enhanced skills and expertise within the local workforce will prepare them for future job opportunities both within and beyond the port sector.

5.3.3.9 Community Development Initiatives

The port operations may lead to increased corporate social responsibility investments by businesses involved in the project, targeting community development initiatives. Collaborative efforts can focus on education, healthcare, and environmental sustainability, addressing pressing local needs and fostering community resilience. These initiatives can enhance the quality of life for the local residents, providing access to vital services and resources.

5.3.3.10 Environmental Management

During the operation phase of the proposed project, effective environmental management practices will be implemented to monitor and mitigate potential impacts on local ecosystems. Initiatives could involve routine environmental assessments, pollution control strategies, and habitat restoration efforts to protect local biodiversity. Additionally, sustainable practices like waste reduction and resource conservation can be incorporated into daily operations, fostering a more environmentally friendly approach to port activities.

5.3.3.11 Social Stability and Security

The port's operations will create economic opportunities that can significantly reduce poverty and enhance living standards, thus promoting social stability. With more job opportunities and a stronger local economy, community cohesion is likely to improve, resulting in a more secure environment. Moreover, better economic conditions can decrease the likelihood of social unrest, leading to a safer community for everyone.

5.3.4 Decommissioning and Dismantling Phase

5.3.4.1 Creation of Employment and Business Opportunities

During decommissioning, new employment opportunities will be created in the form of skilled and unskilled labor. Most of the unskilled labor will be sourced from the project areas.

5.3.4.2 Rehabilitation/Restoration of the Project Area

During decommissioning, the project area will be rehabilitated or restored to/close to its original state.

5.4 Negative Impacts

5.4.1 Pre-construction/Planning and Design Phase

5.4.1.1 Land Acquisition and Resettlement

One of the major project-related impacts will be the land acquisition for the Bor Leudier port construction site which will result in causing disturbance to the affected residents of the project area. Both physical and economic displacement will be taking place for the development of Bor Port. Economic displacement will also take place for the access roads development in the Juba port area. Land acquisition will cause the removal of cultural and commercial structures, resettlement of affected people, removal of vegetation, and inconvenience to the local people and animals living in and around the land area to be acquired. The resettlement is anticipated to cause mainly three types of social impacts such as psychological stress, split of communities, and loss of livelihoods or business opportunities.

The project activity also involves access road improvement. Additional land acquisition will not be required for the access roads as it will follow the existing alignment.

The construction contractor(s) will need to establish a construction camp including site offices, construction vehicles and equipment parking, construction material stores, etc. Thus, land will be required for the intervention of the project. Due to a lack of adequate compensation for the land a community conflict may arise at the project site.

5.4.1.2 Ambient Air Quality

During the Pre-construction/Planning and Design Phase, different surveys and studies i.e., bathymetric survey, soil investigation, topography survey, Environmental and Social Impact Assessment, Resettlement Action Plan, and Livelihood Restoration Plan, etc. will be carried out by different teams. The study team will use vehicles, vessels, and equipment that will generate exhaust emissions as well as dust.

5.4.1.3 Ambient Noise Level

Ambient noise will be generated from the vehicles and equipment that will be used in different surveys and studies. In addition, underwater noise will also be generated during the survey work.

5.4.1.4 Surface Water Quality

Surface water quality may be impacted if accidental spillage of fuel/oil leaks from the survey vessels/boats during the bathymetric survey in the river.

5.4.1.5 Occupational Health and Safety

The bathymetry survey will involve taking measurements on a boat and thus it involves OHS risks including the risk of drowning or hypothermia caused by falling into the water, foot disorders caused by constant exposure of the foot to water, etc. and there will be risk of fire accident in the boat. Potential hazards in conducting a topographic survey include uncontrolled driving, collision with other machines, ground workers being hit by vehicles, loss of communication, personnel getting exposed to dehydration, etc. The risks from geotechnical investigations are pinching of fingers and footwear, falling of heavy equipment, exposure to noise and vibration, etc.

5.4.1.6 Traffic

Traffic impacts may arise from activities such as the mobilization of equipment for surveys and investigations. Both the road and river traffic will be increased during the survey work in the study area. However, it is expected that the impacts will be insignificant considering the number of vehicles and vessels deployed and assignment duration.

5.4.1.7 Labor Influx

During the planning and design stage of the project, for conducting the survey/investigation works mainly skilled personnel will be required. However, to conduct different surveys and data collection at the site unskilled and semiskilled workers will be required. It is expected that a very minimum number of workers will be required on a temporary basis.

A summary of potential impact significance during the pre-construction/planning and design phase has been shown in Table 5-8.

Table 5-8: Potential Impact Significance during Pre-construction/Planning & Design Phase

Potential Impacts/Aspect	Impact Significance Evaluation						
	Nature	Extent & Location	Duration	Intensity/ Severity	Replaceability	Probability	Significance
Land Acquisition and Resettlement	Direct	Project Site	Permanent Mitigated	High	Low	Definite	Medium High
Ambient Air Quality	Direct	Project Site	Short Term	Insignificant	Low	Low	Very Low
Ambient Noise Level	Direct	Project Site	Short Term	Insignificant	Low	Low	Very Low
Surface Water Quality	Direct	Local	Short Term	Low	Low	Low	Very Low
Occupational Health and Safety	Direct	Project Site	Medium Term	Medium	Medium	Medium	Low
Traffic	Direct	Local	Short Term	Insignificant	Low	Low	Very Low
Labor Influx	Direct	Local	Short Term	Insignificant	Low	Low	Very Low

5.4.2 Construction Phase

5.4.2.1 Impacts of Ambient Air Quality

Frequent movement of vehicles for delivery of construction materials to construction sites, site preparation, landfilling, levelling, trees/vegetation removal, structure removal, construction materials handling, etc. will generate a lot of dust, especially during the dry seasons. All project construction sites including access roads in the Bor and Juba port area and the proposed Bor port site are accessed by gravel roads and dirt tracks. Vehicles transporting construction materials on these roads will generate dust. Also, the operation of construction machinery and most construction activities are expected to release dust into the ambient air. Moreover, exhaust gases released from the construction machinery and equipment including transportation vehicles, diesel generator sets, and dredgers will cause the surrounding air quality to deteriorate. The main air pollutants expected during the construction,

transportation, and clearing (dredging) activities are particulate matter, nitrous oxides, carbon monoxide, sulfur dioxide, and ozone. Therefore, deteriorated air quality will pose a significant health impact on project workers and local communities.

5.4.2.2 Ambient Noise Level and Vibration Impacts

Sources of noise pollution and vibration during the construction phase at the proposed project sites are site clearing, landfilling, levelling, trees/vegetation removal, structure removal, operation of excavators/earth moving equipment and leveler, operation of heavy machinery and equipment for construction purposes, loading and unloading of construction materials, port construction activities such as blasting, pilling, clearing, dredging, reclamation, etc.

Due to an increase in activities and the number of operational vehicles and equipment(s), the impacts of noise and vibration will cause disturbance to workers, nearby residents, and animals as well as birds. However, the vehicles and equipment(s) will not be operated throughout the day thus noise generation from the equipment is considered to be of intermittent type. In addition, excavation machines usually operate continuously throughout the day. Pile-driving machines (if used) will be operated continuously throughout the day.

During the construction phase, high underwater noise and vibration will be generated from several sources, including pile driving, clearing/dredging, and boat/ship traffic. Noise from these activities may adversely impact aquatic habitats and the health and behavior of aquatic life including fish, mammals, turtles as well as nearby communities.

5.4.2.3 Surface Water Quality

Construction activities such as clearing vegetation, dredging, reclamation, and construction of access roads can result in increased turbidity via the suspension of sediment in the water column. In addition, the introduction of pollutants can have adverse impacts on aquatic flora and fauna including benthic communities, and human health for example excessive nutrient loading to eutrophication, oxygen depletion, and toxic algal blooms.

Clearing (dredging) and disposal of dredge materials may lead to impacts on water quality from increased turbidity and from the release of contaminants to the water column due to the resuspension of sediments and/or changes of certain chemical compounds in the dredged materials when exposed to the different level of oxygenation. In addition, freshwater disposal of dredged material may result in the smothering of benthic habitats, reduced light penetration impacting light-sensitive organisms, and impacts on grass beds and algae from suspended sediment plumes.

Accidental spillage of fuel, lubricant, solid, liquid, and hazardous waste into the water body may impact water resources. The potential for surface water contamination is associated with uncontrolled spills of fuels and lubricants during the rehabilitation of the access roads, port construction, and clearing (dredging). As the workers' facilities will be set up at the project sites and sanitary facilities including toilets will be provided for the use of the construction/clearing (dredging) workforce on-site. Such liquid effluent streams are likely to be high in organic matter, suspended solids, bacteria, and other pollutants. A small volume of wastewater from the washing of equipment and machinery may also be generated. Improper management of these liquid waste will impact on the surface water quality.

5.4.2.4 Groundwater Quality

Pollution of groundwater is possible if solid, liquid, and hazardous waste is improperly disposed of and leakage from storage containers, accidents involving vehicles or other machinery, and improper handling and storage. Infiltration of sanitary waste may also lead to groundwater contamination in the project site. In addition to that, construction waste, if left unattended may result in forming leachate which will percolate through the soil strata and will reach the underground water table contaminating it. Also, dredged material (if not properly disposed) will affect groundwater quality.

5.4.2.5 Soil Erosion, Siltation, and Contamination

Construction of infrastructure, roads, vehicle movement on surfaces, and material storage will disturb the surface soil. Due to exposure to wind and rain during site clearance, earth moving and excavation, removal of vegetation will expose bare soils to erosion. The released soil particles may enter surface watercourses and result in general migration as a result of erosional processes.

Construction waste, if discarded or duped in the river in an uncontrolled manner may affect the soil of the site or river water quality. Various categories and quantities of fuel oil shall be stored at the site then the occurrence of accidental fuel spillage or leakage cannot be ruled out which eventually will contaminate the adjoining soil strata. Such soil contamination can be severe in case of voluminous leakage.

Movement of construction vehicles and equipment may also lead to soil compaction on haulage roads as well as nearby areas. Soils may also be contaminated due to inappropriate disposal of used oil or various liquid/solid waste (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent, etc.) and oily soil waste (fuel filters, oily rags) are also likely to be generated from repair and maintenance of transport vehicles, construction equipment, and machinery. Soil may also be contaminated due to inappropriate and untreated disposal of domestic solid waste and sewage from construction facilities. However, such surface soil contamination types will be short-term confining to the construction period only, and thus may be insignificant in nature, but appropriate mitigation/management is warranted.

Due to the clearing (dredging) activities in the White Nile River, the siltation and erosion may accelerate. In addition, uncontrolled disposal of dredge material on the banks may contaminate the soil or aesthetic of the disposal site. However, the dredged sediments can be used as fillers (for cut and fill tasks for land leveling in the port construction area) wherever required, if the dredged materials have no contaminants, it cannot be reused or disposed of through a land-based approach. In such a case, confined disposal is recommended.

5.4.2.6 Improper Management of Solid Wastes

Solid waste will be generated from construction activities such as the removal of vegetation, excavated soils, papers used for packing, plastics, scrap wood, glass cullet, metal, and debris from the material used during construction. Waste generated by associated construction activities such as vehicle lubricants and containers, oil filters, solvents, fuel, and other wastes from construction camps, garages, and stores can also be considered as construction wastes. Dumping around the site will interfere with the aesthetic status and have a direct effect on the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be vector or pest breeding, pollution of physical components of the environment including water resources, soil/land, invasion of scavengers, and informal recycling by communities.

5.4.2.7 Improper Management of Liquid Wastes

Wastewater will be generated from the washing of equipment and machinery and pilling activity on site. This wastewater may contain suspended solids and traces of hydrocarbon. The contractor will be responsible for ensuring that any wastewater discharged meets the standards stipulated in WBG General EHS Guidelines 2007 prior to the discharge of such wastewater. Sanitary facilities including toilets will be provided for the use of the construction and operation workforce both on-site. Such sewage streams are likely to be high in organic matter, suspended solids, coliform, and other pollutants. Construction wastes, debris as well as oil and fuel spills, if not properly managed, could result in surface water pollution. The waste may enter the river through stormwater and affect water quality as well as aquatic life.

5.4.2.8 Impacts on Ecosystem Services

The implementation of the proposed project will have far-reaching impacts on ecosystem services, affecting provisioning, regulating, cultural, and supporting functions.

Provisioning services, such as fisheries and freshwater supply will be affected. The disruption of aquatic habitats and pollution from dredging and construction activities can reduce fish stocks, threatening the livelihoods of local fishing communities and food security. Contamination of the Nile due to dredged materials and construction runoff may degrade water quality, reducing access to clean fresh water for drinking, irrigation, and livestock. The dry fish processing business in the Bor area is a vital part of the local economy. The construction of a new port in the area threatens to displace the businesses and livelihoods of the many people involved in the dry fish industry temporarily. Land acquisition for the port project will likely force the closure of the processing business temporarily, leading to economic hardship for the community.

Regulating services, which include flood control, water purification, and erosion prevention, will also be at risk. Wetlands and riparian vegetation that naturally regulate floods and filter pollutants will be damaged by construction and clearing (dredging). This could reduce the capacity of these ecosystems to manage water flow, leading to increased flooding risks for downstream communities. The degradation of these natural barriers can also exacerbate soil erosion, which could negatively impact nearby agricultural lands, reducing their productivity over time.

Cultural services, particularly those related to the Nile's cultural and spiritual significance, may also be compromised. The river holds profound cultural value for local communities, serving as a site for recreation, spiritual practices, and tourism. Disruptions to the natural beauty of the river, along with noise and pollution from construction, could diminish its appeal for ecotourism and recreation, affecting the local economy and eroding community identity.

Finally, the project will impact supporting services like biodiversity and nutrient cycling. The degradation of wildlife habitats, such as fallow land, wetlands, and riverbanks, will reduce the availability of breeding grounds and shelters for fish, birds, and other wildlife. This loss of biodiversity undermines ecosystem resilience, affecting essential ecological processes like pollination, nutrient cycling, and the maintenance of healthy soils. Over time, these impacts could diminish the region's capacity to support agriculture, wildlife, and overall ecosystem health, leading to long-term ecological and socio-economic consequences.

5.4.2.9 Impact on Habitat Types

The proposed rehabilitation and construction activities for the Juba and Bor ports, along with associated access roads and dredging on the White Nile, could pose several potential impacts on project-associated modified and natural habitats. Site clearance, construction, and dredging activities could significantly alter the aquatic and terrestrial habitats, especially near modified areas close to ports and natural habitats in regions adjacent to Bandingilo National Park.

In aquatic habitats, dredging and the transportation of dredged materials may disturb sediment, reducing water quality and impacting fish populations and other aquatic species. This sediment disruption may lead to the loss of spawning grounds critical for fish species like Nile tilapia and African catfish, while also affecting migratory bird species reliant on floodplain wetlands.

On land, construction-related noise, pollution, and physical habitat alteration could disrupt sensitive riparian and woodland habitats that support species like African bush elephants, hippos, and various bird species. The establishment of worker camps and storage areas might lead to encroachment, increased human-wildlife conflict, and pollution from solid waste and hazardous materials, which could be particularly harmful to nearby natural habitats. Additionally, vegetation loss from site clearance could reduce food and shelter for terrestrial species, affecting biodiversity and ecological stability.

Emissions from diesel generators and construction vehicles may degrade air quality, impacting both wildlife and vegetation in the area. These disturbances underscore the need for robust mitigation

measures to preserve the area's ecological integrity and sustain the viability of both modified and natural wildlife habitats.

5.4.2.10 Impacts on Aquatic Flora

Clearing (dredging) activities in the White Nile River will have a potential negative impact on the aquatic flora. These activities will disrupt the delicate ecological balance of the river, leading to habitat loss, water quality degradation, and the introduction of invasive species. However, the loss of vegetation will be regenerated quickly, and consequently, the habitat will regain its previous state within a suitable time frame.

The construction of the Bor port and access roads in Juba and Bor ports will likely lead to the direct loss of aquatic vegetation. For instance, emergent species like Papyrus *(Cyperus papyrus)* and Reed Mace *(Typha latifolia)* may be removed or disturbed during the clearing of the riverbanks and the installation of civil structures. The loss of habitat for submerged plants is critical for maintaining the river's ecosystem and is possible due to riverbank modifications and altered flow patterns. Construction activities, including land clearance, excavation, dredging, and riverbank modifications, may result in the increased suspension of sediments in the river. Sediment deposition can smother aquatic plants, especially submerged species, affecting photosynthesis and reducing water clarity. Excessive sedimentation may impact aquatic flora by blocking sunlight necessary for growth.

Accidental spillage of hazardous substances (fuel, oil, grease), and improper waste handling could introduce toxic substances into the water, adversely impacting sensitive aquatic flora and potentially leading to their die-off or the domination of invasive species like Common Water Hyacinth *(Eichhornia crassipes).*

Dredging activities involve the removal of sediments from the riverbed, which can result in the direct removal of aquatic plants. These plants are vital for providing shelter, oxygen, and nutrients to other aquatic species. Their removal can disrupt the entire food web. Sediment re-suspension from dredging may contain pollutants or nutrients that can lead to eutrophication or promote the growth of invasive species that outcompete native species for nutrients and space. Dredging and construction activities may inadvertently spread invasive species as well which will lead to long-term alterations in the composition of the aquatic flora. This can have cascading ecological effects on the river’s ecosystem.

Improper disposal of dredged materials could result in large-scale loss of habitat for aquatic floral species which are critical for maintaining the ecological balance and supporting biodiversity in the river.

5.4.2.11 Impacts on Aquatic Wildlife

The construction of Bor port, access road construction for Juba and Bor port, and clearing (dredging) activities will likely have several impacts on the aquatic wildlife. These activities could affect the identified species, including the Nile Crocodile (*Crocodylus niloticus*), Nile Softshell Turtle (*Trionyx triunguis*), and Nile Monitor Lizard (*Varanus niloticus*).

Dredging and piling work in the riverbank could result in the destruction or alteration of riverine habitats, which are critical for wildlife species. Key habitats such as basking, nesting, and feeding areas for Nile Crocodiles and Nile Monitor Lizards, as well as nesting and foraging sites for Nile Softshell Turtles, could be negatively affected. Dredging-induced turbidity can harm aquatic ecosystems by reducing sunlight penetration, disrupting food chains, and releasing pollutants that contaminate the food chain, affecting top predators like Nile crocodiles and Nile monitor lizards.

Accidental spillage of hazardous substances (fuel, oil, grease), and improper waste handling could introduce toxic substances into the water, adversely impacting sensitive aquatic wildlife. Underwater noise from construction and dredging can disrupt aquatic wildlife's behavior, causing stress, avoidance, and habitat loss. This can impact their survival and reproduction. Physical injuries or fatalities can occur if aquatic wildlife comes into direct contact with dredging machinery or construction vehicles. For instance, Nile Crocodiles or Nile Softshell Turtles could be harmed during dredging or pile-driving

activities, particularly during their seasonal migrations or movements between nesting and foraging areas.

Increased human activity related to dredging and construction activities can lead to conflicts with wildlife and disrupt their natural behaviors.

5.4.2.12 Impacts on Fisheries Resources

The construction work, which includes site clearance, the building of port infrastructure, access roads, and other civil works, and dredging activities of the project in the White Nile River are likely to have several impacts on fisheries resources. These impacts can be divided into several categories related to habitat disturbance, water quality, pollution, and direct harm to fish populations.

Pile driving activities along the riverbanks of the Bor port site and within the river will likely disturb or destroy potential fish habitats, including breeding and feeding grounds for fish species like Nile tilapia (*Oreochromis niloticus*) and African sharptooth catfish (*Clarias gariepinus*). Fish rely on specific aquatic habitats, and habitat loss may reduce fish abundance and diversity. Emergent and submerged vegetation that provides shelter and food sources for fish will be cleared, affecting species that rely on these environments.

Clearing (dredging) and construction activities can increase sediment load, impairing fish vision, disrupting spawning grounds, and negatively impacting fish species like Sudan squeaker (*Synodontis frontosus*) and Wahrindi (*Synodontis schall*). Dredging activities will stir up sediments, increasing water turbidity. Prolonged periods of high turbidity can interfere with fish respiration by clogging their gills and reducing the amount of dissolved oxygen in the water. Created noise and vibration during pile diving activities can disrupt fish behavior, communication, and migration, leading to temporary displacement of fish from their natural habitats. This displacement can lead to higher mortality rates and reduced population density. Dredging equipment can also directly injure or kill fish, especially smaller or slower-moving species.

Improper handling of hazardous materials and dredging can lead to water contamination, affecting fish health and reproductive success. Changes in river flow patterns due to dredging can also disrupt fish habitats and food availability.

5.4.2.13 Impacts on Terrestrial Flora

The construction and dredging activities in the project area are expected to generate several impacts on terrestrial flora. These impacts may result from direct physical disturbances, alteration of natural habitats, and changes in environmental conditions.

Very few trees like Neem, Borassus palm, and Tamarind will be cleared from the Bor port construction site. The rehabilitation of the access roads in Juba and Bor ports will follow the existing road alignment therefore trees or vegetation will not be cleared. The establishment of workers' facilities, laydown areas, and storage facilities could further contribute to small-scale vegetation clearance.

Construction activities and movement of heavy machinery can compact soil, disturb root systems, and cause erosion, leading to degraded ecosystems and reduced plant health. Dust generated by construction can also harm plants and reduce their photosynthetic process.

Spills of hazardous materials and improper waste disposal can contaminate soil and water, affecting plant growth and ecosystem health. Clearing riparian vegetation can lead to erosion, sedimentation, and negative impacts on downstream ecosystems. Changes in water turbidity, nutrient levels, and sediment load may negatively impact the growth and health of riparian vegetation, causing species to die-off and altering the community composition.

5.4.2.14 Impacts on Avifauna

The civil construction and clearing (dredging) activities of the project will have several impacts on avifauna species. The activities involved in site clearance, civil work, and dredging are likely to create

disturbances to bird populations through habitat loss, noise, pollution, and direct physical disturbances. These impacts can affect the behavior, breeding, feeding, and overall population dynamics of the bird species found in the area.

During the site clearance and preparation phase, vegetation that serves as important habitats for various bird species will be cleared, potentially forcing them to relocate to less suitable areas. Birds like Common bulbul (*Pycnonotus barbatus*) and Grey-backed fiscal (*Lanius excubitoroides*) rely on trees and bushes and Red-cheeked cordonbleu (*Uraeginthus bengalus*) and Northern red bishop (*Euplectes franciscanus*) rely on shrubs and grasslands for foraging and nesting.

Many bird species, like the African jacana (*Actophilornis africanus*), African sacred ibis (*Threskiornis aethiopicus*), and Goliath heron (*Ardea goliath*), rely on wetlands for foraging and nesting. Construction and dredging activities can alter these habitats, leading to habitat loss and displacement of birds like the Hooded vulture (*Necrosyrtes monachus*) and African fish eagle (*Icthyophaga vocifer*), negatively impacting their reproductive success. The operation of heavy machinery, including excavators, trucks, and generators, will introduce high levels of noise into the environment that can disturb birds, particularly during breeding and feeding periods, leading to habitat avoidance and reduced reproductive success.

Construction and dredging activities can also lead to water contamination due to spills of hazardous materials, affecting water quality and negatively impacting species like the Western cattle egret (*Bubulcus ibis*), Black crake (*Zapornia flavirostra*), and other water-dependent birds that forage in or near the river. Dredging can increase water turbidity, making it difficult for birds to find prey and disrupting their access to key habitats. The physical presence of dredging equipment and increased boat traffic may scare away birds or disrupt their access to key feeding and nesting sites. Species which rely on riverbanks and shallow waters may be especially vulnerable to this type of disturbance.

5.4.2.15 Impacts on Herpetofauna

The project activities including the port construction work, access roads, and river clearing (dredging) works, will significantly affect the herpetofaunal species (amphibians and reptiles) present in the project area. The project area is home to a variety of reptiles and amphibians, many of which rely on both terrestrial and aquatic habitats. The activities involved in site clearance, dredging, and construction can lead to habitat destruction, pollution, and direct physical disturbances, which can negatively impact herpetofauna species.

Many herpetofauna, like the Nile crocodile and Nile monitor, depend on riparian zones for basking, nesting, and foraging. Dredging and construction along the White Nile may degrade these areas, disrupting habitats and breeding patterns. Heavy machinery and construction activities can harm reptiles and amphibians. Slow-moving species like the Nile monitor and Finch's agama risk being crushed, while amphibians may lose habitat when moist areas are disturbed. Additionally, sediment displacement during dredging may cover the riverbed, impacting areas where amphibians breed or reptiles forage.

Hazardous material spills may contaminate water, affecting amphibians with permeable skin, leading to health issues and reduced reproduction. Increased turbidity from dredging can reduce water quality, impairing reptiles like the Nile crocodile that rely on clear water to hunt. Noise and vibrations from machinery can disrupt amphibian mating calls and stress reptiles, affecting their behavior. Solid waste from construction may degrade habitats and harm herpetofauna through ingestion or entanglement.

5.4.2.16 Impacts on Terrestrial Mammals

Site clearance, road construction, and worker facility setup will result in the destruction of important habitats, reducing the available range for mammals. Small mammals will face displacement or local population declines. Fragmentation could limit their movement, foraging, and access to water. Fragmentation can increase the vulnerability of mammals to predators, as they may be forced into smaller areas with fewer hiding places. Increased human presence and activity can attract predators,

such as domestic dogs, which can pose a threat to wildlife. The destruction of vegetation can reduce the availability of food resources for herbivorous mammals.

Vehicle traffic and machinery movement during the transportation of materials and the operation of heavy equipment poses a significant risk of accidental collisions with terrestrial mammals. Species that frequently move between habitats may be at risk of roadkill, resulting in direct mortality. Project workers can also engage in opportunistic poaching due to increased access to remote areas with wildlife, particularly in habitats close to the project site.

Noise from the movement of construction machinery, equipment, and human presence may disturb mammal populations, causing stress and altering their natural behaviors. Sensitive species like the Four-toed hedgehog and Marsh mongoose may alter their activity patterns, potentially leading to reduced feeding or breeding success. Hazardous materials and waste (oil, fuel, chemicals) could contaminate the environment, affecting food and water sources for mammals. Improper handling of waste could lead to poisoning of species like the White-tailed mongoose, which forage near human settlements.

5.4.2.17 Impacts on Protected Areas

The project area includes two protected areas, Bandingilo National Park and Juba Game Reserve, as well as an Important Bird Area (IBA) in Bandingilo. Impacts on these protected areas will result solely from clearing (dredging) activities. There will be no direct impacts generated from the construction of the port and access roads as these components are located at a significant distance from the protected areas.

Noise from clearing (dredging) work can disturb wildlife, particularly birds who reside within 500 meters of the clearing (dredging) site. Pollution risks from oil spills, construction waste, and wastewater discharge from dredgers can harm the ecosystems of the protected areas. Dredged material disposal near protected areas can smother habitats, degrading wetlands and threatening wildlife. Sediment disposal can clog wetlands, alter water levels, and disrupt biodiversity. Dredged material may contain pollutants that can leach into soil and water systems, poisoning plants and animals.

Bandingilo National Park is part of the Important Bird Areas (IBAs) network and supports a significant population of migratory birds. The dredged material disposal site can degrade potential habitats used by these birds for resting and feeding during migration. For instance, the increased sedimentation of wetlands can reduce the availability of invertebrates and aquatic plants, which are essential food sources for migratory bird species. Loss of habitat and food scarcity can lead to a decline in bird populations and disrupt migratory patterns.

The world's largest annual animal migration takes place between Bandingilo National Park and Boma National Park, involving multiple species of antelope, including Bohor reedbuck, Tiang, and White-eared kob. However, the migration route does not fall within the project area.

5.4.2.18 Visual Impacts

Construction activities of the access roads will mainly follow the existing alignment and will have no impact on the present visual environment. The Bor port will be constructed on the bank of the river by removing structures and will have a minor impact on the present visual environment. The dredging and disposal activities are limited in time, transient, and along the river. The visual change during clearing (dredging) will have a minor impact.

5.4.2.19 Landscape/Topography

As a result of construction, the topography of the project area (port site) will be changed. One of the important activities during construction will be the cutting of trees, removal of vegetation, dismantling of existing structures, land development, excavation, etc. will have an impact on the topography of the project area. Moreover, the dredging of rivers for navigation improvement will affect the bottom

topography of the river. Clearing vegetation from the port site will cause an appearance change in the landscape.

5.4.2.20 Impacts on Livelihoods

During the construction of the project, the impact on livelihood is expected within the Bor port area, Juba port access road, and the clearing (dredging) section of the river. Specifically, the street vendors, tea sellers, dry fish sellers, and small-scale business will lose their livelihood for the interim period in the Juba port access road. Additionally, porters working at the port, traders, fisherman, boatman, and boat builders, will lose their livelihood on a temporary basis due to the relocation of themselves. Placement of dredgers in the river may disrupt fishing activities, however clearing (dredging) activities at any particular location will be for a short duration and thus the impacts will not be significant. As discussed with the MOT it was noticed that an alternative place will be arranged to relocate the affected person.

5.4.2.21 Community Health, Safety, and Security

The construction of the Juba port access road, Bor port, and the clearing of the Nile River will likely affect community health, safety, and security in several ways. Construction may lead to environmental hazards such as dust, noise, and pollution, which can impact residents' health. Safety problems at the construction sites may arise from excavations, transportation, and the movement of equipment. The influx of non-resident workers to the area will also be a potential impact source. An influx of workers and changes in local dynamics may raise security concerns. The migrant workforce will stay in the accommodation facility in the nearby area. There is a possibility of interaction with local people during visits to nearby marketplaces and other social services. For the security risk and impact analysis, the factors that security risks and impacts are to the project and also from the project. Security risks to the project are with regard to workers, project equipment, and facilities hence the need to retain public security personnel to alleviate threats.

5.4.2.22 Impact on Traffic and Transport

The implementation of the proposed project is expected to significantly impact transport and traffic patterns. The existing access roads are used by the local community and port users. The construction activities will occur in certain sections in densely populated areas and along the existing right of way where there is motorized and non-motorized traffic, especially in port access road areas and port areas. The construction work on the existing access roads will impede the regular movement of vehicles. Construction workers, pedestrians, and onlookers are also prone to accidents. The construction vehicles will add more traffic, increasing traffic congestion and road accidents.

5.4.2.23 Labor Influx and Recruitment

During the construction phase of the proposed project could lead to significant social and economic changes due to a labor influx. Different types of workers, such as community workers, migrant workers, contracted workers, primary supply workers etc. will be engaged in the construction phase of the proposed project activities. While it may provide job opportunities and stimulate local economies, it also poses risks, such as increased competition for resources, housing shortages, and potential social tensions. Moreover, there is a heightened risk of child and forced labor, particularly if proper regulations and monitoring are not enforced. The significance of labor influx is expected to be low and mostly unskilled. There is a potential induced impact during construction causing an increased incidence of communicable diseases due to new entrants in communities for employment. There is a potential induced impact when increased income in the communities, from construction worker salaries, leads to domestic abuse in the home. The Contractor will comply with national labor laws, develop a Labor Management Procedure and submit it to the Ministry of Transport (MOT) before construction begins.

5.4.2.24 Occupational Health and Safety

The implementation of the proposed project will pose significant occupational health and safety risks. Workers may face hazards related to heavy machinery, construction materials, and environmental conditions. Inadequate safety protocols could lead to accidents, injuries, or long-term health issues. Additionally, the potential for increased exposure to pollutants from construction activities may impact workers' health. In brief, the OHS risk includes excavation risk including falling in and collapse of excavation and trapping workers in excavation; risk of work-at-height, hit or trapped by falling, moving, or rotating machines/equipment/objects; risk during heavy weightlifting operations; risk of hot works, electrocution, and fire; risk of drowning while dredging and performing other water-based activities; traffic and road safety risk; poor housekeeping; manual handling; biological risks (venomous animals, insects) etc. Implementing robust health and safety measures, along with regular training and monitoring, will be essential to mitigate these risks effectively.

5.4.2.25 Impact on Vulnerable and Disadvantaged Groups

During the construction phase of the proposed project, vulnerable and disadvantaged groups including women, children, the elderly, and internally displaced persons may face several significant challenges and negative impacts such as economic displacement of female traders/ dry fish sellers, loader – unloader, fisherman communities, small vendors adjacent to Bor Port area, Juba Port access road and dredging and clearing activities at river Nile. Moreover, major concerns are the increased risk of gender-based violence and SEA/SH. The influx of a predominantly male workforce can create an environment where women and girls are more vulnerable to harassment and violence. This risk is particularly acute in South Sudan, where reports indicate that approximately 65% of women experience physical violence in their lifetime. The construction activities may exacerbate these vulnerabilities if appropriate measures, such as the implementation of a robust Code of Conduct and community awareness programs, are not established.

Additionally, the construction activities could disrupt traditional livelihoods, particularly for communities dependent on fishing and agriculture. Many vulnerable individuals, especially women and children, rely on these sectors for their daily sustenance. The diversion of local resources and increased competition for jobs may further marginalize these groups, limiting their access to economic opportunities. Recent data highlights that the unemployment rate in South Sudan stands at around 12.5%, with youth and women disproportionately affected. If residents are not prioritized for employment during the construction phase, social tensions could rise, leading to potential conflicts within communities.

The construction phase may also result in health risks for vulnerable and disadvantaged populations. Increased dust and emissions from heavy machinery could lead to respiratory issues, particularly among children and the elderly. Furthermore, the construction process might strain local healthcare facilities, which are already limited in capacity. Reports indicate that only 60% of the South Sudanese population has access to basic healthcare services, and vulnerable groups may face even greater barriers to accessing these services. As construction progresses, the demand for healthcare may increase, leading to overcrowded facilities and a higher incidence of untreated illnesses.

Moreover, the need for land acquisition for the project could lead to the displacement of vulnerable communities. Many internally displaced persons, who already face challenges related to land rights and access to resources, could be adversely affected by the project. Displacement can result in the loss of livelihoods and social networks, as well as inadequate compensation or support. As of 2023, approximately 1.7 million people in South Sudan are internally displaced, highlighting the urgent need for effective resettlement plans that consider the rights and needs of vulnerable populations.

Lastly, the construction phase may lead to psychosocial stress within vulnerable groups, particularly among women and children. The rapid changes brought about by construction activities can create uncertainty and anxiety, especially for those already experiencing trauma from previous conflicts or displacement. This stress can exacerbate existing mental health issues and hinder the overall well-being of affected communities.

5.4.2.26 Communicable Diseases and Other Infections

During the construction phase, there is a risk of the spread of communicable diseases such as tuberculosis and HIV/AIDS. With the concentration of people in one place during construction, there will be a likelihood of an increase in diseases such as typhoid, tuberculosis, diarrhea diseases, dysentery, cholera, and respiratory diseases. There is also a potential increase in HIV infections given the labor requirements during construction. The most vulnerable members of the community are women and children as they are more vulnerable. It is recommended that the project proponent and the contractor should ensure the prevention and management of HIV/AIDS and other STIs which may result from social interaction between project workers and local populations.

5.4.2.27 Gender-Based Violence and Sexual Exploitation and Abuse and Sexual Harassment

Gender-based violence (GBV) is a critical concern during the construction phase of the port and access road development project in South Sudan. GBV encompasses harmful acts rooted in socially assigned gender differences, leading to physical, sexual, and psychological harm, as well as threats, coercion, and deprivation of liberty. In South Sudan, where GBV and SEA/SH is alarmingly prevalent, the risk could be exacerbated during construction activities, which involve the influx of workers and increased interaction with local communities.

The construction phase, with its concentrated workforce, long working hours, and isolated work camps, can further heighten the risks of GBV and SEA/SH. Construction workers, many of whom may come from different regions or countries, may interact with community members in ways that could lead to exploitation, harassment, or abuse. These risks are particularly acute in areas with weak law enforcement and social services, as is often the case in conflict-affected regions of South Sudan.

The construction phase can increase the likelihood of GBV and SEA/SH occurring in various forms such as between workers, between supervisors and workers, or between workers and local community members. This risk is intensified by factors like economic disparities, power imbalances, and cultural differences. Recent data from UNFPA in 2023 indicates that half of the women in South Sudan reported experiences of GBV, including rape, sexual harassment, sexual exploitation, forced marriages, and denial of resources and opportunities.

5.4.2.28 Child Labor, Forced Labor, and Discrimination

During the construction phase of the port and access road development project in South Sudan, the risk of child labor and forced labor may lead to a significant negative impact. South Sudan, facing high poverty levels and weak regulatory enforcement, is particularly vulnerable to these exploitative labor practices. According to the International Labour Organization (ILO), child labor remains a persistent issue in the country, with children often working in hazardous conditions to support their families.

In the context of the project, there is a heightened risk that contractors or subcontractors may engage in child labor, especially in unregulated or informal employment settings. Children could be employed for unskilled tasks such as carrying materials or assisting with basic construction work. The lack of effective oversight in the construction sector, combined with economic desperation, may lead families to send their children to work on construction sites, exposing them to dangerous conditions and depriving them of education.

Similarly, forced labor is a significant concern during the construction phase. South Sudan's conflict-ridden history and fragile economy have created conditions where vulnerable individuals, including migrants or displaced people, may be coerced or trafficked into forced labor. Workers may be subjected to unfair treatment, denied proper wages, forced to work long hours without breaks, or threatened with violence or penalties if they attempt to leave. The remoteness of the construction sites and poor enforcement of labor laws further exacerbate the risk of forced labor.

In 2023, South Sudan is receiving an assessment of no advancement. Despite initiatives to address child labor, South Sudan is assessed as having made no advancement because it demonstrated complicity in the use of forced child labor. The country's military continued to recruit children, sometimes forcibly, to fight opposition groups, and for use in supporting roles. Otherwise, the government signed the United Nation's Convention on the Rights of Persons with Disabilities, put in place a new strategic plan for education, and participated in an International Labor Organization-hosted workshop in Addis Ababa on building national capacity on child labor data collection and analysis. However, the government did not hold perpetrators of child labor accountable and has yet to ratify the Palermo Protocol on Trafficking in Persons. In addition, police continued to arrest and imprison children engaged in commercial sexual exploitation, rather than treating them as victims.[24]

These exploitative practices not only violate international labor standards but also expose the project to reputational risks and potential legal liabilities. By addressing these risks proactively, the project can help safeguard vulnerable populations and ensure ethical labor practices throughout its execution.

5.4.2.29 Impact on Land Use and Land Cover

Land acquisition will be required for the construction of Bor Leudier port in Jonglei State. Currently, the proposed Bor port site land is under residential and commercial use. However, implementation of the proposed interventions will lead to changes in the land use category and also the land cover of the sites. Development of port facilities can be in general classified under industrial/transportation infrastructures. Furthermore, the access roads developed will follow the exiting alignment therefore no changes are anticipated.

Excavation and filling tasks at the site will lead to the loss of topsoil. Such land use or topographical changes are permanent in nature, but the resultant impacts will not be significant once mitigated properly as the project is to be implemented keeping the overall associated economical gains of the region.

5.4.2.30 Impacts on Microclimate and GHGs

During the construction phase, Greenhouse Gases (GHGs) will be emitted through the operation of vessels and vehicles that use fossil fuels to operate. Combustion of fossil fuels produces GHGs such as CO_2, CH_4, and N_2O. Main sources of emissions will be from the dredgers, construction equipment and machinery, power generation/DG sets, transportation of construction materials, etc. CO_2 being one of the most potential GHG will contribute to increasing GHG concentration and associated increased average temperature/climate change phenomenon. At this stage, the proposed access roads, Bor port, and clearing (dredging) activities will be done. No major tree cuttings are anticipated with the development of access roads and port construction sites. While emitted greenhouse gases can persist in the atmosphere in the long term, the level of emission from the construction phase of this project is expected to be negligible.

5.4.2.31 Impact Due to Natural Hazard

Natural hazards anticipated at the project site are flood and erosion. All the interventions will be developed along the river thus are prone to flooding. Bor County in Jonglei state is a severe flood-prone area in South Sudan. The White Nile is a transboundary river and is perennial in nature and floods and erosion are very common. Thus, threats to navigation are anticipated during heavy flow and flood-like situations, especially to smaller vessels. Thus, it is mandatory for vessels to adopt the measures and prepare emergency preparedness plans to handle emergency situations like floods.

A summary of potential impact significance during the construction phase has been shown in Table 5-9.

[24] South Sudan, 2023 Findings on the Worst Forms of Child Labor. https://www.dol.gov/agencies/ilab/resources/reports/child-labor/south-sudan

Table 5-9: Potential Impact Significance during Construction Phase

Potential Impacts/Aspects	Impact Significance Evaluation						
	Nature	Extent & Location	Duration	Intensity/ Severity	Replaceability	Probability	Significance
Ambient air quality	Direct	Local	Short Term	Medium	Low	High	Low
Ambient noise level and vibration level	Direct	Local	Short Term	Medium	Low	Medium	Low
Surface water quality	Direct	Regional	Short Term	High	Medium	High	Medium High
Groundwater quality	Direct	Regional	Long Term	High	Medium	High	Medium High
Soil erosion, siltation, and contamination	Direct	Project Site	Short Term	Medium	Low	High	Low
Improper management of solid waste	Direct	Local	Medium Term	High	Medium	High	Medium Low
Improper management of liquid waste	Direct	Local	Medium Term	High	Medium	High	Medium Low
Impact on Ecosystem Services	Direct	Local	Short Term	Low	Low	Medium	Low
Impacts on Habitat Types	Direct	Local	Short Term	Low	Low	Medium	Low
Impact on Aquatic Flora	Direct	Local	Short Term	Low	Low	Medium	Low
Impact on Aquatic Wildlife	Direct	Local	Short Term	Low	Medium	High	Medium Low
Impact on Fish Resources	Direct	Local	Short Term	Low	Medium	High	Medium Low
Impact on Terrestrial Flora	Direct	Local	Short Term	Low	Low	Medium	Low
Impact on Avifauna	Direct	Local	Short Term	Medium	High	Medium	Medium Low
Impacts on Herpetofauna	Direct	Local	Medium Term	Low	Medium	Medium	Low
Impact on Terrestrial Mammals	Direct	Local	Short Term	Low	Low	Medium	Low
Impact on Protected Areas	Direct	Local	Short Term	Low	Low	Medium	Low
Visual Impacts	Direct	Project Site	Long Term	Insignificant	Low	High	Low
Landscape/Topography impacts	Direct	Project Site	Long Term	Low	Low	High	Low
Impacts on Livelihoods	Direct	Project Site	Short Term	Low	Low	High	Low

Potential Impacts/Aspects	Impact Significance Evaluation						
	Nature	Extent & Location	Duration	Intensity/ Severity	Replaceability	Probability	Significance
Community Health and Safety	Direct	Local	Short Term	High	Low	High	Medium Low
Impact on Traffic & Transport	Direct	Local	Short Term	High	Low	High	Medium Low
Labor influx & recruitment	Direct	Local	Short Term	Medium	Medium	Medium	Low
Occupational health and safety	Direct	Project Site	Long Term	High	Medium	High	Medium Low
Vulnerable Groups	Direct	Local	Short Term	Medium	Medium	Medium	Medium
Communicable diseases and other infections	Direct	Local	Medium Term	High	Medium	Medium	Medium Low
Gender-Based Violence and Sexual Exploitation and Abuse	Direct	Local	Short Term	Medium	Medium	High	Medium Low
Child and Forced labor, & Discrimination	Direct	Local	Short Term	Medium	Low	Medium	Low
Impacts on land use and landcover	Direct	Project Site	Long Term	Medium	Low	Definite	Medium Low
Impact on microclimate and GHGs	Indirect	National	Short Term	Low	Low	Low	Low
Impacts due to natural hazards	Direct	Regional	Long Term	High	Low	High	Medium Low

5.4.3 Operation and Maintenance Phase

5.4.3.1 Impacts on Ambient Air Quality

During the operation phase, the number of road and river traffic will be significantly increased in the project site. Exhaust gases from vehicles and vessels will be an important source of air pollution and greenhouse gases. Various associated air pollution sources during the operation and maintenance phase will primarily be with the port facilities. The activities that may generate emissions at the port are primarily due to transportation and storage activities of materials such as loading and unloading of materials at the site and loading and unloading of barges. Materials proposed to be transported include a large number of diverse items such as food items, oil, dry fish, etc. Apart from material handling and transportation, other sources of emissions at the site will be the emission from DG sets and other machinery and equipment. Emissions due to the accidental burning of oil or other stored material will be significant and impact the air quality of the project area.

5.4.3.2 Ambient Noise Level and Vibration Impacts

Noise-generating sources during the operation phase of the port area, river, and access roads are primarily the loading and unloading of materials at the site and cargo vessels, movement of boats, generators, increased vehicular traffic, and other equipment. However, the main effect on the environmental noise level will be from increased transportation of goods entering and leaving the port. Underwater noise from increasing vessel movement will significantly impact on aquatic environment.

5.4.3.3 Surface Water Quality

Several sources of effluent streams will be generated during the operation of the project. Liquid effluents associated with land-based activities in the port such as fuel and material storage and transfer, vehicle maintenance and washing, vessel maintenance, and ships/boats, etc. include stormwater, wash water, and sewage. Ship-generated effluents include sewage, ballast water e.g. from oil tankers, bilge water, and vessel-cleaning wastewater. Washing water from land and water-based activities may contain oily residues. Ship sewage and wastewater contain high levels of BOD, TSS, and coliform bacteria, and typically low pH levels (due to chlorination).

Spills may occur due to accidents (e.g., collisions, groundings, fires), equipment failure (e.g., pipelines, hoses, flanges), or improper operating procedures during cargo transfer or fueling. With the construction of Bor port, the number of vessels and size of the vessel are expected to increase between Juba to Bor section which also increases the chance of an oil spill incident. In the event of an oil spill incident reaching fresh water, its quality will be negatively affected.

5.4.3.4 Groundwater Quality

Water will be required during the operation phase at the port and facility for the purpose of consumption, dust suppression, cleaning, washing, cooling, and landscaping. Potable water can be sourced from groundwater. Groundwater and surface water interact (through recharge and discharge) and thus if surface water is contaminated there is the possibility to impact nearby unconfined groundwater aquifer.

5.4.3.5 Soil Erosion, Siltation, and Contamination

Solid waste to be generated during the operation and maintenance including municipal waste and used oil from DG sets. This waste can pollute the soil if allowed to uncontrolled interface with soil. Increasing the number of vessels/boats movement in the river may accelerate the riverbank erosion. In addition, extreme rainfall and flood events can erode the soil.

5.4.3.6 Improper Management of Solid Waste

The type and amount of solid waste associated with the port operation may vary depending on the nature of port operations and the types of ships serviced. Improper disposal of solid waste generated from future operations of the port and the offices could also be from three sources viz. institutional or office waste, domestic waste, and waste from cargo handling, etc. This will include biodegradable food

waste and paper products from offices and packaging, polythene or plastic materials, and packaging. The improper collection of waste in the port will increase foul smells, vermin, rodents, and contaminated effluent. This is a negative site-specific and long-term impact.

Solid waste will also be generated on a ship/boat including glass, paper, cardboard, aluminum and steel cans, plastics, and maintenance waste. It can be either non-hazardous or hazardous in nature. Solid waste that enters the water body becomes aquatic debris, and can then pose a threat to aquatic organisms, humans, coastal communities, and people that use the river water.

5.4.3.7 Improper Management of Liquid Waste

During the operation of the port, there will be increased activity of ship/boat movement in the port area. All these activities will increase sources of waste that if not collected and disposed of correctly will pollute the aquatic environment. Sources of aquatic pollution would be from the release of waste generated from the ships including solid waste, oily ballast, and bilge water as well as sewage and waste generation at the port facilities such as domestic wastewater.

5.4.3.8 Impacts on Ecosystem Services

The operation stage of the Bor port, along with the associated access roads of Juba and Bor ports, and the maintained Juba-Bor section of the River Nile, will continue to affect ecosystem services, impacting provisioning, regulating, cultural, and supporting functions over the long term.

Provisioning services, such as fisheries and freshwater supply, will experience ongoing pressure. Continuous port operations and river traffic may disrupt aquatic ecosystems, impacting fish stocks and threatening the livelihoods of local fishing communities. Improved access to the biodiverse region of Bor via new waterways could lead to unchecked development, threatening the area's rich biodiversity, particularly bird and aquatic life. Increased pollution from port operations, such as fuel spills, waste discharge, and runoff, could further degrade water quality in the Nile. This contamination will reduce the availability of clean freshwater for drinking, irrigation, and livestock use, affecting both local communities and agricultural productivity. The displacement of the dry fish processing center in Bor will have lasting economic consequences, as many people will lose their primary source of income, affecting food security and the local economy. The operation of Bor and Juba ports, along with increased river traffic, may facilitate bush meat extraction for foreign markets, worsening unsustainable wildlife hunting and risking local extinctions. This could have severe consequences for the people of Juba and Bor regions, who rely on local wildlife for survival.

Regulating services, including flood control, water purification, and erosion prevention, will be further compromised. The ongoing presence of infrastructure and alterations to the river’s flow from clearing (dredging) may reduce the ability of wetlands and riparian areas to naturally regulate floods and purify water. This could lead to more frequent and severe flooding, particularly during high rainfall events, and increase the burden on water treatment systems. Soil erosion may also persist as natural vegetation continues to be degraded, leading to reduced agricultural productivity in areas adjacent to the ports and the river.

Cultural services tied to the Nile’s cultural and spiritual significance may be permanently altered. The industrialization of the riverbanks and the noise and pollution generated by port operations will diminish the river’s aesthetic value, making it less attractive for ecotourism, recreation, and spiritual practices. This could lead to a decline in tourism revenue and negatively impact the cultural identity of local communities, who view the river as a source of heritage and tradition.

Supporting services, such as biodiversity and nutrient cycling, will face ongoing disruption. The loss of key habitats, such as wetlands, riverbanks, and areas of riparian vegetation, will continue to reduce biodiversity, limiting the breeding grounds and habitats for fish, birds, and other wildlife. This reduction in biodiversity weakens the resilience of the ecosystem, affecting important ecological processes like pollination, nutrient cycling, and soil maintenance. Over time, the diminished health of the ecosystem

could reduce agricultural productivity, harm wildlife populations, and decrease the overall sustainability of the region.

5.4.3.9 Impact on Aquatic Ecosystem and Biodiversity

Continuous port operations, maintenance dredging, and increased river traffic can disrupt aquatic habitats, affecting fish breeding grounds and biodiversity in the River Nile. This disturbance may cause habitat fragmentation, reducing the available space for aquatic species to thrive.

Fuel spills, waste discharge, and runoff from port activities can contaminate the river, degrading water quality. Pollutants harm aquatic life, reduce fish populations, and threaten species that depend on clean water. The disruption of wetlands, riverbanks, and riparian vegetation can reduce the availability of breeding grounds for fish, birds, and other wildlife. A loss of biodiversity weakens ecosystem resilience, leading to declining species populations and overall ecosystem health.

Increased river traffic and port operations may introduce invasive species, which can outcompete native species, disrupt ecosystems, and reduce biodiversity. This traffic also poses direct risks to the critically low populations of Hippopotamus, Nile buffalo, Waterbuck, and Nile lechwe along the Nile.

Improved access to aquatic resources could lead to overfishing or unsustainable resource extraction, depleting fish stocks and disrupting aquatic food chains. Key fish species may be targeted, leading to reduced populations and a decline in overall fish diversity. Aquatic and semi-aquatic wildlife may also be victims of increased traffic fatalities during the operation period due to heightened freight transport.

Dredging often fails to permanently straighten rivers, as rivers naturally meander. This can result in more frequent maintenance dredging and continued ecological disruption. The altered river flow and sediment deposition can increase erosion, further impacting species that rely on stable habitats.

5.4.3.10 Impact on Terrestrial Ecosystem and Biodiversity

During the operational phase, activities will primarily involve the operational management of various river vessels, maintenance dredging, the disposal of dredged materials, and the generation and disposal of solid, liquid, and hazardous wastes from the river vessels.

Increased river traffic from vessel operations will raise noise levels and light pollution, negatively impacting birds, mammals, and herpetofauna. Habitat degradation on riverine islands and floodplains is anticipated, with excessive light disrupting migratory birds' behavior and altering migration patterns.

Improved access to remote areas may lead to greater human encroachment, displacing large mammals, increasing poaching, and heightening human-wildlife conflict. Roads and port operations contribute to vegetation degradation, reducing food and shelter for wildlife, while maintenance dredging alters riparian habitats. Vulnerable species like the Hippopotamus, Nile buffalo, and Waterbuck may lose habitat and face increased poaching.

Additionally, human activity and infrastructure can introduce invasive plants, degrading native ecosystems. Port operations also generate air and noise pollution, disrupting wildlife behavior and potentially causing habitat abandonment.

5.4.3.11 Impacts on Protected Areas

Ongoing vessel operations from Juba to Bor and vice versa during the operational phase of the project will generate continuous noise and light pollution, disturbing wildlife, particularly sensitive species such as birds and large mammals living in or near Bandingilo National Park and Juba Game Reserve. This disturbance may lead to altered behavior, decreased breeding success, and displacement from critical habitats.

Regular operations may increase the risk of oil spills, wastewater discharge, and other pollutants, adversely affecting both aquatic and terrestrial ecosystems. Pollutants can bioaccumulate in wildlife, leading to health issues and population declines.

Maintenance dredging and ongoing material disposal can lead to sediment accumulation in and around protected areas, smothering vegetation and disrupting essential habitats. This can significantly impact the flora and fauna, including species such as gazelles, elephants, and various birds reliant on these ecosystems.

Wetlands and riparian vegetation within Bandingilo National Park, critical for supporting biodiversity, may suffer from increased sedimentation. Altered water levels and disrupted hydrological processes can lead to a decline in aquatic plants and animals, which are vital for maintaining ecological balance.

The disposal of dredged materials may introduce heavy metals, hydrocarbons, and other harmful substances into the soil and water systems of protected areas. This contamination can poison native flora and fauna, negatively impacting ecosystem health.

Bandingilo National Park, recognized as an Important Bird Area (IBA), may see a decline in migratory bird populations due to habitat loss and food scarcity resulting from sedimentation. The degradation of feeding and resting habitats can disrupt migratory patterns and breeding success.

Operational activities may lead to increased human presence in protected areas, raising the risk of illegal logging, poaching, and hunting of wildlife. Such activities can place additional stress on already vulnerable species and contribute to habitat degradation.

5.4.3.12 Visual Impacts

Once the construction of port and access roads and clearing (dredging) in the river is complete, the port and ancillary facilities to be constructed will be prominent in the area. The project infrastructure will not drastically change the existing nature of the landscape, and therefore the visual impact.

5.4.3.13 Community Health, Safety, and Security

During the operation phase of the proposed port, access road, and river clearing project in South Sudan, community health, safety, and security may face significant challenges as outlined in World Bank Environmental and Social Standard 4 (ESS 4). The operation phase may lead to heightened risks related to water quality and vector-borne diseases, impacting overall community health. River clearing and port activities can contribute to contamination of local water sources, threatening access to safe drinking water and undermining local fishing livelihoods. The changes in land use may create stagnant water bodies, increasing the risk of mosquito-borne diseases such as malaria.

5.4.3.14 Impacts on Traffic and Transport

The operation of the port, access road, and clearing of the river will likely result in a significant increase in heavy vehicle traffic, and high-speed traffic, which poses safety risks to local communities, particularly in rural areas where road safety measures may be lacking. Pedestrians, including children and the elderly, may face a heightened risk of accidents, as the local community relies on these roads.

5.4.3.15 Occupational Health and Safety

Operation and maintenance of the port, access road, and clearing of the river will involve workers whose safety may be at risk because of the operation of equipment among others. These risks may include operating large machinery like cranes, dredgers, and loaders; manually lifting, carrying, or moving heavy materials; and the presence of wet, uneven, or cluttered surfaces around the port and riverbank, which increase the chance of slips, trips, and falls, especially during loading and unloading. Workers may also face exposure to harmful chemicals, fuels, oils, and dredged sediment, as well as drowning risks. Additional hazards include prolonged exposure to loud noise from equipment, maintenance or inspection tasks in confined spaces, and the emission of dust and particles. Occupational health and safety impacts during operation/maintenance and repair are considered to be of moderate significance due to the potential risk of the above-mentioned activities. Proper implementation of the OHS management plan should be ensured by the project authority to mitigate the potential OHS risks.

5.4.3.16 Impact on Vulnerable and Disadvantaged Groups

Vulnerable populations, including women, children, and the elderly, may face increased risks of exploitation, neglect, and exclusion from economic opportunities during the port's, access road operation. During the consultation meeting at Juba and Bor, it was identified that women would lose their source of income due to the operation of the proposed project. Women may experience heightened domestic burdens, while children might be at risk of being left unattended due to parents' long working hours.

5.4.3.17 Social Inequality and Marginalization

There is a risk that the economic benefits generated by the port will not be evenly distributed among local communities, leading to increased social inequality. Marginalized groups, particularly women and internally displaced persons, may not have equal access to job opportunities or resources.

5.4.3.18 Impacts on Land use and land cover

The land use and land cover changes will take place during the construction of port infrastructures including ancillary facilities and access roads. Further changes are not anticipated during the operation phase of the project. However, residential and commercial buildings, shops, markets, etc. development is expected to be established beside the access roads. The settlements in the immediate vicinity of the road will be affected, which would have a minor negative impact.

5.4.3.19 Impacts on Microclimate and GHGs

The operation phase of the project will not have any significant impact on climate change drivers or climate change. However, GHG emissions are expected due to the transportation of material to and from the port site, material handling within the port site, operation of the machinery/equipment/pumps, operation of DG sets, and operation of vessels/boats. Though these emissions will not be significant enough, these may increase in a situation like traffic congestion if to and from or port traffic is not managed effectively.

5.4.3.20 Impacts due to Natural Hazards

Vessels/boat movement is subjected to various threats of accidents related to natural disasters like floods and operational like collisions, fire, and spillages. The White Nile is a transboundary river and is perennial in nature and floods and erosion are very common. Thus, threats to navigation are anticipated during heavy flow and flood-like situations, especially to smaller vessels. Thus, it is mandatory for vessels to adopt the measures and prepare emergency preparedness plans to handle emergency situations like floods.

There are the possibility of collision, fire, and spillages which can impact water quality and aquatic life both significantly depending on the material being transported. The effect can be more severe in the case of transportation of petroleum products. This can also affect the health of the crew, nearby habitats, and the aquatic environment.

A summary of potential impact significance during the operation and maintenance phase has been shown in Table 5-10.

Table 5-10: Potential Impact Significance during Operation and Maintenance Phase

Potential Impacts	Impact Significance Evaluation						
	Nature	Extent & Location	Duration	Intensity/ Severity	Replaceability	Probability	Significance
Ambient Air Quality	Indirect	Regional	Long Term	Low	Low	Medium	Low
Ambient Noise Level and Vibration Level	Indirect	Local	Long Term	Low	Low	Medium	Low
Surface Water Quality	Direct	Local	Long Term	Medium	Low	Medium	Low
Groundwater Quality	Direct	Project Site	Long Term	Insignificant	Low	Low	Very Low
Soil erosion, Siltation, and Contamination	Direct	Project Site	Long Term	Medium	Low	High	Medium-low
Improper Management of Solid Waste	Direct	Project Site	Long Term	High	Medium	High	Medium-low
Improper Management of Liquid Waste	Direct	Project Site	Long Term	High	Medium	High	Medium-low
Impact on Ecosystem Services	Direct	Regional	Long Term	Medium	Low	Medium	Medium Low
Aquatic Ecosystem and Biodiversity	Direct	Regional	Long Term	Medium	Low	Medium	Medium Low
Terrestrial Ecosystem and Biodiversity	Direct	Regional	Long Term	Medium	High	Medium	Medium Low
Protected Areas	Direct	Regional	Long Term	Medium	High	Medium	Medium Low
Community Health & Safety	Direct	Local	Long Term	Medium	Medium	Medium	Medium Low
Impact on Traffic and Transportation	Indirect	Local	Long Term	High	Low	Medium	Medium Low
Occupational Health & Safety	Direct	Project Site	Long Term	Medium	High	Medium	Medium Low
Vulnerable Groups	Direct	Project Site	Long Term	High	Low	Medium	Low
Social Inequality and Marginalization	Direct	Project Site	Long Term	Low	Low	Low	Very Low
Impacts on Land Use and Landcover	Indirect	Local	Long Term	Medium	Low	Medium	Low
Impact on Microclimate and GHGs	Indirect	Regional	Long Term	Medium	Low	Medium	Medium Low
Impacts due to Natural Hazards	Indirect	Regional	Long Term	High	Medium	Medium	Medium High

5.4.4 Decommissioning and Dismantling Phase

5.4.4.1 Impacts on Ambient Air Quality

During the decommissioning phase of the project, the biggest source of emissions will be the fugitive dust emissions from demolition activities at the site. In addition, exhaust emissions from equipment and machinery will be used for structure demolition at the site and transportation vehicles.

5.4.4.2 Ambient Noise Level and Vibration Impacts

During the decommissioning phase, the major source of increasing ambient noise levels will be the movement of vehicles and the operation of the Diesel Generator set at the site. Noise will be generated from site clearing, excavation work at the site, handling of demolition material, transportation of material, emissions due to the movement of vehicles and heavy machinery, etc. These activities will be done in a short period of time.

5.4.4.3 Waste from Demolished Structures

Demolition waste is expected to comprise mostly concrete, bricks, glass, wood, plastic, metallic debris, packing material, electronic refuse, etc. Haphazard disposal of such waste may cause contamination/impaired quality of the receiving body, especially soil, water resources, wildlife, livestock, community, and aesthetics.

5.4.4.4 Impact on Aquatic Ecosystem and Biodiversity

The decommissioning phase of the Juba and Bor ports, along with the access road for the project, may impact the aquatic ecosystem and biodiversity. The removal of structures and movement of heavy equipment could disturb sediments, increasing turbidity and potentially smothering aquatic habitats such as aquatic weeds, and fish spawning grounds.

During dismantling, improper storage or handling of fuels and chemicals could result in leaks or spills, contaminating nearby water bodies and affecting aquatic species. The dismantling of surface structures may also lead to the loss of habitats that may have developed around piers or underwater structures.

The movement of vehicles and demolition activities could generate underwater noise, disrupting fish and aquatic megafauna in the White Nile River, which relies on sound for navigation and communication. The dust generated could be deposited on plant leaves, potentially hampering photosynthesis. Improper treatment and disposal of solid or liquid waste during decommissioning activities could further pollute water bodies and harm aquatic species.

Additionally, the movement of equipment and vessels in and out of the port may introduce or spread invasive species, negatively affecting local aquatic biodiversity. Dismantling port structures could alter water flow patterns, potentially leading to erosion, sedimentation, or changes in water quality, all of which could impact aquatic ecosystems.

5.4.4.5 Impact on terrestrial Ecosystem and Biodiversity

Decommissioning Juba and Bor ports, along with their access roads could have significant impacts on terrestrial ecosystems and biodiversity. The removal of infrastructure, including roads and buildings, could lead to vegetation clearance and the destruction of critical habitats for local wildlife and plants. This could result in loss of biodiversity and disruption of ecological processes.

The presence of fuels, chemicals, and waste at port facilities can contaminate the soil. This contamination can harm plants, invertebrates, and other organisms that rely on the soil for survival. Runoff from the decommissioning site can pollute nearby water bodies, affecting aquatic ecosystems and potentially impacting drinking water sources.

Dismantling activities and the movement of equipment can introduce invasive species into the area, which can outcompete native species and disrupt ecosystem balance. The decommissioning process

can create noise and disturbance that can stress wildlife and disrupt their natural behaviors. The dust generated could be deposited on plant leaves, potentially hampering photosynthesis.

5.4.4.6 Risks to Occupational Health and Safety

Decommissioning will involve the use of machinery and equipment that may endanger the lives of both operators and other workers within the site. Other issues that could be pertinent to worker health and safety during the decommissioning phase include risks and hazards associated with noise and vibration, and air quality. Works related stress including long hours of work and under extreme heat may also affect workers.

A summary of potential impact significance during the decommissioning and dismantling phase has been shown in Table 5-11.

Table 5-11: Potential Impact Significance during Decommissioning and Dismantling Phase

Potential Impacts	Impact Significance Evaluation						
	Nature	Extent & Location	Duration	Intensity / Severity	Replaceability	Probability	Significance
Impacts on Ambient Air Quality	Direct	Project Site	Short Term	Low	Low	High	Low
Ambient Noise Level and Vibration Impacts	Direct	Project Site	Short Term	Low	Low	High	Low
Waste from Demolished Structures	Direct	Project Site	Short Term	Low	Low	Definite	Low
Impact on Aquatic Ecosystem and Biodiversity	Direct	Local	Short Term	Low	Low	Medium	Low
Impact on Terrestrial Ecosystem and Biodiversity	Direct	Local	Short Term	Low	Low	Medium	Low
Risks to Occupational Health and Safety	Direct	Local	Short Term	High	High	High	Medium High

5.5 Cumulative Impacts

Cumulative impacts occur when a Project activity acts together with other activities (other projects or third-party activities) to impact the same environmental or social resource or receptor. *The IFC defines cumulative impacts as "impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted".*

The IFC 'Good Practice Handbook for CIA and Management' provides a practical and preliminary six-step approach for developers in emerging markets to conduct a CIA that meets such requirements. The methodology in this CIA has been based on the principles of the IFC guidance, which sets out a six-step structure (i.e., the foundation) for conducting a comprehensive CIA, with the objectives from each step presented in Figure 5-1. It is not always possible to follow this methodology word-for-word and the IFC guidance document is exactly that - a useful guide. Where there are deviations from the guidance - because of the specifications of the Project and other activities - or lack of information about third-party other projects/initiatives. The assessment was adapted and modified throughout the course of compiling the CIA.

Figure 5-1: CIA Six-Step Approach



Source: IFC Good Practice Handbook for CIA and Management, 2013

Selection of Valued Environmental Components (VECs) and Defining the Impact:

VECs were selected based on consultant observation of the study area and the outcome of the consultations. The selected VECs are:

- Ambient Air Quality
- Ambient Noise Level
- Surface Water Quality
- Aquatic Ecosystem and Biodiversity
- Community Health, Safety, and Security
- Occupational Health and Safety
- Traffic and Transport
- Trade
- Employment
- Ecosystem Services

The impact on selected VECs is considered from different project activities to know the cumulative impacts.

Identification of Different Projects within the Study Area:

Past and present activities were considered in developing the environmental and social baseline against which the Project is assessed, thus, such previous activities have already been considered in this ESIA and used as the baseline to assess the potential impacts of the proposed Project activities. The following have been identified as 'reasonably defined' activities that could act together with the Project to cumulatively affect the environment:

Basically, there is no large number of industrial activities in the study area. However, a list of past and ongoing projects that was identified during the data collection has been given below:

- Juba-Bor-Malakal Highway
- Juba Thermal Power Station - 33 MW Diesel fuel-fired thermal power plant
- Juba Solar Power Station - 20 MW solar power plant
- Bor Counties' Dyke Rehabilitation Project
- Rehabilitation of other river ports along the Nile River stretch between Juba and Bor

In addition, a list of future projects in the study area has been given below:

- Power plant and grid network in Bor
- Annual maintenance of dyke along the river Nile in the Bor area
- Expansion of urban water supply network
- Construction & Infrastructure Improvement in Bor Town - Jonglei State including road, flood drainage, etc.
- Rehabilitation work on the Bor-Ayod Road in Jonglei State
- Construction of South Sudan-Ethiopia cross-border road

Establishing Baseline Condition:

The baseline condition of the area is already given in Chapter 4. The consultant has monitored the ambient air quality and water quality of the study area. The monitoring result shows that the ambient air quality and ambient noise level of the area are within the WBG EHS guideline value. Surface water quality was compared with the East African Standard used by the South Sudan National Bureau of Standards and found that all water quality parameters in collection samples complied with the East African Standard. However, in one location the turbidity and chromium concentrations exceeded the standard value. There are two protected areas i.e., Bandingilo National Park and Juba Game Reserve are located in the study area and two IBAs namely Bandingilo and Sudd (Bahr-el-Jebel system) are located in the project area. During baseline data collection, a total of 16 aquatic flora species from 12 families were identified. Major species identified in the study area include emergent plants such as Papyrus *(Cyperus papyrus),* Reed Mace *(Typha latifolia),* and Common water Hyacinth *(Eichhornia crassipes).* A total of 17 fish species from 10 families were identified and all these fish species are classified as Least Concern (LC). Among the identified megafauna species, Nile softshell turtle *(Trionyx triunguis)* is categorized as Vulnerable (VU) as per the global IUCN Red List of Threatened Species (ver. 3.1). In Jonglei state about 72% of the population has access to health care, while 28% do not. Similarly, Central Equatoria state has the highest access rate with 81% of the population having access to health care and only 18% without. These health facilities include hospitals, health centers, and dispensaries. Likewise, the main economic activities of the project study area are subsistence agriculture, livestock rearing, fishing, and informal trade.

Assess Cumulative Impact on VECs:

- **Impact on ambient air:** the baseline monitoring of air quality in the study area reveals that all the parameters meet the WBG EHS guidelines. Currently, the rehabilitation of Juba port is ongoing involving construction work in proximity that may affect air quality conditions, particularly as a result of increased traffic and construction dust. Due to the implementation of the proposed project, ambient air quality of the area can be temporarily deteriorated from the use of machinery, and vehicles for different projects. The developed access road network will be able to cope with the higher volume of traffic, allowing vehicles to drive at a more efficient rate of fuel consumption. Increased road traffic will increase the total suspended particles (dust particles). However, with the large number of cargo/boats being handled within the port, it is also likely that higher traffic volumes could account for higher air emissions. These may affect things such as eye irritation, allergies, coughing, asthma attacks, and dust layer coating on property and vegetation.
- **Impact on ambient noise level:** the baseline monitoring of noise level in the study area reveals that all the parameters meet the WBG EHS guidelines. Currently, the rehabilitation of Juba port is ongoing involving construction work in proximity that may affect noise levels, particularly as a result of increased traffic and construction noise. Activities under the proposed project such as the movement of construction vehicles and machinery including trucks, concrete mixture, earthwork, and offloading and loading of equipment and material at the site among others will generally contribute to the increase in noise levels. These may affect things such as anxiety, mental fatigue, irritability, blood pressure, and pulse rates, etc. due to excessive noise exposure.

- **Impact on surface water:** surface water in the White Nile River is impacted by human activities in both Juba and Bor area. Sewage disposal from the residential area is mixed with surface water. Current activities in the Juba port area have no impact on waterbodies and most of the work is ongoing in the land area. Due to the implementation of the proposed project, the surface water quality may be changed due to the increasing turbidity while dredging or backfilling. During the operational phase, there will be increased activities of cargo/boat movement on the port jetty. In addition, improper collection and disposal of liquid waste may impact surface water quality.
- **Impact on the aquatic ecosystem and biodiversity:** human activities including improper management and disposal of solid and liquid waste are impacting the aquatic ecosystem in the area. The numerous construction activities under the proposed project in the area may increase the pollution concentration in the river. Increasing underground noise due to the movement of vessels/boats and dredging activities the aquatic mammals, fish, birds, and benthic community may be affected. Improper management of municipal waste from different activities in the area may impact the water quality. Sediment contamination is where bottom substrates in the aquatic environment accumulate contaminated sediment that could interfere with the reproduction and feeding mechanism of aquatic organisms such as fish. Impaired aesthetics due to turbid water, trash, debris, and an oily sheen may reduce the visual appeal of waterways and affect recreational potential**.**
- **Impact on community health, safety, and security:** there is likely to be overlap with construction of other project activities in close proximity that will primarily present risks associated with traffic movements and construction activities posing a risk to local communities residing close by and other road users. Due to the implementation of the proposed project an increase in vehicles, particularly construction vehicles, leads to an increased potential for accidents to occur. An increase in the prevalence of HIV/AIDS and other sexually transmitted diseases (STDs) should be expected because of the influx of people in the area. Daily construction activities in close proximity to residential areas could lead to an incident with a community member.
- **Occupational Health and Safety:** cumulative impacts on OHS can arise from overlapping activities like construction, heavy vehicle movement, and waterway operations. These activities increase the risk of accidents, exposure to hazardous materials, and worker incident accidents, especially in challenging environments. Additional pressure on local health, services, and emergency response systems could further complicate safety management. To address these risks, it is essential to establish clear safety protocols, provide proper training and protective equipment for workers, and set up effective monitoring and emergency response systems to ensure a safe working environment.
- **Impact on traffic and transport:** the road and both traffic will be significantly increased in the area. High-speed traffic may pose safety risks to local communities, particularly in rural areas where road safety measures may be lacking.
- **Impact on trade:** trade within the surrounding states as well as in neighboring countries including Ethiopia, Democratic Republic of the Congo, Uganda, etc. is anticipated to increase.
- **Impact on employment:** different projects will increase employment opportunities for businesses, such as shops, food stalls, tea stalls, restaurants, workshops, etc. Also, different projects will provide employment for local people. The construction activities under the proposed project will lead to additional temporary and permanent job creation, of varying skill levels. It will allow greater traffic levels and therefore improved access to the supply and delivery of goods.
- **Impact on Ecosystem Services:** cumulative impacts on ecosystem services in the project area considering activities of this project and additional past, current, and future projects are expected to be significant. These combined activities, which include increased development,

infrastructure expansion, and intensified river modifications, may profoundly affect water quality, habitat stability, and biodiversity along the White Nile. With added sedimentation and pollution from multiple projects, the river's natural water purification processes could be compromised, impacting drinking water quality and agricultural irrigation for local communities. Ongoing and future habitat alterations, such as road construction and increased human encroachment, could also lead to habitat fragmentation, reducing the natural flood control capacity of the floodplains and wetlands. This may heighten flood risks, affecting agriculture and settlement areas that rely on stable water levels. Increased traffic, construction, and maintenance dredging activities can lead to wildlife disturbance and a decline in fish populations, directly impacting food provision and local livelihoods that depend on fishing and sustainable agriculture. In addition, cumulative deforestation and vegetation loss may diminish carbon sequestration and pollination services, crucial for ecosystem stability. Without integrated management and conservation strategies, these compounded impacts could significantly undermine ecosystem resilience and the long-term provision of critical ecosystem services in the region.

Mitigation and Management of Cumulative Impacts:

Mitigation and management of cumulative impacts often require cooperation with other stakeholders or at a government level and are frequently beyond the ability of a single project development to control solely. In line with international good practice, mitigation should be commensurate with the level of contribution to the cumulative impact by the developer.

Effective implementation of good construction management measures, the cumulative impacts can be adequately mitigated to acceptable levels. These cumulative impacts could be effectively managed and mitigated through practical implementations of the following proposed mitigation measures to minimize the adverse impacts:

- Implementation of mitigation/engagement measures as well as monitoring plans proposed in this ESIA.
- Community sensitization on air and noise pollution and conduct monitoring of air quality and noise level against WBG EHS guidelines/WHO guidelines in the construction phase.
- Adhering to both national legal framework and World Bank Environmental and Social standards requirements specifically ESS6 and deployment of restoration plans to alleviate biodiversity loss.
- A waste management system development and implementation for liquid, solid, and hazardous waste in the port facility area is strongly recommended.
- Provision of pedestrians, and animal crossings to access farmlands, drinking water, and grazing land.
- Community sensitization on the prevalence of HIV/AIDS and other sexually transmitted diseases.
- Proper maintenance of the existing community access roads, traffic safety, and provision of alternative temporary access to local traffic during construction.
- Intersectoral collaboration to ensure sustainable planning infrastructural development in the states.
- It is recommended that coordination be undertaken with the relevant project authorities to understand how overlapping construction movements will be managed.

6 ANALYSIS OF ALTERNATIVES

6.1 Introduction

For the proposed project, a number of options are under consideration to present the most feasible alternatives. These options considered are in respect of:

- No-go alternative
- Alternative site
- Access road alignment
- Dredging methods
- Dewatering
- Disposal options
- Selection of disposal site
- Alternative construction technology and materials

6.2 Assessment of Alternatives

6.2.1 No-go Alternative

The no-go alternative assumes that the proposed project will not go ahead i.e., it is the option of not implementing the proposed project. This alternative would result in short-term environmental and social impacts on the site or surrounding area. It provides a baseline against which other alternatives are compared and will be considered throughout this report. The following implications will occur if the “no-go” alternative is implemented:

- River port at the Bor site will not be constructed.
- No access roads will be constructed/rehabilitated to connect the Juba and Bor ports.
- No clearing (dredging) will be done in selected locations of the White Nile River.
- Accessibility from Juba to Bor port using the waterway remains as it is.
- No capital cost to the project proponent, short-term benefit.
- River conditions and lack of navigation aid remain as it is.
- Impact on river morphology and aquatic environment (short-term impact) from clearing (dredging) work and port construction can be avoided.

Converse to the above, the following benefits could occur if the “no-go” alternative is not implemented:

- Assist the government in providing efficient, reliable, safe, and secure river transportation services for both passengers and goods as part of a seamless, integrated multimodal transport system.
- Navigational difficulties including riverbed weeds growth, water hyacinth, debris from sunk vessels, and riverbed condition on the Juba-Bor stretch will be removed and travel time between Juba and Bor port will be significantly reduced.
- Cost-effective transportation will be developed, and business opportunities will be increased in the region.
- Appropriate cargo handling capacity and equipment for facilitating integration with other modes of transportation will be developed.
- Infrastructure development for developing waterways will involve comparatively less expenditure than required for developing a road network for the transportation of an equivalent amount of freight.
- Opportunities for additional employment (both direct and indirect) in the Bor area as well as the surrounding region will be generated.
- The positive socio-economic impacts likely to result from the proposed project such as increased business opportunities, improvement of the livelihoods of the surrounding community, local spending, and the creation of local employment opportunities will be realized.

- The community livelihoods (fishing-based livelihoods) will be advanced through employment activities and transportation/supplies that will be provided through proposed project facilities and infrastructures.

While the "no-go" alternative will not result in any long-term permanent negative environmental impacts, and it will also not result in any positive community development or socio-economic benefits. The clearing (dredging) activities will have a significant impact on aquatic ecology on a short-term basis, which requires to be managed adequately to minimize the impact. It will also not assist the government in providing efficient, reliable, safe, and secure river transportation services for both passengers and goods as part of a seamless, integrated multimodal transport system. Hence the "no-go" alternative is not currently the preferred alternative.

6.2.2 Alternative Site

The selection of a riverport site is a complex process and involves the consideration of technical design/engineering, commercial, environmental, and social criteria. One of the key variables in the site selection process was the land availability for the construction of a river port by ensuring adequate ancillary facilities and future expansion. The following two sites were considered to find out the best location.

- Site-1: Existing port at Bor town
- Site-2: Proposed port site at Leudier

6.2.2.1 Site Alternative 1: Existing Port at Bor Town

The existing port is located at Bor town and close to the secretariat of the Jonglei state. Table 6-1 summarizes the alternative advantages and disadvantages of the existing river port at Bor town.

Table 6-1: Advantages and Disadvantages of the Existing River Port at Bor Town

Advantages	Disadvantages
• Port connectivity to the existing road. • Will use the existing access road so no land acquisition is required for the access road development. • No resettlement is involved in this site. • No tree cutting is involved as this site is already being used as a river port. • No landscape and visual impact.	• Insufficient land to develop a modern port terminal to accommodate the anticipated demand. • Future expansion is not possible due to the physical presence of the secretariat of Jonglei State. • Cumulative impact of traffic on the community and road uses. Traffic congestion may occur at the Bor town. • Lack of available space for plantation and habitat restoration. • The proposed Bor port site is a flood-prone area.

6.2.2.2 Site Alternative 2: Proposed Port site at Leudier

The proposed port is located in the Leudier area in Bor. Table 6-2 summarizes the alternative advantages and disadvantages of the proposed port site in Leudier.

Table 6-2: Advantages and Disadvantages of the Leudier Area

Advantages	Disadvantages
• Sufficient land area for the development of the port to accommodate the anticipated demand and further expansion.	• Land acquisition will be required for the proposed port construction. • Require the relocation of settlers which raises social and political concerns. It also needed to

Advantages	Disadvantages
• Will use the existing access road so no land acquisition is required for the access road development. • Currently, the proposed site is used as a most suitable fish landing site and retail of dry fish activities takes place mainly by women. • Ease the difficulty of transportation of dry fish and increase the supply to domestic and external markets such as the Democratic Republic of the Congo and Uganda. • Available space for plantation and habitat restoration.	prepare a RAP including LRP, consultation, and ensure compensation of affected people. • Both the physical and economic displacement will take place. • An insignificant number of trees/vegetation removal will be involved. It also needed to prepare a Resettlement Action Plan including a Livelihoods Restoration Plan and ensure compensation for the affected trees. • The proposed port site is a flood-prone area therefore a detailed flood risk assessment will be required before finalizing the project design.

Finally, the proposed Leudier site is preferable considering the construction of a modern port for trade and cargo handling and the future expansion of the port. There is no environmentally sensitive area in and close to the proposed port site. A very limited number of trees/vegetation need to be removed. However, both physical and economic displacement will be required for the Leudier site. Therefore, RAP and LRP need to the carried out.

6.2.3 Alternative Access Road Alignment

Alternative access road alignment has not been taken into consideration as the proposed access road development will follow the existing access roads in Juba and Bor ports are already developed and well connected with the ports. The project development actually entails an improvement of the present access road condition. To build an access road on a new alignment would not be feasible in terms of environmental, social, and economic perspectives. The existing access road alignment has the following advantages:

- No additional land acquisition will be required.
- No house or community structures are located on the proposed access roads.
- Areas requiring extensive clearing of vegetation have been avoided.
- Access road alignment avoids environmentally sensitive areas/protected areas.
- The access road avoids the habitation area.

6.2.4 Dredging Methods

The selection of dredging equipment and method used to perform the dredging will depend on the factors including physical characteristics of the material to be dredged, quantities of material to be dredged, dredging depth, distance to disposal area, physical environment of and between the dredging and disposal areas, contamination level of sediments, method of disposal, production required, and type of dredges available.

Selection of dredgers is important as selection of dredger has many environmental implications such as the effect of production rate on the project duration, levels of turbidity and suspended sediment concentrations generated relative to background levels, proportion of total sediment lost to the environment, and degree of contamination in the sediment.

There are two primary types of dredging equipment presently being used for dredging. These are the mechanical dredgers (grab dredger, backhoe dredger, and bucket ladder dredger), and hydraulic dredgers (cutter suction dredger, trailing suction hopper dredger, and plain suction dredger). The difference between these types of operations is the mechanisms and methods by which the sediments are excavated, collected, and conveyed.

6.2.4.1 Mechanical Dredgers

A mechanical dredge employs a bucket to remove sediment from the river/seabed, move the sediment up through the column, and place it in a haul vessel for transport and final disposal. There are two major classes of mechanical dredges, based on how the bucket is deployed. The first uses a wire rope attached to a crane to lower the bucket to the bed and retrieve e.g., clamshell dredge. The second class deploys a bucket at the end of the arm of an excavator or backhoe and is referred to as an articulated fixed-arm dredge. This type of method produces a high percentage of resuspended sediment and allows for the removal of debris. It is more mobile, can work in tight areas, and requires less time to do more work. It is efficient for disposal at long haul distances. However, it has higher equipment costs as well as operation, and maintenance.

Grab Dredgers

Grab dredgers are a simple method of dredging operation that involves the collection of sediments in a crane-mounted bucket, the jaws of which are opened and closed (rope-operated or hydraulically) like clamshell-napping sediment. There are various grab buckets designed for different types of material, such as mud grab, sand grab, and heavy digging grab. The upper structures of the conventional grab buckets are open, and if they are overfilled, which is a common occurrence, sediments spill out of the bucket as it is raised through the water column. Suspended sediments are also released from the impact of the grab on the bottom, pulling the grab out of the sediments, seepage from grabs, and from overflow of barges or hoppers.

Specially designed grabs are available with a closed-plated upper structure which reduces spillage by over-topping, however, whilst they appear to reduce suspended sediment levels in the upper water column, there is evidence to suggest that they may increase the levels of suspended sediments near the bottom. A photograph of the grab dredger is given in Figure 6-1.

Figure 6-1: Photographs of a Grab Dredger



Source: https://worldmaritimenews.com/wp-content/uploads/2014/04/East-Marine-Launches-New-Grab-Dredger-Bestla.jpg

Backhoe Dredgers

Backhoes are shore-based or pontoon-mounted diggers that can be used in marine environments. Especially where ground conditions are difficult, such as shallow waters and confined spaces. Suspended solids can be released into the water column during excavation of the sediments, as the bucket is raised and lowered to the seabed, and from the overflow of barges. Suspended solids generated during the excavation activity are likely to be similar to those generated using a grab dredger.

This method of dredging is highly accurate and may be of particular benefit when working on environmentally sensitive areas. A photograph of the backhoe dredger has been given in Figure 6-2.

Figure 6-2: Photographs of a Backhoe Dredger



Source: https://offshore-fleet.com/images/backhoe_dredger.jpg

Bucket Ladder Dredger

A bucket dredger is equipped with a continuous chain of buckets which are carried through a ladder. A u-shaped pontoon is used to mound the ladder. The bucket dredger is anchored on six anchors and the drive of the bucket chain is on the upper side. During dredging, the dredger swings around the bow anchor by paying out the winches on board. The buckets, which are filled on the underside, are emptied on the upper side by tipping their contents into a chute along which the dredged material can slide into the barges moored alongside. The chain is driven by the so-called upper tumbler at the top of the ladder frame, which is connected either via a belt to the diesel or directly to an electro-motor or hydro-motor. A photograph of the bucket ladder dredger is given in Figure 6-3.

Figure 6-3: Photographs of a Bucket Ladder Dredger



Source: https://rohr-idreco.com/hubfs/Products/Bucket%20ladder/Bucket%20Ladder%20Dredger_1200x811.jpg

6.2.4.2 Hydraulic Dredging

Hydraulic dredges add water to the sediment and transport it as slurry through a pipeline to the selected disposal site. It normally involves the use of a dredger head to dislodge the sediment from the bed where it mixes with water for transport through the pipeline e.g., Cutter heads. This method can remove more fine materials such as silt and sand and produce a low percentage of suspended sediment. However, it is not suited for removing larger or coarser dredge spoils. It requires more skill and experience to achieve the optimal suction setting for different bodies of water and types of sediment. It has lower equipment costs as well as for operation and maintenance. Depending on the site may require longer dredge time as compared to the mechanical equipment.

Cutter Suction Dredgers

A cutter suction dredger cuts hard soil into fragments with a rotating cutter head. The material is sucked up by dredge pumps and discharged to a deposit area through pipelines across sea and land. In some cases, split hopper barges moored alongside the cutter suction dredger transport the soil to the deposit area to unload it there.

While operating, cutter suction dredgers are stationary dredgers. During the dredging works, a spud is lowered into the seabed to secure the vessel. As a result, it is kept in the same location, but by using winches and anchors, the dredger swings sideways, and the cutter head cuts and removes the soil. A photograph of the cutter suction dredger has been given in Figure 6-4.

Figure 6-4: Photographs of a Cutter Suction Dredger

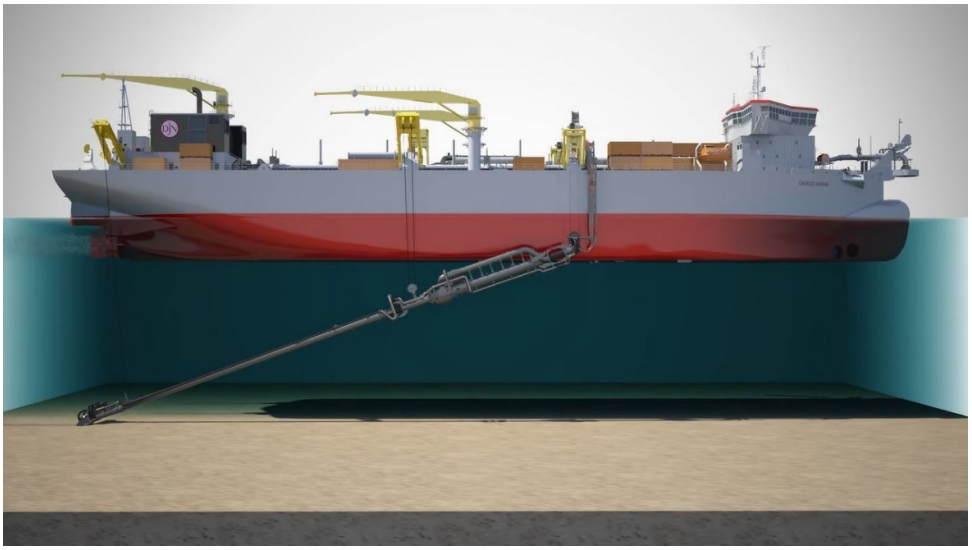


Source: https://www.mining-dredger.com/test/mining-dredger.com/photo/pl35039487-remark.jpg

Trailing Suction Hopper Dredgers

A trailing suction hopper dredger is commonly used for maintenance dredging in coastal areas. As the ship moves slowly, sediments from the seabed are pumped through trailing drag heads into a hopper. Suspended sediments can be generated as the drag head moves over the seabed, as well as from various other operating activities from the ship, although the largest contribution of sediments arises from overflow during loading. Trailer suction hopper dredgers can be used for maintenance dredging in environmentally sensitive areas if special care is taken. Certain modifications can be made to the equipment to minimize the release of suspended solids including the use of special drag heads, reduced trailing speed, increased under-keel clearance to minimize propeller scour, use of degassing to maximize pump performance in areas with organic materials, use of underwater pumps to maximize solid concentration, and avoid using drag-head water jets. A photograph of the trailing suction hopper dredger has been given in Figure 6-5.

Figure 6-5: Photographs of a Trailing Suction Hopper Dredger



Source: https://www.dredgingtoday.com/wp-content/uploads/sites/11/2022/12/jdn.jpg

Plain Suction Dredgers

A plain suction dredger is a stationary dredger, consisting of a pontoon anchored by one or more wires and with at least one sand pump, that is connected to a suction pipe. The discharge of the dredged material can take place via a pipeline or via a barge-loading installation. Suction tube is arranged in a well in the bows of the pontoon. Other end of the suction pipe is suspended from a gantry or a frame by the ladder hoist. The ladder hoist is connected to the ladder winch to suspend the suction pipe at the desired depth. The excavation of dredge material is done by the erosion of a Jetstream/suction flow of the dredge pump and breaking process. During dredging the dredger is moved slowly forward by a set of winches. To increase the amount of sand flowing towards the suction mouth, a water jet is often directed onto the breach bank. In this case, the jet pipe is often mounted above the suction pipe. A photograph of the plain suction dredger has been given in Figure 6-6.

Figure 6-6: Photographs of a Plain Suction Dredger



Source: https://www.ectmarine.com/wp-content/uploads/2023/01/1_bewerkt-1-scaled-e1638880080865.jpeg

A comparative analysis of types of dredgers and their relative performance related to environmental aspects is given in Table 6-3.

Table 6-3: Comparative Analysis of Dredgers and their Relative Performance Related to Environmental Aspects

Types of Dredgers	Noise	Turbidity	Spill	Dilution	Mixing	Accuracy	Safety
Mechanical Dredgers							
Grab dredger	Better than average	Below average /Average	Better than average	Better than average	Average	Below average	Below average
Backhoe dredger	Better than average	Below average /Average	Better than average	Better than average	Better than average	Better than average	Below average
Bucket ladder dredger	Below average	Below average /Average	Better than average	Better than average	Average /Better than average	Better than average	Below average
Hydraulic Dredgers							
Cutter suction dredger	Better than average	Better than average /Average	Average	Average	Better than average /Averag e	Better than average	Better than average
Trailing suction hopper dredger	Better than average	Below average /Average	Average	Below average	Below average	Below average	Better than average /Average
Plain suction dredger	Better than average	Better than average	Below average	Average	Below average	Below average	Better than average

A comparative analysis of different types of dredgers related to environmental aspects is given in Table 6-4.

Table 6-4: Comparative Analysis of Different Types of Dredgers Related to Environmental Aspects

Attributes	Grab Dredger	Backhoe Dredger	Cutter suction Dredger	Hopper Dredger
Types	Mechanical	Mechanical	Hydraulic	Hydraulic
Usage	Inland and coastal waters	Shallow water and confined places	Inland waters	Coastal areas
Strata	Silty, gravel, mud, and soft rock	Clay and gravel	All types of soil, sandy, silty, and rock	Silty and gravel
Ambient Noise Level dB(A)	115 dB(A)	110-118 dB(A)	100-115 dB(A)	100-112 dB(A)

Attributes	Grab Dredger	Backhoe Dredger	Cutter suction Dredger	Hopper Dredger
Underwater noise level at 1m underwater at 1µPa2m2	Less	186-188 dB	172-185 dB	186-188 dB
Suspended sediment generation during dredging (kg/cum)[25]	0.4-5	-	Ordinary 4000 PS1/-2.2-4.5 Ordinary 2000 PS-0.1-0.3	2.4-5.2
Suspended sediment generation during placement of dredge material (kg/cum)[25]	NA	-	Ordinary 4000 PS1/-1.2-1.4 Ordinary 2000 PS-NA	12-203

Selection of Dredgers:

From the environmental and social perspective, the most preferred dredging method would be the mechanical dredging method. Considering the unlined nature of some sections of the channel, this method will be much easier to operate to accomplish the task as it is more mobile and can work in tight spaces. Also, the mechanical dredger does not generate slurry, and the dredge material can be safely carted to an appropriate disposal site. It is efficient for disposal at long haul distances. Mechanical dredging is considered because it may require less time to complete work.

6.2.5 Dewatering

After clearing (dredging) in the proposed project site, the dredge materials must be placed in an area that will facilitate efficient dewatering as the high-water content of dredged material effectively prohibits its use in a productive manner. Dewatering will reduce dredge volumes considerably to allow for easy transport to the selected disposal site.

6.2.5.1 Evaporation or Open Air

With this method, the dredged material is deposited in heaps at a temporary holding site for several days prior to final disposal. The dredge materials are left exposed to the sun and air. This option is the most common and lowest-cost method and does not require any machinery.

6.2.5.2 Mechanical Dewatering

Mechanical dewatering methods dewater sediment much faster than the evaporation or open-air method but are usually the most expensive. Typical mechanical dewatering equipment consists of belt presses, plate and frame presses, filter presses, hydro cyclones, shaker/vibratory screens, or a combination of all these products.

Selected Option:

The selected option would be evaporation or open-air dewatering. This option does not require any machinery and is equally efficient. Dewatering during the dry season will provide ideal conditions.

Open air dewatering process will not involve any machinery therefore fuel will not be required. Similarly, no air emissions including Greenhouse Gases emission will happen. No impact on ambient noise level during open air dewatering process. In terms of financial perspective open air dewatering process is cheaper than mechanical process.

[25] Assessment of the Environmental Impact of Port Development, United Nations, New York, 1992

6.2.6 Disposal Options

The latest techniques for the disposal of dredged material generally consist of placement of sediment in geo-tubes, bank line stabilization and erosion control, habitat restoration/enhancement, fill materials, open water disposal, etc. if the dredge material has no contaminants. Compensation for the disposal of land should be ensured.

6.2.6.1 Placement of Sediment in Geo-tubes

Geo-tubes are high-strength woven geotextiles designed to resist pressures from dredge pumping operations while fully containing the sediments. The bags are connected to the discharge end of a dredger and filled with dredge material. The geotextiles contain special filtering properties that provide for the rapid dewatering of the materials. The water draining from the container can be held within a containment basin or allowed to flow back into the waterway. This dewatering system provides for the quick consolidation of the material allowing the removal of the sludge sediment for transportation to a landfill or relocation of the entire geotextile container to be used as a bank line protection, erosion control, breakwaters, jetties, groins, and beams whereby the container can be covered with soil and vegetative grasses planted. Typically, the containers are 30 feet in length and 30 inches in diameter with sealed ends. This method is suitable when upland disposal space is limited and used with a small dredging operation regarding the handling of smaller pump discharge rates. However, geotextile containers tend to be very costly in the purchase of the material.

6.2.6.2 Riverbank Stabilization and Erosion Control

The use of dredged materials for riverbank stabilization and erosion control typically consists of the placement of dewatered sediments along eroded embankments and riverbanks to replace lost material. In addition, as indicated earlier, sediments placed in geo-tubes can also be used to create protective beams. Uses of dredged materials for erosion control are generally limited to sediments containing primarily coarse gained sands. One of the advantages of this method is the use of the material for stabilization and erosion control can provide a much-needed source to prevent damaging erosion and minimize the threat of property loss due to storm erosion. This method for erosion control requires significant labor and equipment increasing the dredging cost, dredging must the in close proximity to the proposed site to avoid high transportation costs, and environmental concerns regarding the filling of eroded bank lines and eroded waterfront property must be considered.

6.2.6.3 Habitat Restoration/Enhancement

Habitat development refers to the establishment and management of relatively permanent and biologically productive plant and animal habitats. The use of dredged material as the substrate for habitat development is one of the most common and most important beneficial use categories. The use of dredged material for habitat development offers a disposal technique that is an attractive and feasible alternative to more conventional disposal options. Within various habitats, several distinct biological communities may occur.

6.2.6.4 Fill Material

Dredged sediment can be used as fill material for construction works after dewatering e.g., road construction, port area land development, erosion-prone sites, etc. This will help to reduce overall project costs by not having to purchase off-site material for landfilling/development purposes. This will allow large volumes of dewatered dredged sediment in holding areas to be used up which will make available more space at disposal sites for subsequent disposal of material. This option, however, requires large holding areas and depending on dredge volumes will be required for storage of these materials until they are used.

6.2.6.5 Open Water Disposal

Discharge into the river or sea is one of several alternative options for dealing with the dredged material. Depositing large amounts of sediment may lead to physical and chemical changes in the water column

as well as changes in bottom morphology. This may disrupt the balance inside and around the selected dumping site. Dumping sediments into water columns has the potential to adversely impact the environment. Dumping may influence food chain structures for inhabiting aquatic species.

Selected Option

A preferred option would be the use of the dredge material as fill material if the dredged material is free from contamination. Dewatering will reduce volumes of the sludge available for disposal and allow recovery of the sand for reuse. The sand can be used as construction material, reclaiming low-lying areas in the proposed Bor port area, etc.

6.2.7 Selection of Disposal Sites

The locations of disposal sites should be selected considering the following issues:

- Public perception about the location of dredge/debris disposal site has to be obtained before finalizing the location.
- Permission from the village/payams/bomas/local community to be obtained for the disposal site selected.
- Disposal sites are located at least 1000m away from any sensitive locations like settlements, waterbodies, notified forest areas, wildlife/birds/mammals/fish sanctuaries, or any other sensitive locations.
- Disposal sites shall not contaminate any water sources, river, etc. so the site should be located away from the waterbody and disposal site should be lined up properly to prevent infiltration of water.
- Environmental specialist of PIU and Project Coordinator must approve the plan before commencement of clearing (dredging) work.

6.2.8 Alternative Construction Technology and Materials

There are several alternative construction technologies and materials for port/jetty construction that could be considered. The most relevant is the choice to build the quay as a “deck on piles”, partly onto land and partly above water. This requires only a little reclamation. Further, the in-situ construction of the piles could be chosen over pile driving, which is from an environmental point of view (noise and vibration) preferable.

7 STAKEHOLDER CONSULTATION AND PARTICIPATION

Stakeholder engagement is a continuous process of sharing information, seeking to understand the concerns of community stakeholders, and building relationships based on collaboration. It is an inclusive and culturally appropriate process that provides stakeholders with opportunities to express their concerns, views, observations, and feedback. It begins as early as possible in a project preparation because early identification of and consultation with both the affected and interested parties allows stakeholders' views and concerns to be considered in the project design, implementation, operation, and decommissioning.

In order to achieve effective engagement, the disclosure of project information is crucial. Disclosure refers to the provision of relevant and adequate project information/report/data to support stakeholders in understanding the impacts, risks, and opportunities of the project. Engagement seeks to develop effective means of communication with potentially affected groups in ways in which they are encouraged and feel most able to participate in the development of projects and express their views. For truly effective engagement, it is fundamental that stakeholders feel that they can access project decisionmakers and comment and feedback in an ongoing manner as a project develops.

7.1 Objectives

The main objectives of the stakeholder engagement are to:

- Adopt long-term relationships with the project stakeholders, establish a positive community existence, and manage expectations and possible misconceptions.
- Identify and prioritize stakeholders as well as vulnerable groups, within the Project area.
- Generate a good understanding of the proposed project amongst stakeholders, including project updates, environmental and social assessments, mitigation measures and management plans, and monitoring plans.
- Receive feedback from stakeholders regarding environmental and social risks and impacts associated with the proposed project, along with proposed measures and actions to address them.
- Demonstrate the project’s commitment to all stakeholders with respect to environmental and social issues.
- Prepare a list of corrective actions/procedures suggested by stakeholders and include them in the project planning and implementation.
- Prevent conflict by addressing impacts and issues raised by stakeholders promptly, particularly with the communities that will not be served by the project.
- Demonstrate the ability to comply with standards and expectations that may arise in the future.
- Propose a guideline for the systems to be implemented in the proposed project and how they achieve an effective environmental and social management system.
- Fulfill the World Bank’s requirements concerning public access to information and public involvement in the decision-making process.

7.2 Regulatory Context

7.2.1 World Bank Requirement for Stakeholder Engagement and Public Consultation

World Bank’s Environmental and Social Standards under the Environmental and Social Framework pertaining to stakeholder engagement activities are:

- World Bank Environmental and Social Standard1: Assessment and Management of Environmental and Social Risks and Impacts
- World Bank Environmental and Social Standard10: Stakeholder Engagement and Information Disclosure.

7.2.2 National Legislations Related to Community Engagement

The national regulatory requirements relating to community engagement are given below:

- ***Transitional Constitution of South Sudan 2011:*** emphasizes the importance of public participation in governance and decision-making processes. It guarantees the right to access information and promotes transparency, which forms the legal basis for stakeholder engagement. Articles on community consultation and public participation are critical when engaging stakeholders in projects.
- ***Environmental Protection Act 2013:*** any project with environmental impacts must engage stakeholders as part of the ESIA process. Public consultations with affected communities and stakeholders are legally required to identify potential E&S impacts. The Act outlines that stakeholder views must be considered during the planning phase of a project and should be documented in the ESIA reports.
- ***Land Act 2009:*** recognizes the rights of local communities, especially with regard to land use and ownership. It mandates that customary landholders and communities be consulted when any development project affects their land. The law also requires the free, prior, and informed consent of affected indigenous or rural communities for projects involving land acquisition.
- ***Public Health Act 2017:*** underscores the need to engage communities in projects that might affect their health and well-being. Projects with potential public health risks must conduct consultations with relevant health stakeholders, including local communities.
- ***Local Government Act 2009:*** empowers local governments to engage in consultations with local communities, including civil society organizations and traditional leaders, especially for projects that have local-level impacts. It provides a legal foundation for community participation in decision-making processes regarding local development.

7.3 Stakeholder Identification

The first step in the process of stakeholder engagement is stakeholder identification, that is, determining who the project stakeholders are and what they should be grouped under. According to the World Bank's ESSs, a stakeholder refers to *"individuals or groups who: (a) are affected or likely to be affected by the project (project-affected parties), and (b) may have an interest in the project (other interested parties)".* Therefore, aiming to understand the surrounding social context of the proposed project area, the Consultant conducted site investigation visits for the proposed project activities. Once stakeholder groups were identified, it was then possible to suitably understand the social context and map out all the relevant stakeholders. Aligning with the requirement of WB ESS10, the stakeholders have been categorized into the following groups:

- **Project Affected Parties:** those who are or are likely to be affected by the project activities.
- **Other Interested Parties:** those who have an interest in the project.

In addition to the above two main categories, the following group has also been identified as stakeholders for this project considering different socioeconomic vulnerabilities and disadvantages:

- **Disadvantaged/Vulnerable Individuals or Groups:** Persons who may be disproportionately impacted or further disadvantaged by the project(s) as compared with any other groups due to their vulnerable status, and that may require special engagement efforts to ensure their equal representation in the consultation. These groups may include the elderly, especially those living alone, individuals with chronic diseases and pre-existing medical conditions, ethnic minority groups, female-headed households, disaster-affected populations, poor households including homeless and landless families, and persons with disabilities.

Subsequently, a primary analysis is applied to distinguish each stakeholder's impact on project development so as to plan their respective level of engagement in the future. This stakeholder mapping

and analysis exercise is used to group stakeholders according to their roles and influence pertaining to the project. Table 7-1 lists the identified stakeholders and states their effect on the project:

Table 7-1: Stakeholder Identification

Categories of Stakeholders	Stakeholder Groups
Project Affected Parties	• Affected Persons who are living in or beside the proposed project area including the port and access road • Communities in the vicinity of the project's planned activities and people living downstream of Bor. • Communities living downstream of Bor. • The vulnerable group (that includes the elderly, physically and mentally disabled persons, single mothers, minority transgender community, and the children). • Residence, business entities, and individual entrepreneurs in the area of the project who are adversely affected owing to the project activities. • Local laborers are to be engaged in the project work. • Fisherman • Suppliers and service providers • South Sudan Boats Union • Boat builders • Boda-boda riders • Dried fish seller • Porters • Tea shop owners • Passengers • Tour operators • Truck drivers • Food vendors
Other Interested Parties (International Level: Investors)	• Environmental and societal non-governmental organizations (including those working on labor, human rights, environment, gender, and gender-based violence matters) • Donor agencies • International non-governmental organizations, local and national civil society organizations, and non-governmental organizations operating in the agriculture, health, education, livelihood, wildlife and biodiversity management sectors • World Bank • Japan International Cooperation Agency • Other UN agencies and entities (United Nations Mission in South Sudan, United Nations International Children's Emergency Fund, United Nations Population Fund, United Nations Development Programme, United Nations Office for Project Services, United Nations Environment Programme, Food and Agriculture Organization, World Food Programme)
Other Interested Parties (National Level, State level Government, investors, political groups)	• Ministry of Transport • Directorate of River Transport • Ministry of Environment and Forestry • Ministry of Water Resources and Irrigation • Ministry of Wildlife Conservation and Tourism • Ministry of Animal Resources and Fisheries

Categories of Stakeholders	Stakeholder Groups
	• Ministry of Land, Housing, and Urban Development • Ministry of Agriculture and Food Security • Ministry of Education, Science, and Technology • Ministry of Gender, Child, and Social Welfare • Ministry of Culture, Youth, and Sports • Ministry of Trade and Industry • Ministry of Labor and Public Service • Ministry of Wildlife Conservation and Tourism • State governments of Jonglei and Central Equatoria • Local government of Jonglei and Central Equatoria • Payam administrator • MPs and representatives • Civil society organizations - Peace Canal • Youth Group • Academia - Juba University at Juba and John Garang Memorial University at Bor • Non-governmental organizations - Sudd Institute, South Sudan Nature Conservation Organization, and African Parks • River police • Contractor - Katahira & Engineers International

7.4 Stakeholder Engagement Process

The engagement of stakeholders is an evolving process that commences from the inception phase and continues throughout the project's life. Each stage and phase has its specific objectives of engagement and results in specific outputs to be integrated into the ESIA. Special attention was given to vulnerable groups including women, old people, young people, people with disability, and children. A summary of the stakeholder engagement process for the ESIA has been given in Figure 7-1.

Figure 7-1: Stakeholder Engagement Process during the ESIA



Source: EQMS, September 2024

7.5 Stakeholder Engagement Methods

Various techniques were employed through stakeholder engagement exercises under the ESIA which included different participatory methods such as public consultation meetings, focus group discussions, and key informant interviews.

- **Focus Group Discussions (FGDs):** Focus Group Discussion sessions were held with the stakeholders such as local community members, porters, fisherman community, dried fish sellers, vendors, and businessmen along the access road of Juba and Bor port area, etc. in the different parts of the project area and project-surrounded communities.
- **Key Informant Interviews (KIIs):** Stakeholders such as government departments 'representatives, project staff, community leaders, boat owner's associations, traders, vendors, and local and regional stakeholders were also consulted following KII. Their opinion and suggestions were recorded considering the study objectives.
- **Public Consultation Meetings (PCM):** Public Consultation Meetings are often the cornerstones of public participation processes and provide the opportunity for stakeholders to raise their concerns in open forums. Two public consultation meetings have been organized in the Juba access road and Bor port area.

Photographs of the stakeholder consultations are given in Figure 7-2 and Appendix C.

Figure 7-2: Photographs of the Stakeholder Consultations



Public consultation meeting with affected parties, interested parties, and vulnerable groups at Juba



Consultation with Hon. Mary Akech Taban, Undersecretary for MOT



Consultation with the local community in Bor



Consultation with Bor County Administrations and Makwach Payam

Source: EQMS, September 2024

7.6 Key Informant Interviews

Thirty-two key informant interviews were conducted with different stakeholders in Juba and Bor areas. Appendix C-4 shows the details of key informant interviews.

7.7 Summary Outcomes of Key Informant Interviews

A summary of the key informant interviews with different stakeholders has been given in Table 7-2.

Table 7-2: Summary of Key Informant Interviews

Issues Discussed	Participant's Opinions, Comments, and Suggestions
Knowledge and Perception of the Project	• All the respondents are aware of the project and have a positive perception of the project. • Stakeholders of the Bor port area are very much concerned about the compensation for land and livelihood. • Disclosure of future development activities should be ensured.
Legal Aspect	• The project should comply with the national legal framework and International standards.
Impact on Livelihoods	• Nearby communities, particularly affecting those dependent on fishing, farming, and small-scale trading in the Bor port area and along the Juba port access road may temporarily lose their livelihoods during the construction of the proposed project unless they are relocated to suitable alternative locations. • The project will bring positive changes, such as creating new job opportunities, occupational shifts, higher wages, and migration for work.
Employment Generation	• The construction and operation of the Bor port and Juba port access road, and clearing (dredging) of the White Nile River are expected to generate substantial employment in construction, logistics, and trade, reducing local unemployment. • The project is also anticipated to boost trade, increase business incomes, and lower costs for consumers through improved infrastructure. • Local communities, especially young people, have high expectations of being directly employed, while indirect job creation is expected through small businesses and service providers in the surrounding areas. • Additionally, the project is projected to stimulate demand for skilled labor in the Bor port area. • Local residents should be given priority for employment opportunities in the project, based on their education and skill levels.
Local Infrastructure	• The development of the Bor port and Juba port access road is expected to significantly impact the region's social infrastructure. • The increased population from the incoming workforce will create a higher demand for healthcare, education, and sanitation, requiring major investments in these services. • Additionally, the influx of diverse populations might change traditional lifestyles, which could enrich but also challenge community dynamics.
Institutional Arrangements	• Coordination between the relevant authorities should be confirmed during the project implementation. • Environmental and Social Management Plan prepared for the project should be implemented accordingly.
Land and Other Resources	• The land system in Bor, South Sudan, combines customary and statutory tenure, with local chiefs overseeing communal land use and dispute resolution.

Issues Discussed	Participant's Opinions, Comments, and Suggestions
	• A statutory system introduced during colonial times aims for individual ownership, but enforcement is limited. • The Ministry of Land will set land prices for the Bor port project.
Resettlement and Compensation	• A Land Acquisition Plan and Resettlement Action Plan will be prepared to ensure the proper compensation in terms of land requirements as a significant number of both physical and economic displacements will occur due to the construction and operation of the port in Bor area. • Economic displacement will take place during the construction and operation of the access road at Juba port. • Proper compensation for both the physically and economically displaced person should be ensured.
Community Health and Safety	• In the Bor port area due to risks from increased traffic, industrial activities, and displacement, which may lead to higher exposure to diseases, air pollution, and disrupted access to healthcare. • The influx of workers could strain social dynamics, increasing crime and insecurity. • Proper security arrangements should be undertaken including area demarcation and closed-circuit camera operation to prevent theft and other unwanted security concerns.
Gender-Based Violence and SEA/SH	• An influx of male workers for the port development may increase the vulnerability of women and girls to sexual violence and exploitation. • Stakeholders call for proactive measures, such as gender-sensitive planning, community awareness programs, and engagement with local women's groups, to protect women's rights and well-being during the project.
Expectation	• Employment generation for the local community. • Speed boat for emergency rescue. • A Livelihood Restoration Plan for economically displaced persons.
Flora and Fauna	• White Nile River supports migratory birds, and species like Nile crocodiles and turtles inhabit the river, with dredging potentially harming aquatic ecosystems and disrupting fish spawning. • Dredging can degrade water quality, alter river dynamics, and cause downstream erosion and flooding, posing risks to biodiversity, including through oil spills and contamination. • Environmental issues like deforestation and sewage discharge are prevalent, with South Sudan committed to international environmental agreements like the Convention on Biological Diversity and the Ramsar Convention.
Waste Management	• Lack of proper waste management facilities at existing port area and port access road area. • Prevent the discharge of solid and liquid waste into the river. • Implement a comprehensive waste management plan that includes classifying waste into hazardous and non-hazardous categories, ensuring safe handling, storage, and disposal in compliance with local and international regulations, and promoting waste reduction, reuse, and recycling strategies.
Protected Areas	• Animals migrate between Bandingilo National Park and Boma National Park, especially during the dry season.

Issues Discussed	Participant's Opinions, Comments, and Suggestions
	• There is frequent violence between wildlife forces and poachers around parks. • Poaching remains the primary threat to wildlife in the area, exacerbated by increased access due to road and port development. • Conflicts between humans and wildlife, such as leopards, are common in the area. • There are some restrictions on working in protected areas. • Dredging can have severe effects on species like crocodiles, hippos, and fish due to habitat destruction, increased sedimentation, and pollution. • Hippopotamus, Nile buffalo, waterbuck, Nile lechwe, and other migratory species like Tiang and Shoebill Storks will be affected by project activity in the river. • Tree felling requires permission from the Ministry of Forestry. • Increased access to the river may lead to overfishing, reducing fish populations and overall biodiversity. • Hippopotamus, elephants, buffalo, and endemic species such as Nile sitatunga and Nile lechwe are found in the Sudd Wetland.
Environmental Issues	• Ecofriendly building/construction materials should be preferred to use in the proposed to avoid the environmental impact as much as possible. • Adoption of proper mitigation measures to prevent dust pollution during the construction period.
Occupational Health and Safety	• Develop and implement a site-specific occupational health and safety policy, aligned with local and international standards (e.g., ILO, OSHA), outlining safety protocols, emergency response plans, and responsibilities. • Workers should receive regular safety training, including the use of personal protective equipment (PPE), emergency response procedures, and safe work practices. • Enforcing strict safety protocols for handling hazardous substances, traffic management, and equipment operation is also critical to minimizing accidents.

7.8 Focus Group Discussions

A total of sixteen focus group discussions were conducted with various local community groups, including Boda-boda riders, passengers, porters, vendors, female groups, the fishing community, youth groups, dry fish sellers, etc. Separate discussions were held for female participants. In total, 121 people participated in the focus group discussions, comprising 79 males and 44 females. Details of the focus group discussions are provided in Table 7-3.

Table 7-3: Venue and Nature of Participants of FGDs

Date	Participants	Number of FGDs	Number of Participants			Location
			Male	Female	Total	
5 to 20 August 2024	Local Community	3	22	8	30	Juba and Bor
	Boda Boda Riders and passengers	2	12	0	12	Juba and Bor
	Porters	2	16	0	16	Juba and Bor
	Vendors	2	8	12	20	Juba and Bor
	Female Group	2	0	12	12	Juba and Bor

Date	Participants	Number of FGDs	Number of Participants			Location
			Male	Female	Total	
	Fisherman Community	2	11	2	13	Juba and Bor
	Youth Group	1	8	0	8	Bor
	Dry fish seller	2	2	10	10	Juba and Bor
Total		**16**	**79**	**44**	**121**	

A summary outcome of the FGDs with different stakeholders has been given in Table 7-4.

Table 7-4: Summary Outcomes of Focus Group Discussions

Issues Discussed/Raised	Response/Suggestions
• Informed about the proposed project • Ethnic groups, land price determination • Community conflicts, displacement history • Compensation for displacement • Major problems, health, and education issues • Types of fishing (capture/culture) • Ethnic fishing communities • Fish species and landing stations • Protected areas, fish sanctuaries • Fish capture, income, project impact on fishing/boatman communities • Compensation and support needs • Number of women workers, activities, education • GBV risk, child marriage, wage discrimination • Education, skills, perceptions of youth • Construction experience, livelihood activities of youth • Suggestions for project implementation	• People have varying levels of awareness about the project, with some being well-informed while others lack adequate information. • Requests for compensation and support to help reduce adverse impact due to land acquisition and disruption of livelihood. • Few women are working in the project area, and their education levels vary. • Fishing practices include catching fish and farming fish. • Concerns about protected areas and cultural heritage. • The project may impact fish catches and the livelihoods of fishermen and boatmen. • There are worries about gender-based violence, child marriage, and unfair pay. • Youth have mixed education and skills; they are aware of the project. • Concerns about conflicts within the community and past experiences with displacement. • Calls for fair compensation if people are displaced. • Major issues include health and education. • Suggestions for making the project better are welcomed.

7.9 Public Consultation Meetings

Public Consultation Meetings were exhaustively conducted in the area, focusing on affected and vulnerable groups residing along the project areas, as well as other relevant supplementary activities. These consultations were carried out in a culturally appropriate manner and the perceptions of beneficiaries were assessed to improve their engagement with the project. Consultation meetings undertaken by the Consultant have been documented using an appropriate form that had been agreed upon with the client.

As a part of the stakeholder consultation, two large-scale separate public consultation meetings were held at the Juba Port access road area and in the Bor port area adjacent to Laudier the proposed project

area. Stakeholders were communicated prior to the consultation meetings through invitation letters and discussion.

To inform the participants about the proposed project and understand the views, perceptions, and suggestions from the participants total of three languages i.e., English, Arabic, and Local language were used. The responses were also provided by the Consultant and MOT using the three languages.

Details of the PCMs conducted for this project have been depicted hereunder (Table 7-5).

Table 7-5: Venue and Number of Participants in the Public Consultation Meetings

Date	Location	Number of Participants		
		Male	Female	Total
13/08/2024	Bor Port Area	47	6	53
20/08/2024	Juba Port Area	30	15	45

7.10 Summary Outcomes of Public Consultation Meeting

The Public Consultation Meeting addressed various topics, such as stakeholders' understanding and views on the project, expected impacts, their opinions, key concerns, and recommended mitigation measures. The Consultant and the Ministry of Transport also provided responses to the issues raised by the participants. The summary outcomes and responses are given in Table 7-6.

Table 7-6: Major Findings of the Public Consultation Meetings

Themes/Aspect	Findings/Observations/ Issues	Responses
Knowledge and Perception of the Proposed Project	• Most of the participants of the PCM in relation to the Bor port area and Juba port access road indicated that they are aware of the proposed project. • The general perception of the project among the community is largely positive, with many stakeholders recognizing its potential to bring long-term economic benefits and development to the region. People view the construction of the port and access road as vital for improving infrastructure, boosting trade, and creating employment opportunities. Local leaders and community members, including youth and business representatives, expressed support for the project, highlighting the positive impact it would have on their livelihoods and the overall economic growth of the area. • Stakeholders should be regularly informed and updated on the project's progress at every phase of its implementation.	All the issues raised by participants were noted duly and will be considered in the E&S study.
Economic Development and Infrastructure Improvement	• All participants recognized the project's potential for economic development, including job creation and infrastructure improvement. • There was widespread optimism about the long-term economic benefits, with stakeholders welcoming the port and access road projects.	All the issues raised by participants were noted duly and will be considered in the E&S study. An institutional setting and implementation arrangement

Themes/Aspect	Findings/Observations/ Issues	Responses
	• Coordination between different ministries and agencies should be ensured for proper planning and implementation.	will be incorporated in the ESIA.
Impact on Livelihoods	• Most of the people's livelihood in the project and adjacent areas depends on fishing and small businesses. • Participants of the consultations opined that the project would bring potential positive impacts on the existing livelihood pattern. Potential impacts would include the scope of new work, occupational shifting, increase in wages, migration, etc. • The construction of the port at Bor will lead to the displacement of nearby communities, affecting their livelihoods, especially those dependent on fishing, or small-scale trading in the area. • Economic displacement will take place during the construction and operation of the access road at Juba port and clearing activities. • Local businesses, including food vendors and dry fish traders, have raised concerns about financial losses resulting from the port relocation. The removal of temporary structures is likely to disrupt small businesses' ability to sustain their income and operations. • Proper compensation should be provided to the economically displaced persons.	A Livelihood Restoration Plan will be adopted to enhance or restore the livelihood of economically displaced persons.
Employment Generation	• The construction and operation of the port and the access road and clearing of the river will generate employment opportunities, particularly in sectors such as construction, logistics, and trade. This would provide much-needed jobs to locals, reducing unemployment in the area. • The port development could boost trade activities, leading to increased income for businesses and traders. Improved transport infrastructure may also reduce the cost of goods and services, benefiting local consumers. • Young people are hoping to be directly employed in different activities of the proposed project. • The project would be a great contributor to the local labor market as the proposed project will create future skilled labor demand in the proposed project area.	In addition to the anticipated scope of direct employment in the project activities, the project has also been considered to contribute indirectly to employment generation in the adjacent areas. Surrounding the project areas, for instance, different types of economic activities are taking place/planned to take place such as small businesses, shopkeeping, service providers (e.g., service provider for port management, engineering services for housing development, etc.), etc.
Alternative Arrangements	• Concerns were raised about disruptions to livelihoods, especially for fishermen and	All the issues raised by participants were noted duly

Themes/Aspect	Findings/Observations/ Issues	Responses
for Affected Communities	boat operators. Participants called for temporary alternative arrangements to allow economic activities to continue during construction.	and will be considered in the E&S study.
Social Vulnerability and Gender-Specific Concerns	• Female vendors emphasized the unstable conditions resulting from the port's demolition. Many women, including widows, were displaced into insecure areas with limited capacity to afford rent, underscoring the need for gender-sensitive measures to address social vulnerability.	The consultant recognizes the social challenges faced by female vendors due to the port demolition and recommends implementing gender-sensitive measures. Key responses include providing financial assistance or rental subsidies for displaced women, offering alternative livelihood opportunities through skill development, and ensuring their involvement in decision-making through stakeholder engagement.
Resettlement and Compensation	• A significant number of both physical and economic displacements will occur due to the construction and operation of the port at Bor area. • Economic displacement will take place during the construction and operation of the access road at Juba port. • Fair compensation should be provided accordingly to the landowners. • A detailed Inventory of Losses should be prepared for project-affected persons of the Juba port access road, Bor port area, and clearing (dredging) of the river.	A RAP along with LRP will be developed to ensure the affected individuals and communities are adequately compensated, resettled, and provided with opportunities to restore and improve their livelihoods. These plans will focus on minimizing disruption and ensuring sustainable socio-economic conditions for those impacted by the project.
Environmental Issues	• The port development could lead to deforestation, soil erosion, and contamination of local water sources. Given South Sudan's fragile ecosystem, these changes could have lasting impacts on biodiversity and the natural resources that communities depend on. • The degradation of water quality can affect not only agriculture but also public health, exacerbating existing health challenges in the region. • Waste management should be conducted properly to reduce the negative impact on the environment.	An Environmental and Social Management Plan will be prepared as a part of ESIA.
Community Health and Safety	• Participants in the Bor port area have raised concerns about the potential impacts of increased industrial activity on community health and safety. Key issues include heightened exposure to waterborne	Responses will be incorporated in the ESIA report accordingly.

Themes/Aspect	Findings/Observations/ Issues	Responses
	diseases and air pollution due to traffic and industrial operations, especially in a region with limited healthcare facilities. • Additionally, the influx of workers and economic activities may lead to increased crime and insecurity, further endangering community safety. • Participants emphasized the need for improved infrastructure, such as roads, healthcare, and sanitation services, to support the growing population and economic activity.	
Grievance Mechanism	• Several participants pointed out the absence of clear grievance mechanisms to address losses during relocation. They expressed frustration over the lack of support, with no structured process for raising complaints or seeking redress.	A GM will be developed during ESIA report preparation.

7.11 Way Forward

Stakeholder consultation is a continuous process under the ESIA. Next round public consultation meetings will be conducted at Juba and Bor area to disclose the outcomes of the draft ESIA. Potential impact and proposed mitigation measures will be shared with the stakeholders and based on their comments/opinions/suggestions the ESIA report will be finalized accordingly.

As per discussion with MOT, an additional stakeholder consultation meeting will be held in Juba after drafting the ESIA report. This meeting will be mainly conducted for the stakeholders from different ministry and departmental officials, local and international civil society organizations, universities and research institutions, international organizations, UN agencies, regional organizations, etc. Stakeholders' views and concerns will be integrated into the ESIA report and proposed mitigation measures integrated into the ESMP.

8 GRIEVANCE MECHANISM

A well-structured grievance mechanism is essential for managing and resolving project-related concerns from various stakeholders, including workers, local communities, and others impacted by the project. This section outlines the grievance mechanism established for the Port, Access Road, and River Clearing Project in South Sudan, aligning with the World Bank's Environmental and Social Standards (ESS). It serves as a vital resource for affected individuals, enabling them to lodge complaints or express grievances related to environmental and social issues arising from project activities, staff conduct, or contractor performance, etc.

The document details the procedures for submitting grievances and delineates the roles and responsibilities of project personnel in effectively addressing and resolving these issues. By ensuring that every affected person has the opportunity to raise their concerns and seek timely resolution, this mechanism promotes an inclusive and responsive approach to stakeholder engagement, consistent with the principles of the World Bank ESS, which emphasize accountability, transparency, and the protection of the rights of affected communities throughout the project's implementation.

8.1.1 Objectives of the Grievance Mechanism

The objectives of the GM are.

- Establish a clear and accessible process for stakeholders to raise grievances.
- Ensure timely resolution of complaints and concerns from workers and the community.
- Ensure that community grievances related to project activities are addressed promptly and effectively.
- Facilitate constructive dialogue between project implementers and the affected communities.
- Provide a transparent process for handling complaints, feedback, and concerns raised by community members.
- Promote transparency and accountability in project implementation.
- Foster positive relationships between the project, affected communities, and workers.
- Safeguard the rights and welfare of affected individuals and groups.

8.1.2 Scope of the Grievance Mechanism

The scope of the grievance mechanism is as follows.

- Address environmental and social impacts of project implementation.
- Cover work conditions, treatment of workers, and compliance with labor laws.
- Focus on the behavior of project personnel and contractors.
- Residents living near project sites.
- Local businesses are affected by project activities.
- Community organizations and local leaders.
- Concerns raised by the community from project implementation.
- Include any relevant issues raised by stakeholders, such as social, environmental, or economic impacts.

8.1.3 Process of Worker-level Grievance Mechanism

The process of the worker-level grievance mechanism is as follows:

Step 1: Assess and Clarify

- All workers will be informed about the GRM during recruitment and receive induction on their rights and grievance submission procedures.
- Contractors are responsible for ensuring that all employees are aware of the grievance mechanism and that any concerns raised are addressed promptly.

- Workers can seek clarification on their contractual terms, workplace conditions, or the GM itself from their employer or contractor at any time.

Step 2: Intake, Acknowledge, and Follow-Up

- If a worker believes their rights have been violated, they can file a grievance by reporting it to their direct supervisor or, if there is a conflict of interest, to the supervisor's superior. Grievances can be submitted in writing, verbally, or through a designated hotline/email.
- The supervisor or superior must acknowledge receipt of the grievance within 48 hours and provide an initial response to the worker.
- In cases where there is a risk of retaliation, the worker may escalate the grievance directly to the courts. The project may provide support through referrals to legal aid organizations if needed.
- The grievance process ensures that worker confidentiality is maintained, particularly in sensitive matters (e.g., sexual harassment), to avoid any risk of retaliation.

Step 3: Verify, Investigate, and Act

- Upon receiving a grievance, the supervisor will verify the details and seek to resolve the issue within 48 hours.
- If the issue cannot be resolved at this level, the grievance will be escalated to the Grievance Redress Committee (GRC) at the project level.
- The GRC will conduct an investigation, which may include interviewing witnesses, reviewing relevant documents, and consulting both parties involved.
- A resolution plan will be developed and shared with the worker within 7 days. If the worker agrees, the resolution will be implemented promptly.

Step 4: Appeal Process

- If the worker is not satisfied with the outcome of the grievance, they can escalate the matter to:
  - Sector-specific institutions (e.g., Ministry of Labor of South Sudan) or local courts if the issue remains unresolved.
  - Project-level GRM in cases where formal courts are unavailable or inaccessible.
- In the case of Supreme Court appeals the Court's decision will be final where it has jurisdiction.

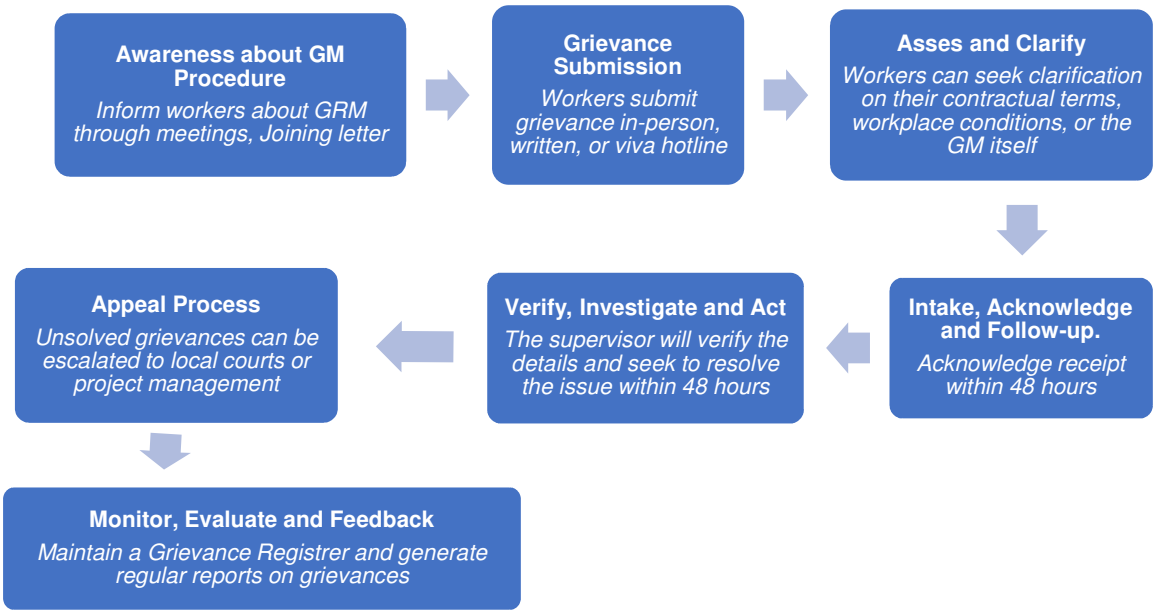
Step 5: Monitor, Evaluate, and Feedback

- Contractors are required to maintain records of all grievances and resolutions and submit these to the Project Implementing Units (PIUs) as part of their regular progress reports.
- PIUs will track grievances using a Grievance Database linked to the Project's Management Information System (MIS) and produce quarterly reports summarizing:
  - A number of grievances were received and resolved.
  - Types of grievances (e.g., working conditions, discrimination).
  - Time taken to resolve grievances.
- Workers will be regularly updated on the progress of their grievances, and all outcomes will be shared with relevant project stakeholders, including the World Bank as part of the regular project reporting.
- Workers who file grievances will be protected against any form of retaliation. Measures will be put in place to ensure that their employment conditions are not negatively impacted by their use of the GRM.
- Grievances related to sexual harassment, gender-based violence, or other SEA/SH concerns will be handled with utmost confidentiality and sensitivity.
- These grievances will be addressed in accordance with the SEA/SH Action Plan, with specialized personnel trained to handle these types of cases.
- Workers who raise SEA/SH-related concerns will have access to psychosocial support, legal aid, and other resources, as appropriate.

- All project workers will receive training on the Workers' GM, including the steps for filing grievances, the protections in place, and the escalation process.
- Contractors will maintain detailed records of all worker inductions and make these available for inspection by the PIUs.
- The PIUs will ensure that grievance-handling staff receive adequate training on conflict resolution, labor rights, and workplace grievance management.

Figure 8-1 depicts the grievance mechanism process for the workers.

Figure 8-1: Workers Grievance Mechanism Process



8.1.4 Process of Community-level Grievance Mechanism

The process of community-level grievance mechanism is as follows:

Step 1: Awareness and Outreach

- The project will conduct community awareness campaigns to inform residents about the GRM, its purpose, and the process for submitting grievances.
- Information will be disseminated through community meetings, local media, flyers, and community notice boards. Special attention will be given to engaging marginalized groups, including women and youth, to ensure their voices are heard.

Step 2: Grievance Submission

Community members can submit grievances through various channels, including:

- In-person at designated project offices or community centers.
- Written submissions via suggestion/ grievance boxes placed in accessible locations.
- Hotline or email for remote submissions.
- Community meetings where grievances can be raised publicly.
- Provision of the grievance submission form

Step 3: Acknowledgment and Intake

- Upon receiving a grievance, the project staff will acknowledge receipt within 48 hours through written or verbal communication to the complainant.

- An initial assessment of the grievance will be conducted to categorize its nature and urgency (e.g., high, medium, low).

Step 4: Grievance Resolution

- The project team will investigate the grievance within 14 days, which may involve:
- Interviews with the complainant and other relevant parties.
- Site visits to understand the situation better.
- Consultation with local stakeholders and experts.
- Based on the investigation, a resolution plan will be developed, outlining corrective actions and timelines.

Step 5: Communication of Resolution

- The complainant will be informed of the resolution plan and its implementation within 5 days of the investigation's conclusion.
- All communication regarding the grievance will be documented and kept confidential.

Step 6: Escalation of Grievances

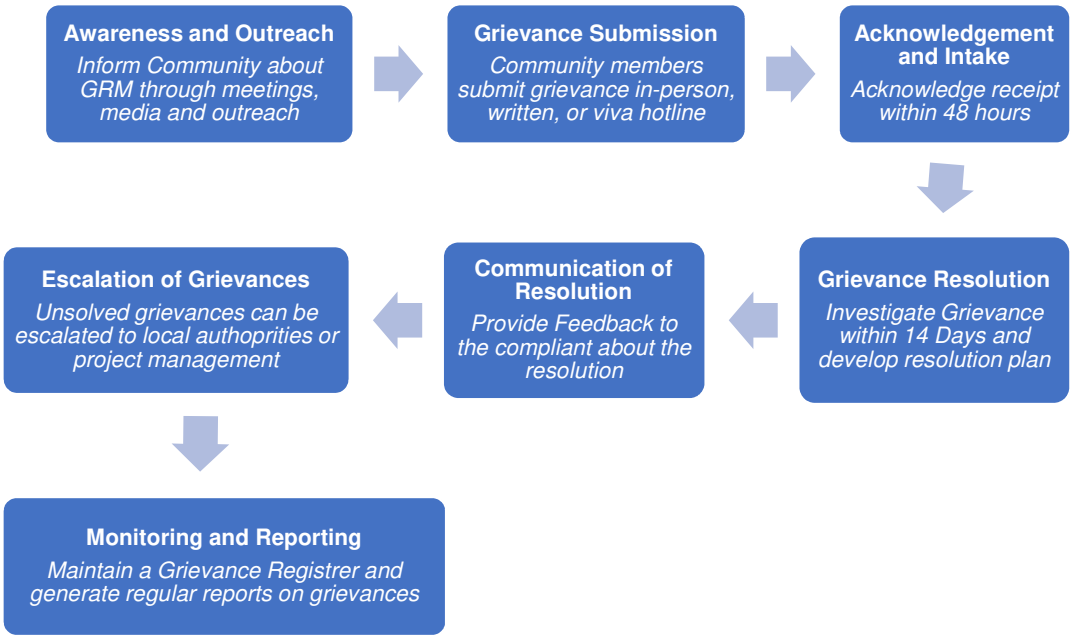
- If the community member is unsatisfied with the proposed resolution, they can escalate the grievance to:
  - Local government authorities (e.g., Ministry of Labor, Community Development).
  - Community leaders or established community groups.
  - Higher-level project management or PIUs.

Step 7: Monitoring and Reporting

- The project will monitor the implementation of resolutions to ensure effectiveness and sustainability.
- A Grievance Register will be maintained, recording all grievances received, their status, and outcomes. Regular reports will be generated for project management and shared with the community and relevant stakeholders.
- Summaries of grievances and their resolutions will be publicly shared at community meetings to promote transparency and accountability.

Figure 8-2 depicts the grievance mechanism process for the Community.

Figure 8-2: Community Grievance Mechanism Process



8.1.5 Grievance Redress Committee

Effective GMs are crucial for ensuring that the voices of both workers and community members are heard and addressed in projects like the South Sudan Port, Port Access Road, and River Clearing Project. To facilitate this, two dedicated committees - the Community Grievance Redress Committee (CGRC) and the Worker Grievance Redress Committee (GRC) will be established. Each committee comprises diverse stakeholders, including project officials, social and environmental specialists, community leaders, and representatives from marginalized groups. The following table outlines the composition and roles of each member in these committees, highlighting their responsibilities in promoting transparency, accountability, and inclusivity in the grievance redress process. The detail of the GRC is depicted in Table 8-1.

Table 8-1: Composition of GRC for Both Worker and Community

SL #	Member	Role	Committee
1.	Project Coordinator/ Senior Project Official	Oversees grievance redress process, ensures compliance with procedures, and provides final approvals for resolutions.	Workers' GRC
2.	Social Safeguards Specialist (PIU)	Ensures grievances are handled per national labor laws and ESS standards.	Both CGRC & Workers' GRC
3.	Environmental Specialist (PIU)	Addresses health, safety, and environmental grievances affecting workers.	Workers' GRC
4.	Human Resources (HR) Officer	Assists with grievances related to employment contracts, wages, and working conditions.	Workers' GRC
5.	Workers' Representative	Represents workers' perspectives, ensuring their concerns are addressed.	Workers' GRC
6.	Local Community Leaders	Represents community interests and perspectives; acts as a bridge between the community and the project.	Community GRC

SL #	Member	Role	Committee
7.	Community Members Representatives	Represents community interests and perspectives; acts as a bridge between the community and the project.	Community GRC
8.	Community Members (e.g., women, youth)	Ensures grievances from all community members, especially marginalized groups, are represented.	Community GRC
9.	Local Government Representatives	Provides oversight and legitimacy to the grievance process, ensuring alignment with local policies.	Community GRC
10.	Civil Society Organizations (CSOs)	Facilitates dialogue and provides support to affected community members and mediation as needed.	Community GRC
11.	Contractor's Management	Represents workers' perspectives, ensuring their concerns are addressed.	Workers' GRC
12.	Representative of the Labor Office	Represents workers interests and perspectives.	Workers' GRC

8.1.6 Grievance Reporting Procedure

EPC/MOT would ensure that any person/ group can file grievances without any intimidation. Grievances would be submitted either in writing or may be submitted verbally to the GRC. The decision made by GRC would be communicated to the concerned person or group in writing.

GRC would maintain records of any grievance received at their end in written or verbal. This record would include the details of the complainant, the subject of the grievance, the appropriate department, and the status of the grievance. A sample recording format is provided in Table 8-2.

Table 8-2: Sample Grievance Log (for non-SEA/SH complaints)

Case no.	Date Claim Received	Name of Person Receiving Compl aint	Where/ how the complaint was received	Name & contact details of complainant (if known)	Content of the claim (include all grievances, suggestions, and inquiries)	Was Receipt of the Complaint Acknowledged to the Complainant? (Y/N – if yes, include date, method of communication & by whom)	Expected Decision Date	Decision Outcome (include names of participants and date of decision)	Was the Decision communicated to the complainant? Y/N If yes, state when, by whom, and via what method of communication	Was the complainant satisfied with the decision? Y/N State the decision If no, explain why, and if known, will pursue an appeals procedure	Any follow-up action (and by whom, by what date)?

8.1.7 Budgeting

MOT shall ensure adequate budgeting and resource allocation for implementing the grievance mechanism. A tentative budget for the GM establishment, operation, and training is approximately 15,000 USD could be considered. However, the MOT shall adjust it during the implementation of the project.

8.1.8 Specific Process for SEA/SH and GBV

For sensitive claims regarding SEA/SH and GBV, specific procedures will be put in place under the project grievance mechanism and will include a response protocol to ensure timely referral for survivors to appropriate support services. Generally speaking, the project will put into place a separate structure to review and resolve SEA/SH and GBV-related claims in an ethical and confidential manner. This review structure may be comprised of specially trained members from the GRC, PIUs, and Contractors if needed, as well as representatives of local or national NGOs, specialized in GBV prevention and response, which may also include a service provider present to act as an advocate on behalf of the survivor.

At all times, the procedures for resolution of SEA/SH and GBV-related claims will follow a survivor-centered approach and assure the anonymity of the survivor and alleged aggressor. In addition, with the survivor's express consent, he or she will be informed of available options, such as receiving psychosocial support, medical assistance, and other services as required. Where needed, the MOT must also ensure that it has a trained focal point in place to refer SEA/SH and GBV cases for appropriate support and review and to ensure that workers receive necessary information about SEA/SH and GBV prevention and response, including prohibited behaviors and MOT grievance mechanism. SEA/SH and GBV related cases brought through the project grievance mechanism will be documented separately, and related documentation will be kept in a confidential and locked storage space with limited access. Specific training on how to handle SEA/SH or GBV claims will be provided by an external consultant or provider. MOT may use the potential procedures for addressing SEA/SH and GBV and will establish a 'SEA/SH and GBV Compliance Team' to find adequate responses.

8.1.9 World Bank Grievance Redress System

Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project-affected communities and individuals may submit their complaints to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB's non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been allowed to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redressservice. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The main purpose of the Environmental and Social Management Plan is to identify project-specific actions that will be undertaken by the MOT for mitigation of the specific impacts identified in the proposed project. These actions will be incorporated into the project management system and integrated into the implementation at various stages of project development. The ESMP describes both generic good practice measures and site-specific measures, the implementation of which is aimed at mitigating the potential impact associated with the project activity.

9.1 Objectives of the Environmental and Social Management Plan

The main objective of the ESMP is to warrant that the development in an identified particular study area needs to be entangled with judicious utilization of non-renewable resources and to ensure that the stress/load on the ecosystem is within its permissible assimilative capacity i.e., its' carrying capacity. An effective ESMP ensures that these environmental and social requirements and objectives are satisfied during all phases of the project. The long-term objectives of the ESMP for all the environmental and social attributes are as under:

- To comply with all the regulations/applicable laws stipulated by the MOEF.
- To ensure good working conditions for employees.
- To strengthen the capacity of the implementing agency to achieve the highest environmental and social performance and response from individual employees and contractors.
- To plan out the complete strategy to take care of stakeholder engagement.
- Budgeting and allocation of funds for environmental management.
- Continuous development and search for innovative technologies for a cleaner and better future environment.

9.2 Environmental and Social Mitigation Measures

Key environmental and social impacts of the proposed project have been identified and impact significance is assessed in this ESIA. These analyses identify the scope of adopting mitigation measures or reconciliation of the project design to prevent environmental pollution in compliance with the national environmental quality guideline/standards prescribed in the Environmental (Protection) Act 2001, Draft Environment Protection Bill 2023, South Sudan National Bureau of Standard Guidelines, EAS (East African Standard) 12:20 2018, and applicable WBG EHS Guidelines. Table 9-1, Table 9-2, Table 9-3, and Table 9-4 describe mitigation measures required for limiting the negative impacts of the proposed project activities and enhancement measures for enhancing positive impacts with the aim of sustainable implementation and operation of the project ensuring environmental, social, and community safety.

This also identifies lead responsibility for implementing the mitigation measures and supervision for such implementation. The MOT will be responsible for ensuring that the mitigation measures in the Environmental and Social Management Plan are implemented throughout the lifespan of the proposed project.

9.2.1 Pre-construction/Planning and Design Phase

The possible environmental and social impacts during the pre-construction/planning and design phase have been already identified and assessed in Chapter 5 of this ESIA report. For mitigating the possible environmental and social impacts, mitigation measures for the pre-construction/planning and design phase are proposed in Table 9-1.

Table 9-1: Environmental and Social Mitigation Measures during the Pre-construction/Planning and Design Phase

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Land acquisition and resettlement	Medium High	• The land acquisition will be restricted to the bare minimum required. • Careful alignment and route selection by the designer minimize the impacts by avoiding the important environmental components, settlements, etc. • A Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) should be prepared by the project authority following the national legal frameworks and WB's E&S standards in order to deliver proper compensation and resettlement of the affected people. • A proper judicious compensation package should be prepared for affected people and given compensation amount before the affected people shift. • Identify and provide additional compensation for vulnerable households. • Compensation and other support are to be provided to affected families as per RAP. • Ensure that the compensation payment process is transparent, timely, and accessible.	Very Low	PIU of MOT	Ministry of Land, Housing, and Urban Development

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Occupational Health and Safety	Low	• When working on a waterway, surveyors are advised to work in pairs and never alone but where it becomes imperative that they work separately. • It is advised that every surveyor should have basic swimming skills. • Surveyors are advised to protect their health and wear appropriate clothing while doing a bathymetric survey to avoid the risk of getting hypothermia. • The crew members must be trained and should wear life jackets. • First Aid Facility to be available in the vessel. • Appropriate personal protective equipment (PPE) must be always worn by field personnel.	Very Low	Survey Consultant/ Contractor	MOT

9.2.2 Construction Phase

The possible environmental and social impacts during the construction phase have been already identified and assessed in Chapter 5 of this ESIA report. For mitigating the possible environmental and social impacts, mitigation measures for the construction phase are proposed in Table 9-2.

Table 9-2: Environmental and Social Mitigation Measures during the Construction Phase

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Ambient Air Quality	Low	• Regularly spray water to suppress the resuspension of dust during construction, particularly during the use of gravel roads and dirt tracks.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• The mixing plant, crushers, and batching plant should preferably be located in a downwind direction. • Compaction of soil is to be minimized by careful stockpiling and separation of topsoil. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust. • Avoid unnecessary vehicle idling and switch off the engines of vehicles, machinery, and equipment while not in use. • Conduct regular maintenance and servicing of construction vehicles and machinery to minimize air pollution. • Low Sulphur diesel should be used for operating DG sets, dredgers, and other construction equipment(s) if applicable. • Limit the speed of vehicle movements to minimize dust. • Monthly monitoring of ambient air quality to check the level of pollutants following the standards i.e., World Bank EHS Guidelines.			
Ambient noise and vibration	Low	• Barricading (temporary noise barrier) the construction sites to minimize the noise level outside the site boundary.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• All equipment shall be fitted with silencers/noise mufflers and will be properly maintained to minimize operational noise. • Restriction on honking at the project site. • Coordinate and schedule pilling and dredging activities to avoid or minimize the presence of sensitive aquatic species, for example by respecting migratory patterns and calving/breeding seasons. • Employ observers during piling and dredging activities to detect the presence of sensitive aquatic species and allow for these species to vacate the area. • Use soft start/slow ramp-up during pile driving and dredging activities to allow time for sensitive aquatic species to vacate the area. • Job rotations system for workers working in high noise level areas. • Restriction of high noise-generating activity between 6:00 AM to 5:00 PM. • Protection devices i.e., earplugs/earmuffs shall be provided to the workers operating near high noise-generating machines. • Monthly monitoring of noise levels to check the level of pollutants following the standards i.e., World Bank EHS Guidelines.			
Surface Water Quality	Medium High	• The minimum amount of vegetation and topsoil should be removed from construction areas. • Construction work shall be avoided during rain or stormy weather.	Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• No solid waste shall be discharged into any section of the drain or waterway. • Solid waste generation, storage, handling, transfer or dispose shall be visually inspected. • Proactive operational measures in dredging and disposal work will be taken to reduce sediment mobilization. • Use silt or bubble curtains to minimize the development of a plume of suspended sediment from disturbed area to undisturbed area. • Continuous monitoring of water quality should be done as per the monitoring plan. • All sewage and liquid effluent will be treated to meet the standards. • Construction vehicles and equipment should be serviced off-site. • Labour deployed onsite should be sensitized about the use of sanitation facilities, disposal of waste in dustbins, and storage of materials in designated locations. • Fuel storage should not leak, and should be periodically monitored, and repaired or replaced when necessary. • Maintain fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g., impermeable surface, settlers, and oil separator). • Fuel, oil and used oil storage areas will be contained in bunds of 110 percent capacity of the stored material.			

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Train the relevant construction personnel in handling fuels and spill control procedures. • Refueling shall occur only within enclosed areas. • Spill containment and clean-up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of at a registered landfill site. • All unused materials are to be properly handled at the construction sites. • Proper handling and management of generated waste at the construction site and dredgers. • Monthly monitoring of surface water to check the level of pollutants following the standards i.e., World Bank EHS Guidelines/WHO guidelines and EAC Standards.			
Groundwater Quality	Medium High	• No solid waste shall be discharged into any section of the drain or waterway. • All waste materials must be properly segregated, and temporarily stored in a manner commensurate with the hazard posed by the waste and then disposed of in a proper waste facility that is appropriate to the waste type. • Dredge materials should be checked before finalization of the disposal methods. If contamination identified, then land fill should be avoided. • Oil, chemicals, lubricants, and fuel leakage or spillage should be contained and cleaned up immediately if any events occur.	Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Spill containment and clean-up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of at an appropriate site. • Construction vehicles and equipment will be serviced regularly at off-site designated locations. • Refueling should be carried out in designated areas using strict protocols. • Waste oil should be collected and stored for recycling or disposal through licensed vendors. • Adequate sanitary facilities, i.e., toilets and showers, will be provided for the construction workforce.			
Soil erosion, siltation and contamination	Low	• Construction vehicles shall be refueled or repaired/serviced at the designated place with proper arrangement of waste collection and disposal. • Excavation and filling tasks should be carried out in parallel so as to minimize soil erosion. Unusable debris material should be suitably disposed of at predesignated disposal locations, with the approval of the concerned authority. • Compaction of soil shall be undertaken by controlled sprinkling of the water to minimize surface runoff and erosion. • Agricultural land/productive land shall not be selected for dredging material disposal, workers facilities, or any other construction purpose.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Well-designed water sprinkling to be carried out for dust suppression. • Dredge soil shall also be either utilized for construction activity or disposed of along with excavated soil to the identified debris disposal site. • Fuel shall be stored in High-density polyethylene (HDPE) containers on paved surfaces with the provision of a catchment pit to prevent soil contamination from oil spillages. • Arrangements should be made for the segregation of municipal soil waste into recyclable and non-recyclable waste. • Nonrecyclable waste generated should be disposed of regularly through an authorized agency. Recyclable waste should be sold to authorized vendors. • Septic tanks or mobile toilets fitted with an anaerobic treatment facility shall be provided at worker's facilities and dredgers. • Hazardous waste like used oil from DG sets shall be stored in HDPE containers and shall be stored on paved surfaces in isolated locations to prevent spillage and contamination of soil. • Movement of construction vehicles shall be restricted to designated haulage roads only to prevent compaction of soil in other areas. • Bank protection works like stone pitching and geotextile matting along the riverbank and construction of stone aprons in the river to			

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		prevent the scouring of banks shall be undertaken.			
Solid Waste	Medium Low	• Contractor should prepare a Solid Waste Management Plan as part of the CESMP to be implemented at the site before commencement of any works, which should promote waste minimization and recycling. • The construction contractor will follow the 3Rs principle (reduce, reuse, and recycle) to manage solid waste. • Contractors should be responsible for handling and disposal of all construction and related waste. • Contractor should maintain records of types, quantities, origin, storage, transport, and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices. • Any waste including excess soil should be disposed of at designated sites. • Excavated soils should be reused as much as possible as filling material and should be contained after excavation. • Solid waste shall not accumulate on site, to cause odor, fly, or rodent problems. • Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Open burning of waste shall not be permitted, and signage should be erected directing such.			
Liquid Waste	Medium Low	• A waste management plan should be prepared and followed. • Adequate sanitary facilities, i.e., toilets and showers, shall be provided for the construction workforce. • Septic tanks and soak pits shall be provided at the workers facility for the treatment of domestic wastewater. • Storage of chemicals, oil, fuel, and lubricant in a paved storage area. • Used oil from construction machinery, generators used chemicals barrels/drums will be stored in HDPE containers/drums placed in secondary containment with impervious liners.	Very Low	Contractor	PIU of MOT
Ecosystem services	Low	• Implement sediment control measures (e.g., silt fences) to reduce pollution from dredging and construction runoff. • Test dredged materials for contaminants before disposal; dispose of toxic materials in a controlled manner. • Designate disposal sites away from sensitive habitats (wetlands, riparian zones) to protect aquatic life and maintain water quality.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Relocate and rehabilitate the business community involved in the fishing and dry fish industry to ensure their livelihoods are preserved. • Restore disturbed habitats by replanting native vegetation and rehabilitating affected areas. • Provide alternative fuel sources (e.g., gas cylinders) to reduce pressure on park vegetation. • Implement erosion control techniques (e.g., vegetation buffers) to prevent soil degradation and protect agricultural land. Encourage community engagement to preserve cultural and spiritual values associated with the river and surrounding environment. • Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Habitat Types	Low	• Implement silt curtains and sediment traps during dredging to minimize sediment dispersal and protect water quality in sensitive aquatic habitats. • Schedule construction activities during non-breeding seasons for key wildlife species to reduce disturbance to fish spawning grounds and migratory bird habitats. • Limit access to natural habitats, especially near Bandingilo National Park to prevent encroachment and reduce human-wildlife conflict.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Use low-emission machinery and regularly maintain equipment to reduce air pollution and minimize noise impact on nearby wildlife. • Develop a waste management plan to ensure safe disposal of solid, hazardous, and sewage waste, preventing contamination of soil and water in sensitive habitats. • Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Aquatic flora	Low	• Employ techniques to control sedimentation, such as silt curtains and sediment traps. • Stabilize riverbanks during and after construction to prevent erosion and sedimentation, which could further impact aquatic flora. • Ensure proper handling of hazardous materials, solid waste, and sewage to prevent contamination of the river. • Develop and implement a plan to prevent the introduction and spread of invasive species. • Establish a comprehensive water quality monitoring program to track changes in water parameters and identify potential pollution sources. • Train dredge workers on the importance of preserving aquatic flora and the potential impacts of their activities.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Aquatic Wildlife	Medium Low	• Avoid elimination of the aquatic habitats, breeding, and feeding areas of the wildlife species. • Schedule dredging and construction during times when aquatic and semi-aquatic wildlife species are less likely to be present, such as outside the nesting and breeding seasons. • Use noise-reducing technologies such as mufflers or bubble curtains around pile-driving equipment to minimize underwater noise pollution. • Limit the use of heavy machinery during sensitive periods such as nesting or hibernation seasons. • Implement sediment control measures, such as silt curtains, to minimize turbidity and avoid the release of trapped pollutants. • Regularly monitor water quality to detect changes in pollutant levels that could harm aquatic species. • Implement a comprehensive biodiversity monitoring plan to track the presence and health of aquatic megafauna before, during, and after construction.	Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Provide environmental awareness training for workers on the importance of aquatic megafauna conservation, encouraging safe practices to avoid unnecessary harm to these species during construction and dredging activities. • Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Fisheries resources	Medium Low	• Use silt curtains or other barriers to limit the spread of sediments during construction and dredging. • Schedule construction and dredging activities to avoid critical fish breeding and migration seasons. • Employ noise and vibration reduction techniques, such as bubble curtains or dampeners, to minimize the impact of underwater noise on fish. • Implement continuous water quality monitoring during construction and dredging to ensure that key parameters (turbidity, dissolved oxygen, pollutants) remain within acceptable limits. • Properly manage hazardous materials and waste, ensuring that spills are prevented, and any waste materials are handled and disposed of in compliance with environmental standards. • Implement the Biodiversity Management Plan prepared as part of this ESIA.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Terrestrial flora	Low	• Reduce unnecessary clearance of vegetation cover for construction of ports, access roads, and preparation of dredged materials disposal site. • Regular water spraying should be implemented in the construction areas to suppress the generated dust. • Replanting native tree species, especially those that were removed during the construction phase. Priority should be given to ecologically important native species. • Proper management of dredged materials and erosion control measures, such as silt fences and vegetation barriers. • Proper handling, storage, and disposal of hazardous materials and waste will help prevent contamination of soil and vegetation. • Plant health monitoring should be conducted. • Implement the Biodiversity Management Plan prepared as part of this ESIA.	Very Low	Contractor	PIU of MOT
Avifauna	Medium Low	• Minimize the extent of habitat clearance and avoid clearing areas of high ecological importance, such as wetlands and riverbanks, which are crucial for birds. • Limit noisy activities, such as construction and dredging, during sensitive periods for birds, particularly breeding and nesting seasons.	Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Implement strict pollution control measures to prevent fuel, oil, and hazardous material spills from contaminating the river. • Ensure proper waste disposal and sewage treatment from construction camps to prevent water pollution. • Use silt curtains or other barriers during dredging to contain sediment resuspension and prevent the degradation of water quality in areas used by birds for feeding. • Establish a bird monitoring program to track the impacts of construction and dredging on bird populations. • Train construction workers on the importance of protecting avifauna and their habitats. • Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Herpetofauna	Low	• Minimize habitat destruction by designating and protecting areas of high ecological importance, such as riparian zones and wetlands. • Schedule construction activities to avoid critical periods, such as the breeding and nesting seasons of amphibians and reptiles. • Implement strict pollution control measures to prevent fuel, oil, and hazardous material spills.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Limit noise pollution by using quieter machinery where possible and installing noise barriers around construction sites. • Restrict nighttime activities to avoid disturbing amphibians and reptiles. • Use silt curtains or other sediment control measures during dredging to reduce turbidity and prevent sediment from smothering aquatic habitats. • Design access roads and infrastructure to allow for the free movement of reptiles and amphibians. • Install wildlife crossings or culverts to facilitate the safe passage of herpetofauna species across roads and other barriers. • Establish a herpetofauna monitoring program to assess the impacts of construction and dredging activities on local populations. • Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Terrestrial mammals	Low	• Minimize habitat destruction by limiting site clearance to essential areas and preserving wildlife corridors to maintain habitat connectivity. • Noise and light control measures to reduce disturbance to wildlife.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Speed limits and warning signs on access roads to prevent vehicle collisions with mammals. • Proper waste and hazardous materials management to prevent contamination of soil and water sources. • Rehabilitation of disturbed habitats post-construction, including replanting native vegetation to restore habitats. • Establish a monitoring program to assess the impacts of construction and dredging activities on local populations. • Implement the Biodiversity Management Plan prepared as part of this ESIA.			
Protected area	Low	• Dispose of dredged material away from sensitive habitats of the protected areas (wetlands, riparian zones, wildlife corridors). • Test dredged material for contaminants; treat or dispose of toxic material in a controlled manner. • Use sediment control techniques (silt fences, vegetation buffers) to prevent erosion and runoff. • Restore affected areas by replanting native trees and rehabilitating disturbed habitats. • Provide gas cylinders to workers to reduce pressure on park vegetation.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Continuously monitor disposal sites and surrounding habitats; implement corrective actions as needed.			
Visual Impacts	Low	• The minimum amount of existing vegetation and topsoil should be removed from construction areas. • Ensure, wherever possible, all existing natural vegetation is retained. • The sites should be always kept neat and tidy. • Litter and dust management measures should always be in place.	Very Low	Contractor	PIU of MOT
Landscape/Topography Impacts	Low	• All areas affected by the activity will need to be rehabilitated and re-vegetated. • Rehabilitate disturbed areas as soon as practically possible after construction.	Very Low	Contractor	PIU of MOT
Livelihoods	Low	• The business relocation place should be selected in consultation with affected parties and relevant stakeholders. • Identification of economic displaced persons should be conducted at Juba port access road and Bor port area. • It is strongly recommended that Resettlement Action plan (RAP) and Livelihood Restoration Plan (LRP) should be developed accordingly. • The SEP and GRM for the project will be applicable to the affected persons.	Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Training would be provided to the local people for their skill enhancement.			
Community health, safety, and security	Medium Low	• Barriers will be provided to prevent the ingress of persons into the construction site and also to protect the public from exposure to hazards associated with construction activities. • Avoiding the formation of stagnant water pools in and around the site. • Implementation of a vector control program in labour camps and surrounding areas; and • Emphasizing safety aspects among drivers, particularly with regard to the speed limit of 20 km/hr that will be enforced. • Ensuring that only licensed drivers are employed by the Project. • Avoiding peak hours for heavy vehicle movement where possible. • Collaboration with local communities and responsible authorities to improve signage (e.g., pedestrian crossings, speed limits, etc.), visibility, and awareness of traffic and pedestrian safety. • Screening, surveillance, and treatment of workers, through the provision of medical facilities and, where required, immunization programs.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• The SEP and GRM for the project will be applicable to the community people. • A Security Risk Assessment and Security Risk Management Plan to be developed and implemented to alleviate security risks and threats to and from the project. • Community health and safety plan prepared as part of this ESIA, and it should be implemented accordingly.			
Traffic and transport	Medium Low	• Prepare and submit a traffic management plan to the PIU of MOT for approval at least 30 days before commencing work on any project component involved in traffic diversion and management. • Inform local communities about the construction program in advance. • Enforce on-site speed limits. • Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the project information in both local language and English. • Implement appropriate traffic plans with the help of local police when (partial) closure of roads is required. Use flagmen to give directions to traffic.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• In case access roads have to be closed, inform local communities and road users in advance. • Use reflective signatures to direct traffic to the designated areas.			
Labour influx and recruitment	Low	• A Labor Management Procedures (LMP) to be developed and implemented to manage labour risks in the project. • Implement a local hiring policy that prioritizes employment for residents of nearby communities to reduce influx of workers. • Develop training programs to equip local community members with the necessary skills for available jobs. • Provision for the foreign workers may engage only in technical works if locally skilled workers are not available. • Facilitate regular meetings and consultations with local communities to discuss labor influx concerns and address any grievances. • Implement monitoring mechanisms to track the social impacts of labour influx, including increased crime rates, changes in local dynamics, and community sentiment.	Very Low	Contractor	PIU of MOT
Occupational health and safety	Medium Low	• Demarcate all hazardous trenches with signs posts and warning tapes.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Conduct daily morning briefs related to safety measures for all workers. • Only authorized personnel to enter the working areas. • Contractors shall provide appropriate Personal Protective Equipment (PPEs) to all project workers and visitors and ensure the use at the construction sites. • Sensitization of workers on safety measures. • Confirm the availability of permanent first aid kit at the project sites. • Contractors should recruit environmental, social, and health and safety personnel at the site to oversee environmental management, social concerns, and the implementation of environmental policies and regulations. • Carry out training of staff in environmental, health, and safety monitoring and evaluation. • Confine access to restricted work sites (including those with operation mechanical and electric equipment) to people with permits. • Contractors should confirm the horizontal and vertical clearance prior to starting any construction activities to rule out any accidents and other risks from the overhead electricity line. In the case of confined space, contractors should			

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		request the concerned power supply authority to stop the supply temporarily. • Install CCTV cameras at the project construction site to monitor the accidents and injuries, and protect construction sites from trespass, vandalism, and theft. • Occupational Health and Safety Plan prepared as part of this ESIA, and it should be implemented accordingly.			
Vulnerable Groups	Low	• Identification of vulnerable people. • Preparation of LRP for the vulnerable groups (economically displaced persons) • Extensive consultation with the vulnerable groups and consider their feedback in the project design. • Access to the grievance mechanism will be ensured.	Very Low	Contractor	PIU of MOT
Communicable Diseases and Other Infections	Medium Low	• Treat workers which will control the spread of disease vectors (through contaminated water and between people). • Provision of adequate and accessible sanitation facilities in good condition with adequate water supply. • Create awareness among workers on proper sanitation and personal hygiene to promote proper health.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• To mitigate the risk of food-related contamination amongst construction workers, food supplies will be from vendors with public health certificates. • Hiring workers from the local community to prevent social challenges associated with labour camps. • Education and sensitization of workers and the local communities on HIV/AIDS and STIs. • Contractors should sign a code of conduct (COC) to guide on promoting behavior change among the workers.			
Gender-based Violence and Sexual Exploitation and Abuse	Medium Low	• During the recruitment of workers, there will be no discrimination against one gender either by design or oversight. • The contractor to ensure the provision of the necessary basic sanitary facilities to each gender - provides separate sanitary facilities for each gender. • Contractor to put in place mechanisms for reporting and addressing gender discrimination incidents and other human rights violations. • Contractors should develop and implement a code of conduct that encompasses a clear warning to workers on any kind of GBV and SEA/SH, to be signed by all contractor workers on site.	Very Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Conduct GBV and SEA/SH awareness among all workers. • Share information with the community on the GRM. • Report any violations of the COC to workers 'representatives, HR, or GRC, and ensure that no employee who reports a violation of the COC in good faith will be punished in any way.			
Child Labour, Forced Labour, and Discrimination	Low	• Contractors should update and implement the Labor Management Procedure. • Children under the age of 18 years should not be hired on-site as provided by the Labor Act. • Ensure that the recruitment inventory indicates the ages of employment applicants and age verification is done using national identification cards or birth certificates. • Protect the workforce from inequality, social exclusion, child labour, and forced labour.	Very Low	Contractor	PIU of MOT
Land Use and Land Cover	Medium Low	• Vegetation clearing has to be at a minimum level as possible and in harmony with planned landscaping. • After completion of construction, trees shall be planted along sections of the road near the populous residential areas to mitigate the impact of traffic noise on residents living along the road and to improve the landscape along the road.	Low	Contractor	PIU of MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• All the affected areas will be restored to their original levels as much as practicable.			
Microclimate and GHGs	Low	• Minimizing the resource requirement and waste generation through best management practices like re-use, reduce, recycle and recover. • All vehicles and construction equipment must be maintained and properly tuned in accordance with manufacturers' specifications. • All equipment shall be checked to determine if they are in proper condition prior to the commencement of construction activities. • Construction equipment idling times shall be minimized by shutting equipment off when not in use.	Very Low	Contractor	PIU of MOT
Natural Hazard – Flood and Erosion	Medium Low	• A detailed flood risk assessment must be carried out before the detailed design of the project infrastructures, especially the Bor port. • All structures should be designed above the high flood level (HFL) of the river for 50 years return flood period. • Mock drills should be conducted for the workers to handle various emergency situations like floods, erosion, accidents/incidents, etc. • An emergency response cell at the river port should be developed to take care of and handle the expected emergency situation.	Low	Contractor	PIU of MOT

9.2.3 Operation and Maintenance Phase

The possible environmental and social impacts during the operation and maintenance phase have been already identified and assessed in Chapter 5 of this ESIA report. For mitigating the possible environmental and social impacts, mitigation measures for the operation and maintenance phase are proposed in Table 9-3.

Table 9-3: Environmental and Social Mitigation Measures during the Operation and Maintenance Phase

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Ambient Air Quality	Low	• Material having potential to generate dust should be transported under covered conditions. • Regular maintenance of vessels engine and propellers. • Transportation vehicles shall be properly serviced and maintained. • Adoption of cleaner fuels such as low Sulphur oil as per USEPA norms or switching to LNG based vessels. • Adoption of energy efficient machinery for material handling & barge loading to minimize energy consumption. • A green belt should be developed and maintained along the port periphery and along the access roads. The green belt should be developed in canopy shape with local species of broad leaf variety. • Species selected for development of green belt shall also be tolerant to expected pollutions and shall have the ability to absorb the pollutants. • Adoption of clean energy options like solar energy. • Monitoring of air quality shall be carried out on a monthly basis to check the level of pollutants and effectiveness of the proposed environmental management plan.	Very Low	MOT	Ministry of Environment and Forestry (MOEF)
Ambient noise level and vibration level	Low	• Provision shall be made for thick green plantations at port sites and access roads as natural noise barriers.	Very Low	MOT	MOEF

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Maintain and operate all vehicles, vessels, and equipment in accordance with manufacturer's recommendations. • Ensure periods of respite are provided in the case of unavoidable maximum noise level events and provide adequate Personal Protective Equipment (PPE) for workers. • Impose vehicle speed limits for heavy goods vehicle traffic travelling on access roads close to receptors. • Inform all potentially impacted port workers of project activities that have the potential to be with high noise levels.			
Surface Water Quality	Low	• An adequate number of toilet facilities including the provision of a Sewage Treatment Plant (STP) should be established at the Bor port site. • Adopt treatment system design specifications for all effluents intended for discharge that allow compliance with specified discharge limits; as national limits don't exist, indicative values for treated sanitary sewage discharges given in the IFC General EHS Guidelines (IFC, 2007) shall be used as discharge limits to comply with. • Sanitary/domestic wastewater collected in septic tanks shall be commingled with other sanitary wastewater streams and treated prior to discharge. • No waste/wastewater shall be discharged in river or dumped into the ground.	Very Low	MOT	Ministry of Water Resources & Irrigation (MWRI)
Soil erosion, siltation, and contamination	Medium Low	• Fuel shall be stored in HDPE containers on paved surfaces only to prevent spillage of fuels on the soil and thus soil contamination. • Dustbins shall be provided at the required locations at the port site for the collection of recyclable and nonrecyclable waste. Recyclable	Very Low	MOT	MOEF

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		waste shall be sold to authorized vendors and nonrecyclable waste shall be disposed of through authorized agencies and shall not be dumped in the open. • Used oil from DG sets and other equipment shall be stored in HDPE containers in isolated locations on paved surfaces and shall be disposed of through authorized vendors only and shall not be dumped in the open.			
Improper management of solid waste	Medium Low	• A waste management plan should be prepared and followed. • The port authority should follow the 3R policy to manage solid waste. • Any waste including excess soil should be disposed of at designated sites. • Solid waste shall not accumulate on site, to cause odor, fly, or rodent problems. • Provisional material storage on site should be designed and undertaken in such a way as to ensure that soil and underground water are not polluted. • Open burning of waste shall not be permitted, and signage should be erected directing such.	Low	Municipal Authority	MOT
Improper management of liquid waste	Medium Low	• A waste management plan should be prepared and followed. • Adequate sanitary facilities, i.e., toilets and showers, shall be provided for the port users. • Septic tanks and soak pits shall be provided for the treatment of domestic wastewater. • Storage of chemicals, oil, fuel, and lubricant in a paved storage area.	Low	Municipal Authority	MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Used oil from machinery, generators used chemicals barrels/drums will be stored in HDPE containers/drums placed in secondary containment with impervious liners.			
Impact on Ecosystem Services	Medium Low	• Implement sustainable fishing practices and establish protected zones to preserve fish stocks. • Enforce regulations to control unchecked development and protect key habitats around Bor. • Establish pollution controls, including waste management systems, to prevent fuel spills and runoff from degrading the Nile's water quality. • Develop alternative livelihoods for the displaced dry fish processing community to minimize economic hardship. • Enforce strict wildlife protection laws to prevent illegal bush meat extraction and unsustainable hunting. • Promote ecotourism and cultural preservation initiatives to protect the Nile's cultural and spiritual significance. • Establish biodiversity conservation programs to protect key habitats and enhance ecosystem resilience.	Low	MOT	MOWI, Ministry of Wildlife Conservation and Tourism, Ministry of Animal Resources and Fisheries
Impact on Aquatic Ecosystem and Biodiversity	Medium Low	• Implement sustainable dredging practices to minimize habitat disruption and maintain natural river flow patterns. • Establish pollution control measures to prevent fuel spills and regulate waste discharge, protecting water quality. • Create protected zones for wetlands and riparian areas to preserve key breeding grounds and maintain biodiversity. • Monitor and control invasive species introduction, implementing rapid response plans to mitigate their impact on native species.	Low	MOT	Ministry of Wildlife Conservation and Tourism

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Develop and enforce sustainable fishing regulations to prevent overfishing and protect key fish species. • Conduct regular biodiversity monitoring to assess the health of the ecosystem and the status of vulnerable species such as the Hippopotamus and Nile buffalo. • Promote ecological restoration programs to rehabilitate degraded habitats and restore natural ecosystem functions.			
Terrestrial Ecosystem and Biodiversity	Medium Low	• Implement noise reduction technologies on vessels and machinery to minimize disturbances to wildlife. • Use directional lighting and shielded fixtures to reduce light pollution and its impact on nocturnal and migratory species. • Limit infrastructure expansion and access roads to prevent further fragmentation of critical ecosystems. • Conduct community awareness programs to educate local populations about wildlife conservation and the importance of protecting habitats. • Establish wildlife corridors to facilitate safe movement and migration of species between fragmented habitats. • Monitor and restore degraded vegetation areas through replanting and management of invasive species. • Develop and enforce strict regulations against poaching and illegal hunting to protect vulnerable species. • Promote the use of native plant species in landscaping and restoration projects to maintain ecosystem integrity. • Establish protocols for the proper handling and disposal of solid, liquid, and hazardous wastes generated from port operations. • Implement air quality monitoring to assess and mitigate the effects of emissions from vehicles and machinery.	Low	MOT	Ministry of Wildlife Conservation and Tourism

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Conduct regular ecological assessments to evaluate the impacts of port operations on terrestrial ecosystems and biodiversity.			
Protected Areas	Medium Low	• Implement noise-reducing technologies for vessels and equipment. • Schedule operational activities to minimize nighttime operations and reduce light pollution. • Establish spill prevention and response plans for oil spills and wastewater discharge. • Limit dredging and material disposal to designated areas to prevent sediment accumulation in critical habitats. • Restore degraded riparian zones to enhance biodiversity and ecological balance. • Regularly test dredged materials for harmful substances before disposal. • Conduct regular wildlife surveys to monitor populations and habitat conditions, particularly for migratory birds. • Establish conservation measures to protect sensitive species and their habitats. • Enforce strict access controls to protected areas to prevent illegal logging and poaching. • Promote community awareness and involvement in conservation efforts to mitigate human-wildlife conflict.	Low	MOT	Ministry of Wildlife Conservation and Tourism, MOEF
Community Health & Safety	Medium Low	• Implement strict traffic management plans • Conduct road safety awareness • Use water sprinkling, dust screens, and emissions control measures to reduce air pollution from construction activities, thereby minimizing respiratory issues among nearby residents. • Establish disease prevention programs focusing on vector-borne diseases such as malaria and provide health services for both	Very Low	MOT	Ministry of Health

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		workers and community members, including access to vaccinations and STI prevention education. • SEP and GM will be applicable to the community.			
Traffic and Transportation	Medium Low	• Inform local communities about the maintenance program in advance. • In case access roads must be closed, inform local communities and road users in advance. • Use reflective signatures to direct traffic to designated areas. • Use flagmen to give directions to traffic.	Low	MOT	MOT
Occupational Health & Safety	Medium Low	• Ensure that work sites (especially excavation works) have proper protection with clear marking of safety borders and signals and fences off all dangerous areas. • Confine access to restricted work sites (including those with operation mechanical and electric equipment) to people with permits. • Provide comprehensive training on equipment operation, vessel handling, hazard communication, and PPE use. • Enforce load limits, provide ergonomic lifting aids, and train employees on safe handling techniques. • Perform routine inspections and preventive maintenance on equipment; enforce lockout/tagout during maintenance. • Implement a traffic management plan with clear signage, speed limits, and visual aids. • Mandate PPE use, fall protection, and respiratory protection in hazardous areas. • Develop an emergency response plan, including fire and spill control measures, first aid training, and regular drills. • Ensure compliance with OHS regulations, maintain documentation, and update safety protocols regularly.	Very Low	MOT	Ministry of Health

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Contractor should recruit an H&S person during maintenance. • The contractor should confirm the horizontal and vertical clearance prior to maintenance work to rule out any accidents and other risks from the overhead electricity line.			
Vulnerable Groups	Low	• Tailored consultations and culturally appropriate communication for vulnerable groups. • Prioritize local employment for vulnerable groups such as women and IDPs. • Provide skills training and capacity-building programs for vulnerable groups. • Implement and enforce GBV prevention measures and Codes of Conduct. • Establish GBV support services like counselling and healthcare. • Ensure fair, transparent, and accessible compensation for vulnerable individuals. • Develop livelihood restoration programs for displaced and landless persons. • Improve access to healthcare, clean water, and sanitation for vulnerable groups. • Strictly enforce anti-child labour policies across the project. • Ensure project infrastructure is accessible for persons with disabilities.	Very Low	MOT	MOT
Social Inequality & Marginalization	Low	• Job preference for local people. • Preference for vulnerable people especially women. • SEP and GM will be applicable to vulnerable people.	Very low	MOT	MOT
Land Use and Land Cover	Low	• A tree plantation program should be introduced after the completion of the construction activity around the port site and access roads.	Very Low	MOT	MOEF

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Microclimate and GHGs	Medium Low	• Management of the traffic carrying cargo to be received at the port by fixing the hours and route of transportation. • Usage of low Sulphur diesel/CNG-based vehicles to transport the material. • Adoption of energy-efficient machinery for material handling & barge loading to minimize energy consumption. • Adoption of 4Rs, i.e. Reduce, Re-use, Recycle, and Re-use for material use and fuel consumption. • Adoption of clean energy options like solar energy in the port operation.	Very Low	MOT	MOEF
Natural Hazards	Medium High	• Record of the accidents in the inland waterways should be maintained by the port authority. • Analysis of each accident should be carried out to know the reason for the accident and prevention should be undertaken so as not to repeat the same cause. • Safety equipment, safety boats, lights, signalling system, and patrol services should be ensured. • Provision of shelters should be provided for boats in waterways to manage severe weather conditions like floods. • Minimum passing distance between vessel and from vessel to the banks must be ensured for safe traffic conditions. • Maintenance of buoys, beacons, signs, gauges & limiting the shoals through maintenance dredging. • Carrying out river training works at critical bend locations and provision of cautionary signage at the navigational hazard locations. • Installation of navigation lights to make channel visible and painting beacons & bays with refractive paints for enhancing nighttime visibility.	Low	MOT	Ministry of Humanitarian Affairs and Disaster Management

9.2.4 Decommissioning and Dismantling Phase

The possible environmental and social impacts during the decommissioning phase have already been identified and assessed in Chapter 5 of this ESIA report. For mitigating the possible environmental and social impacts, mitigation measures for the decommissioning phase are proposed in Table 9-4.

Table 9-4: Environmental and Social Mitigation Measures during the Decommissioning and Dismantling Phase

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
Ambient Air Quality	Low	• Proper dust suppression measures shall be ensured at the site. • Emissions from the emergency DG set and other stationary machines should be controlled by ensuring that the engines are always properly tuned and maintained.	Very Low	Decommissioning Contractor	MOT
Ambient Noise level and vibration	Low	• Only well-maintained equipment should be operated on-site. • Machinery and equipment that may be in intermittent use should be shut down or throttled down during non-work periods. • Lubricating moving parts, tightening loose parts, and replacing worn-out components should be carried out for the equipment that will be generated too much noise. • Instruct the workers to avoid unnecessary noise-generation activities.	Very Low	Decommissioning Contractor	MOT
Solid waste from demolition structure	Low	• A waste management plan should be developed and implemented by the Contractor considering all types of waste. • The contractor will be followed the 3R policy to manage the solid waste. • All waste generated from dismantling should be collected and disposed of at the nearest municipal disposal site. • Efforts will be made to keep the non-hazardous and hazardous waste segregated in well-defined spaces. • All hazardous waste is to be disposed of with the help of approved vendors.	Very Low	Decommissioning Contractor	MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• The contractor through the project authority should inform the workers and local community about the dismantling plan and duration of work.			
Aquatic Ecosystem and Biodiversity	Low	• Implement spill prevention plans, provide secondary containment for fuel storage, and ensure rapid-response teams are available for spill clean-up. • Use silt curtains and schedule activities during low-current periods to minimize sediment suspension. • Regularly spray water to suppress the generated dust. • Assess existing habitats around structures before dismantling and consider habitat relocation or restoration plans. • Use low-noise machinery, limit demolition activities to times when aquatic species are less active, and employ acoustic deterrents if needed. • Clean and inspect all equipment and vessels before entry and exit to prevent the spread of invasive species.	Very Low	Decommissioning Contractor	MOT
Terrestrial Ecosystem and Biodiversity	Low	• Restrict vehicle movement to predefined paths and minimize the footprint of dismantling activities. • Store fuels and chemicals in designated, secure areas to prevent spills and contamination. • Regularly spray water to suppress the generated dust. • Ensure all waste, including hazardous materials, is treated and disposed of in compliance with environmental regulations. • Restore disturbed sites by replanting native species and rehabilitating habitats after decommissioning. • Conduct regular monitoring of the site for invasive species and implement measures to prevent their spread.	Very Low	Decommissioning Contractor	MOT

Potential Impacts/ Aspects	Impact Significance (Without Mitigation)	Proposed Mitigation/ Enhancement Measures	Residual Impact Significance	Responsibility	
				Implementation	Supervision
		• Involve local communities in the planning and implementation of the decommissioning process to ensure their concerns are addressed and they benefit from the project.			
Occupational Health and Safety	Low	• Adequate training regarding health and safety will be provided to the workers. • Appropriate PPEs shall be ensured for the workers at the site. • Workers handling electricity and related components will be provided with shock resistant gloves, shoes, and other protective gear. • First aid box/arrangement to be ensured.	Very Low	Decommissioning Contractor	MOT

9.3 Environmental and Social Monitoring Plan

The effectiveness of the various mitigation measures described will be monitored through a well-defined environmental and social monitoring program. This will be done by direct measurement of parameters related to environmental quality, emissions, discharges, etc.

An environmental and social monitoring program is important as it provides useful information on the following aspects:

- It helps to verify the predictions on environmental and social impacts presented in this study.
- It helps to identify the need for improvements in the management plans.
- It helps to verify compliance with statutory and community obligations.
- It helps to indicate warnings of the development of any alarming environmental situations and thus, provides opportunities for adopting appropriate control measures.

The monitoring program in different areas of the environment and social, outlined in the next few sections, has been based on the findings of the impact assessment studies, described earlier.

9.3.1 Pre-construction/Planning and Design Phase

During the pre-construction/planning and design phase of the proposed Project in Juba and Bor, regular environmental and social monitoring of a few environmental and social parameters will be required. The suggested monitoring plan for the pre-construction/planning and design phase of the proposed project is given in Table 9-5.

Table 9-5: Environmental and Social Monitoring Plan for Pre-construction/Planning and Design Phase

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Land acquisition and resettlement	Area of land compensated, price lists, full inventory, disclosure of the cutoff date, total number of Resettlement/PAPs, total number of compensated PAPs	Project site	RAP Monitoring Report	Once before construction works	South Sudan Land Act of 2009 and WB ESS5	MOT through an NGO or 3rd party appointed consultant	Ministry of Land, Housing, and Urban Development
Occupational Health and Safety	Availability of occupational safety and health plans or procedures and implementation of the plan, availability of emergency preparedness and response plan, safety gear (PPEs) for worker's survey site, occurrence of accidents and injuries	Survey/ investigation sites	Site visit and check on the availability of the plan, number of workers with safety gear, record of accidents and injuries	Daily	-	Survey Consultant/ Contractor	MOT
Grievance Redress	Number of grievances (complaints related to land, resettlement, and others)	Project site	Inspect the grievance register	Daily	-	PIU of MOT	Ministry of Land, Housing, and Urban Development

9.3.2 Construction Phase

The suggested monitoring plan for the construction phase of the proposed project is given in Table 9-6.

Table 9-6: Environmental and Social Monitoring Plan for Construction Phase

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
General	Inspection of mitigation compliance	Project port and access roads construction sites, clearing (dredging) sites, workers facility, etc.	Visual inspection of all active work areas	Daily	Monitoring	Contractor	PIU of MOT
Ambient Air Quality (Dust generation)	Dust/particulate matter	Poer construction site, access roads, and material storage sites	Visual inspection to ensure dust suppression measures are in place	Daily	Monitoring	Contractor	PIU of MOT
Ambient Air Quality (exhaust emission)	$PM_{2.5}$, PM_{10}, CO, SO_2, NO_2, and O_3	10 locations considering project sites/nearest settlements/receptors from the port, access roads, and clearing (dredging) and disposal sites	Onsite measurement and analysis	Monthly	WHO Air Quality Guidelines	Contractor and or through 3rd party environmental consultant/firm	PIU of MOT
Ambient Noise and Vibration Level	Noise level in dBA and vibration level in mm/s	10 locations considering project sites/nearest settlements/receptors from the port, access roads, and clearing (dredging) and disposal sites	Onsite measurement and analysis	Monthly	WHO Nose Level Guidelines	Contractor	PIU of MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Surface Water Quality	Ammonium, BOD, COD, EC, Nitrate, Nitrite, Oil & Grease, pH, Phosphorus, TDS, TSS, Turbidity, Color, Mercury, Lead, Cadmium, Chromium, Copper, TOC, Total N, Chloride, etc.	6 locations/samples considering upstream and downstream of the port construction site, clearing (dredging), and disposal sites	Sample collection and laboratory analysis	Monthly during dredging and	EAC standards followed by the South Sudan National Bureau of Standards	Contractor	PIU of MOT
Groundwater Quality	Aluminum, Ammonium, Arsenic, Chloride, Fluoride, EC, Lead, Color, Boron, Mercury, Cadmium, Chromium, Copper, Nickel, Nitrate, Nitrite, pH, Escherichia coli, Fecal Coliform	4 locations/samples from the Bor port site and access road construction sites in Juba and Bor	Sample collection and laboratory analysis	Two times (before starting construction and after completion of construction)	WHO Guidelines	Contractor	PIU of MOT
Soil erosion, siltation, and contamination	Solid compaction. Check liquid waste is carried out by experienced personnel and in a proper way. Careful and proper handling of oil and other hazardous liquids.	Project construction site and clearing (dredging) and disposal sites	Visual inspection of all active work areas	Daily	Monitoring	Contractor	PIU of MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Solid waste	Types, quality, quantity, storage, transportation, associated hazards, hydrocarbon and chemical storage, and disposal locations	Construction sites, workers' facilities, and disposal sites	Visual inspection of all active work areas	Daily	Monitoring and record-keeping including photographs if applicable	Contractor	PIU of MOT
Liquid waste	BOD, TSS, Coliform, pH, COD, Oil & Grease, Total Nitrogen, Total Phosphorus, etc.	Two locations (Juba and Bor project site) from the point where effluent will leave the worker's facility	Sampling and laboratory analysis of effluent	Monthly	WBG General EHS Guidelines, 2007	Contractor	PIU of MOT
Aquatic Flora	Monitoring of removal of aquatic flora	Clearing (dredging) location and river port	Visual inspection	Daily during clearing (dredging)	Monitoring	Contractor	PIU of MOT
Aquatic Wildlife	Monitoring of death/movement/ capture/killing/ disturbance/breeding/ migration of aquatic megafauna	Clearing (dredging) and disposal location and river port	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging)	Monitoring	Contractor	PIU of MOT
Fisheries Resources	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of fish fauna	Clearing (dredging) and dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging)	Monitoring	Contractor	PIU of MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Terrestrial Flora	Monitoring of cut/removal of terrestrial flora	Riverport construction site	Visual inspection and record-keeping	Daily during site clearing	Monitoring	Contractor	PIU of MOT
Avifauna	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of avifauna	Clearing (dredging) and dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging) and site clearing	Monitoring	Contractor	PIU of MOT
Herpetofauna	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of herpetofauna	Dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging) Daily during clearing (dredging) and site clearing	Monitoring	Contractor	PIU of MOT
Terrestrial Mammals	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of terrestrial mammals	Dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging) Daily during clearing (dredging) and site clearing	Monitoring	Contractor	PIU of MOT
Community Health and Safety	Accidents, incidents, diseases, dangerous occurrences, and community complaints	Construction site and approach roads	Visual inspection and record keeping including photographs	Based on occurrence and records	Monitoring	Contractor	PIU of MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Traffic	- Presence of a Traffic Management Plan. - Presence of traffic signage/ warning signage and speed limits for vehicles. - Training provided to drivers. - Accidents and fatal incidents (number, type, location, and causes, etc.). - Status of alternative routes. Complaints were raised by the community relating to the restriction of access.	Project construction site and approach roads	Site visit and check on the availability of the traffic management plan. Site inspection of the number and types of traffic signage. Review of training records. Review of incidents and accidents log. Review of community GM.	Weekly during construction	Monitoring	Contractor	PIU of MOT
Labor and Working Conditions	Availability of occupational safety and health plans or procedures and implementation of the plan	Construction and clearing (dredging) site	Site visit and check on the availability of the plan	Daily	Monitoring	Contractor	PIU of MOT
	Availability of emergency preparedness and response plan	Construction and clearing (dredging) site	Site visit and check on the availability of the plan	Monthly	Monitoring	Contractor	PIU of MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
	A Waste Management Plan is in place	Construction and clearing (dredging) site	Site visit and check on the availability of the plan	Monthly	Monitoring	Contractor	PIU of MOT
	Meeting and training	Construction and clearing (dredging) site	Number of meetings and training	Daily	Monitoring	Contractor	PIU of MOT
	Safety gear (PPEs) for workers	Construction and clearing (dredging) site	Number of workers with safety gear (PPEs)	Daily	Monitoring	Contractor	PIU of MOT
	Occurrence of accidents and injuries	Construction and clearing (dredging) site	Record of accidents and injuries	Daily	Monitoring	Contractor	PIU of MOT
	Proper worker accommodation is available	Construction and clearing (dredging) site	Site visit and site inspection checklist	Monthly	Monitoring	Contractor	PIU of MOT
	Health and sanitation facilities for labour	Construction and clearing (dredging) site	Availability of sanitation facilities and other disease preventive measures	Daily	Monitoring	Contractor	PIU of MOT
	Availability of worker's grievance mechanism	Construction and clearing (dredging) site	Inspect the grievance register/complaints log	Monthly	Monitoring	Contractor	PIU of MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Gender Based Violence	Availability of Contractor Gender Management Plan, Availability of Code of Conduct, raining received on Code of Conduct, Incidents related to GBV Complaints raised	Project construction sites and clearing (dredging) site	Review the minutes of awareness sessions and information sharing about GBV. Complaints log for community grievances. GBV problems were raised.	Monthly	Monitoring	Contractor	PIU of MOT
Child and Forced Labor	Contractors signed contracts and clauses related to the prevention of child and forced labor, number of children recruited, Worker IDs, Minimum working age, and working condition	Project construction sites and clearing (dredging) site	Inspection of employment records	Daily	Monitoring	Contractor	PIU of MOT
Grievance Redress	Number of grievances	Project site	Inspect the grievance register	Daily	Monitoring	Contractor	PIU of MOT
Security	Security incidents, Complaints raised related to security people's behavior, Criminal incidents	Project site	Review of GRM Site inspection	Monthly	Monitoring	Contractor	PIU of MOT

9.3.3 Operation and Maintenance Phase

The suggested monitoring plan for the operation and maintenance phase of the proposed project is given in Table 9-7.

Table 9-7: Environmental and Social Monitoring Plan for Operation and Maintenance Phase

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Compliance monitoring	ESIA Mitigation Measures, Condition of Environmental Approval	Project site	-	Monthly	ESMP of ESIA	MOT	MOT
Ambient Air Quality	$PM_{2.5}$, PM_{10}, CO, SO_2, NO_2, and O_3	Port operation site and nearest settlements/receptors	Onsite measurement and analysis	Semi-annual	WHO Ambient Air Quality Guideline	MOT	MOEF
Ambient Noise Level and Vibration Level	Noise level in dB(A)	Port operation site and nearest settlements/receptors	Onsite measurement and analysis	Semi-annual	WHO Guidelines	MOT	MOEF
Surface Water Quality	Ammonium, BOD, COD, EC, Nitrate, Nitrite, Oil & Grease, pH, Phosphorus, TDS, TSS, Turbidity, Color, Mercury, Lead, Cadmium, Chromium, Copper, TOC, Total N, Chloride, etc.	Upstream and downstream of the port site	Sample collection and laboratory analysis	Annual	EAC standards followed by the South Sudan National Bureau of Standards	MOT	MWRI
Groundwater Quality	Aluminum, Ammonium, Arsenic, Chloride, Fluoride, EC, Lead, Color, Boron, Mercury,	Port operation site	Sample collection and laboratory analysis	Annual	WHO Guidelines	MOT	MWRI

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
	Cadmium, Chromium, Copper, Nickel, Nitrate, Nitrite, pH, Escherichia coli, Fecal Coliform						
Soil Erosion, Siltation, and Contamination	Check liquid waste is carried out by experienced personnel and in a proper way. Careful and proper handling of solid and hazardous waste.	Port operation site	Visual inspection of all active work areas	Annual	Monitoring	MOT	MOEF and MOWI
Solid Waste	Types, quality, quantity, storage, transportation, associated hazards, hydrocarbon and chemical storage, and disposal locations	Port operation site including office	Visual inspection of all active work areas	Semi-annual	Monitoring and record-keeping including photographs if applicable	MOT	MOT
Liquid Waste	BOD, TSS, Coliform, pH, COD, Oil & Grease, Total N, Total Phosphorus, etc.	Bor port site from the point where effluent will leave	Sampling and laboratory analysis of effluent	Semi-annual	WBG General EHS Guidelines	MOT	MOT
Aquatic flora and Fauna	Monitoring of cut/death/movement/ capture/killing/ disturbance/ breeding/migration of aquatic fauna	Upstream and downstream of the port construction site	Visual inspection and record keeping including photographs if applicable	Semi-annual	Monitoring	MOT	MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Terrestrial Flora and Fauna	Monitoring of cut/death/movement/ capture/killing/ disturbance/ breeding/migration of aquatic fauna	Upstream and downstream of the port construction site	Visual inspection and record keeping including photographs if applicable	Semi-annual	Monitoring	MOT	MOT
Community Health and Safety	Accidents, incidents, diseases, dangerous occurrences, and community complaints	Port operation and maintenance site & approach road	Visual inspection	Based on occurrence and records	-	MOT	MOT
Traffic	Presence of traffic/warning signage and speed limits for vehicles. Alternative routes. Complaints were raised by the community relating to the restriction of access.	Port operation site and access roads	Site inspection of the number and types of traffic signage. Review of community GM	Daily during maintenance	-	MOT	MOT
Occupational Health and Safety	Availability of occupational safety and health plans or procedures and implementation of the plan	Operation & maintenance site	Site visit and check on the availability of the plan	Daily	-	MOT	MOT
	Availability of emergency	Operation & maintenance site	Site visit and check on the	Once	-	MOT	MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
	preparedness and response plan		availability of the plan				
	Safety gear (PPEs) for Worker's Construction site	Operation & maintenance site	Number of workers with safety gear	Daily	-	MOT	MOT
	Occurrence of accidents and injuries	Operation & maintenance site	Record of accidents and injuries	Daily	-	MOT	MOT
	Availability of worker's grievance mechanism	Operation & maintenance site	Inspect the grievance register/complaints log	Monthly	-	MOT	MOT
Grievance Redress	Number of grievances	Project site	Inspect the grievance register	Daily	-	MOT	MOT
Vulnerable Groups	Number of vulnerable people receive assistance and Training for capacity development	Vicinity of the project area	Inspect the LRP, CSR, and Community Development Initiative	Monthly	-	MOT	MOT

9.3.4 Decommissioning and Dismantling Phase

The suggested monitoring plan for the decommissioning phase of the proposed project is given in Table 9-8.

Table 9-8: Environmental and Social Monitoring Plan for Decommissioning and Dismantling Phase

Aspects/env. Attributes/issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
General	Inspection of mitigation compliance	Project dismantling site and workers' facilities	Visual inspection of all active work areas	Daily	Monitoring	Contractor	MOT
Ambient Air Quality	Dust generation site	Dismantling sites and material storage sites	Visual inspection to ensure dust suppression measures are in place	Daily	Monitoring	Contractor	MOT
Ambient Noise Level and Vibration	Noise level (dBA)	Dismantling site/ nearest settlements/ receptors	Visual inspection	Daily	Monitoring	Contractor	MOT
Solid waste from demolition structure	Quantity/volume of waste generation, storage, transportation, disposal, and waste management	Dismantling site, storage, and disposal site	Visual inspection of storage facilities and recordkeeping	Weekly	Monitoring and recordkeeping	Contractor	MOT
Aquatic ecosystem and biodiversity	Death/disturbance capture of aquatic flora and fauna	Dismantling sites specifically the river near the port and adjacent area	Visual Inspection	Weekly	Monitoring	Contractor	MOT
Terrestrial Ecosystem and Biodiversity	Death/disturbance capture of aquatic flora and fauna	Dismantling sites	Visual Inspection	Weekly	Monitoring	Contractor	MOT
Occupational Health and Safety	Number of accidents, first aid, PPEs	Dismantling sites	Visual Inspection	Use of PPEs on a daily basis & accidents	Monitoring and record-keeping	Contractor	MOT

Aspects/env. Attributes/issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
				based on occurrence			

9.4 Institutional Setting and Implementation Arrangement

9.4.1 Key Institutions Involved in the Implementation of the Project

9.4.1.1 National/Government Level

The Ministry of Transport (MOT) will be the responsible entity for owning, leading, and coordinating the project. Within the MOT, the project implementation structure will be delineated into three levels: Ministerial, Undersecretary, and Project Coordinator. The MOT will provide oversight and overall leadership for the project at the ministry level and will act as the intermediary between the project and the Steering Committee.

The Undersecretary within the MOT will serve as the designated accounting officer and will be the link between the minister and the project implementation team. The Undersecretary will be responsible for all project activities, including safeguards, procurement, financial management, and overall implementation.

9.4.1.2 Project Implementation Units (PIUs)

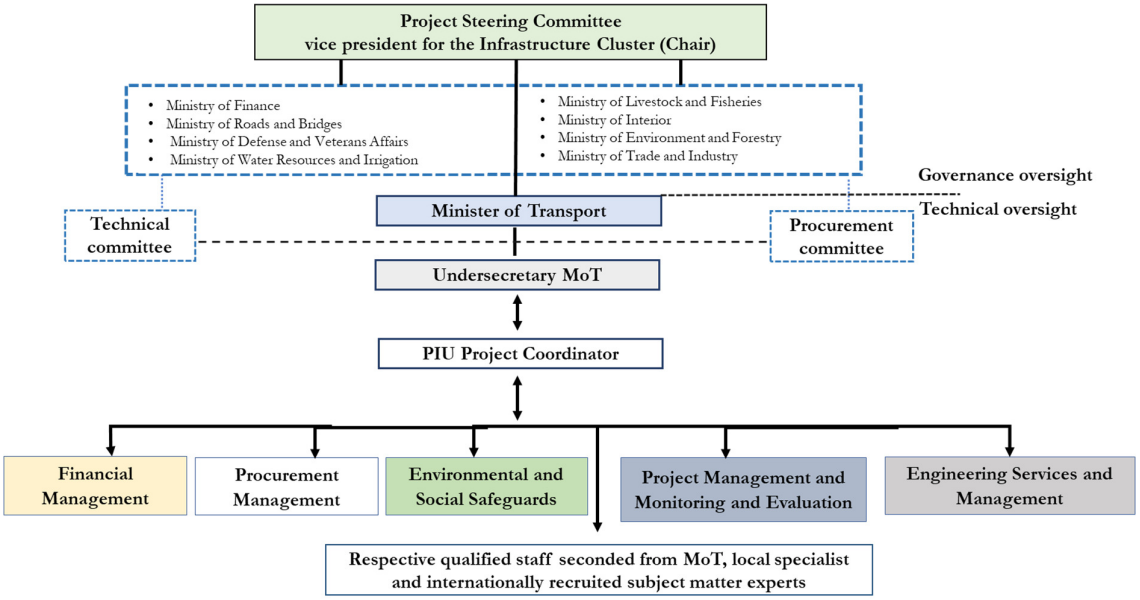
The Project Coordinator will oversee the Project Implementation Unit (PIU) and manage the day-to-day operations, serving as the liaison with the World Bank. The project coordinator will ensure the quality of outputs from the PIU and be responsible for stakeholder engagement on operational aspects of the project. The PIU team will consist of the necessary staff for the project's implementation, including financial management, procurement management, environmental & social management, project monitoring & evaluation, and engineering services and management. Local and international experts will be recruited as needed.

Oversight and strategic guidance will be provided by a Project Steering Committee, chaired by the Vice President for the Infrastructure Cluster. This committee will comprise representatives from the Ministry of Transport, Ministry of Finance, Ministry of Roads and Bridges, Ministry of Defense and Veterans Affairs, Ministry of Water Resources and Irrigation, Ministry of Livestock and Fisheries, Ministry of Interior, Ministry of Environment and Forestry, Ministry of Trade and Industry, and state authorities. The committee is tasked with closely monitoring the project's execution, providing strategic and policy guidance, and conducting quarterly evaluation meetings to ensure optimal project delivery and performance.

The project implementation structure will comprise two dedicated committees: a Technical Committee and a Procurement Committee. These committees are tasked with monitoring and providing technical, strategic, and financial guidance to the project implementation team. They will convene on a quarterly basis and report their findings and recommendations to the Steering Committee. Depending on the committee, mandate includes the evaluation of project milestones, endorsement of the annual work plan, scrutiny of financial reports, and engagement with relevant stakeholders to support project performance. However, they will not hold any contractual obligations under consultancy agreements. The Technical Committee will include: the Undersecretary for Ministry of Roads and Bridges, Undersecretary for Planning, Ministry of Finance and Planning; Executive Director, South Sudan Roads Authority, Director Generals for River Transport and Road Transport and Safety, Ministry of Transport, Director Generals for Planning and Policy Formulation, Ministry of Roads and Bridges; and Director General for Aid Coordination, Ministry of Finance and Planning. The Procurement Committee will consist of the Director General for Administration and Finance, Director General for River Transport, Director General for Road Safety, Director for Policy and Research, and Procurement Officer-Secretary.

The overall implementation model and structure is depicted in Figure 9-1.

Figure 9-1: Project Implementation Structure



Source: Project Appraisal Document

9.4.1.3 Contractors

The firms contracted to put up the proposed project will be required to comply with the requirements of the ESMP within this report. ESMP should form part of the contract documents to ensure strict compliance with environmental specifications and social risk mitigation measures that address the project-related impact and risks at the community level. Contractors will establish a grievance mechanism at the construction site for solving worker's as well as the community's grievances.

The Contractor will be required under the contract to engage a competent Environmental Health and Safety Manager to advise them on ESMP compliance. Under the EHS Manager, one environmental specialist, one social safeguard specialist, and one health and safety expert (occupational and community) should be deployed during the construction stage of the project. Undertake risk assessments and prepare project-specific Construction Environmental and Social Management Plan (C-ESMP) for review and approval by the MOT and implement the approved C-ESMP.

9.4.2 Institutional Arrangements for ESMP Implementation

The proposed project implementation will be led by the Project Implementation Unit (PIU) established within the Directorate of River Transport. The PIU will be headed by the assigned Project Coordinator from Directorate of River Transport, supported by Deputy Project Leader/Coordinator, an Environmental Safeguards Specialist, Social Safeguards Specialist, Health and Safety Specialist, GBV/SEAH Specialist, financial procurement, engineering service and management, project management, monitoring and evaluation Specialist.

The PIU safeguards team will oversee the project implementing agencies, consultancies, and other contractors/subcontractors. They will also compile quarterly monitoring reports on ESMP compliance to be shared with the Project Coordinator and the World Bank throughout the project implementation period. The safeguards team will also provide training to the Directorate of River Transport, states, partnering institutions, and other field personnel responsible for monitoring environmental and social compliance during the project's implementation and subsequent post project period. The PIU will also have the overall responsibility of safeguards performance, including ESMP implementation, supervision of the contractors/subcontractors - environmental and social management requirements, measures on their execution of construction-related, infrastructural development, and other activities that have

significant adverse environmental and social impacts identified in the ESIA. The team will ensure adherence to the monitoring parameters, including quality requirements and all ESMP measures.

9.4.3 Monitoring and Reporting Procedures

During the implementation of the proposed project, the designated environmental and social safeguard officers of the PIU will visually assess the contractor's practices. If high pollutant levels are observed, then the project coordinator will instruct the contractor through the Environmental Specialist to make necessary corrections immediately. Photographic records will be established to provide useful environmental monitoring tools. A full record will be kept as part of normal contract monitoring. All applicable regulations will be enforced by the Project Coordinator and designated staff of the PIU. It is a legal obligation of the Contractor that any discharges from the work sites meet the national standards as well as applicable WB EHS guidelines. Steps will be taken by the Project Coordinator and designated E&S officers to ensure that regular monitoring of water quality, noise, dust/ambient air quality, aquatic ecology, land acquisition, resettlement, grievance, stakeholder consultation, status of compensation and livelihood restoration, etc. will be carried out as provided in the environmental and social monitoring program.

9.4.4 Record Keeping and Control

Contractors as well as PIU will be required to keep records of all activities that will be undertaken on the project site, which will be compiled and used in enhancing the environmental sustainability of the project site. These records may include a site monitoring plan, HSE policy, site safety HSE plan, waste management plan, traffic management plan, emergency response and preparedness procedures, site instructions, training records, grievance/complaint records, incident reports, inspection, maintenance and equipment calibration records, etc. These records will be retained as part of accepted modern contract management and summarized in monthly, quarterly, and annual environmental and social safeguard reports. These documents are to be made available to the E&S safeguard officer of the PIU. Similarly, the PIU will regularly generate environmental and social monitoring reports to be shared with the MOEF and WB.

9.4.5 ESMP Implementation Schedule

The most important aspect of the implementation is the appointment of all the E&S staff at the PIU level and Contractor level to oversee the implementation of the environmental mitigation measures incorporated in the design and contract specifications. Most of the planned mitigation measures and monitoring plans will be implemented along with project activities provided in the ESMP.

9.4.6 Incident Reporting

In line with the requirement of the National Occupational Health and Safety Policy 2022 and WB Environmental and Social Incident Response Tool Kit 2018, all ESHS incidents, accidents, and dangerous occurrences including occupational diseases shall be promptly reported to the respective regulatory institutions and further to the World Bank. C-ESMP shall provide incident classification criteria and an incident escalation hierarchy. Records of all incidents shall also be maintained and made available for inspection on-site throughout the project implementation phase. An investigation shall be conducted, and a corrective action plan developed for every reportable incident to prevent a recurrence.

Incidents relating to construction activities and EHS management will be managed by PIUs. Onsite incidents must be reported, in the first instance, by the Contractor to the PIUs. The Contractor shall establish procedures for incident reporting, and investigation, corrective/preventive action and resolution and will develop those procedures to include reporting lines to the PIUs team. Any exceedance of a standard or threshold will be recorded as an incident. Further work will be undertaken to develop a mutually shared understanding of the nature and scope of reporting required by the WB, for different types of incidents, and incidents of varying scale and significance. Similarly, the escalation process to be used by the Contractor to ensure all relevant incidents are reporting to PIUs will develop to reflect WB and national regulatory requirements.

PIUs will initially notify the World Bank within 24 hours (for severe incidents or accidents) 48 hours (for minor incidents or accidents) after learning of the incident or accident. PIUs will provide a subsequent impartial investigation report to the WB within 30 days from the incident reported to the WB.

9.4.7 Auditing of ESMP

PIU and the Contractor shall conduct an initial and subsequent annual audit of the ESMP by engaging an external auditor to ensure that the system for implementation of the ESMP is operating effectively. WB will also supervise progress during regular implementation support missions. The audit shall check that a procedure is in place to ensure that:

- ESMP being used is the up-to-date version.
- Variations to the ESMP and non-compliance and corrective action are documented.
- Appropriate environmental training of personnel is undertaken.
- Emergency procedures are in place and effectively communicated to personnel.
- A register of major incidents is in place and other documentation related to the ESMP.
- A discrete mechanism for safely and confidentially reporting issues of SEA/SH and GBV at the community level triggered by the Project.
- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued.

9.5 Capacity Building and Training Plan

The aim of capacity building and training for environmental and social risk mitigation is to ensure that all concerned actors in the project have the requisite capacities to comply with the environmental and social requirements. The skills areas where capacity building and training are required are tentative and will be updated when the project starts, and an E&S capacity assessment of the various entities involved is conducted.

Table 9-9 provides a capacity building and implementation plan activity for the proposed project. The project authority may revise the plan during the project implementation as required.

Table 9-9: Capacity Building and Implementation Plan Activity

Activity	Description	Unit Cost (USD)
Training of the PIU staff on the World Bank environmental and social standards under environmental and social framework and applicable WBF EHS Guidelines	Workshops to be facilitated by the WB E&S team	8,000
Training for the PIU staff on environmental and social assessment, implementation and monitoring of ESMPs, stakeholder mapping and engagement, grievance mechanism, emergency preparedness and response, occupational health and safety, community health and safety, GBV, SEA/SH awareness, code of conduct, waste management, chance find procedure and resettlement action plan implementation, dredging and biodiversity management plans	Workshops to be facilitated by the project E&S experts	7,000
Training for implementing partners and contractors on environmental and social assessment, implementation and monitoring of ESMPs, stakeholder mapping and engagement, grievance mechanism, emergency preparedness and response, community health and safety, GBV, SEA/SH awareness, code of conduct, chance find procedure, and waste management	Internal training by PIU E&S experts	7,000

Activity	Description	Unit Cost (USD)
Training for project workers on occupational health and safety including emergency preparedness and response, workers grievance mechanism, GBV, SEA/SH awareness, code of conduct, waste management, chance find procedures, etc.	Internal training by PIU E&S experts	8,000
	Total Budget	**30,000**

9.6 Cost Estimate for ESMP Implementation

The estimated cost for implementation of the mitigation and monitoring measures proposed in the ESMP is provided in Table 9-10.

Table 9-10: Indicative Budget for Implementation of Measures

SL#	Item/Activities	Estimated Cost (USD)
1.	ESMP Implementation (Mitigation + Monitoring) during pre-construction phase	To be included in the RAP budget
2.	ESMP Implementation (Mitigation + Monitoring) during the Construction phase	115,000
3.	ESMP Implementation (Mitigation + Monitoring) during operation and maintenance phase/per year	25,000
4.	ESMP Implementation (Mitigation + Monitoring) during the decommissioning and dismantling phase/once	20,000
5.	Capacity building of PIU (environment and monitoring department) and contractor staff in environmental and social safeguards and ESMP implementation	30,000
6.	Establishment of GM and operation including training	20,000
7.	Implementation of SEP/public communication and disclosure of project information	20,000
8.	Annual auditing of ESMP implementation	30,000
9.	HIV/AIDS and GBV/SEAH awareness campaign	10,000
10.	Contingency	50,000
	Total	**320,000**

9.7 Key Measures and Actions for the Environmental and Social Commitment Plan

The Government of South Sudan will implement the South Sudan Connectivity for Growth Project with the involvement of the Ministry of Transport (MOT). The International Development Association (IDA) has agreed to provide financing for the project.

MOT will implement material measures and actions so that the proposed project is implemented in accordance with the Environmental and Social Standards. The relevant ESSs that apply to the project are:

- ESS1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS2: Labor and Working Conditions
- ESS3: Resource Efficiency & Pollution Prevention and Management

- ESS4: Community Health and Safety
- ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- ESS8: Cultural Heritage
- ESS10: Stakeholder Engagement and Information Disclosure

MOT shall develop an Environmental and Social Commitment Plan (ESCP) and agree with the World Bank on an adaptive management process in which measures and actions necessary to meet the requirements of the ESSs will be identified and implemented over a specified time frame through an ESCP. MOT shall comply with the provisions of environmental and social documents required under the Environmental and Social Framework and referred in the ESCP that will be developed for the Project including the following:

- Environmental and Social Impact Assessment including Environmental and Social Management Plan shall be finalized, cleared, and disclosed prior to project appraisal and implement throughout the project lifecycle.
- Resettlement Action Plan and Livelihood Restoration Plan shall be prepared and finalized prior to carrying out the relevant works, including ensuring that before taking possession of the land and related assets, full compensation should be provided, and displaced people to be resettled including moving allowances.
- A Labor Management Procedures shall be prepared, cleared, and disclosed prior to the project appraisal and implemented throughout the project lifecycle.
- Stakeholder Engagement Plan shall be prepared prior to project appraisal and implemented the plan throughout the project lifecycle.
- Occupational Health and Safety Plan shall be finalized prior to the project appraisal and implement the plan throughout the project lifecycle.
- Community Health and Safety Plan shall be finalized prior to the project appraisal and implement the plan throughout the project lifecycle.
- A Waste Management Plan shall be prepared and finalize prior to the commencement of project implementation and implement the plan throughout the project lifecycle.
- SEA/SH Action Plan shall be prepared and finalized before project commencement and implement the plan throughout the project lifecycle.
- Security Management Plan shall be prepared and finalized before project commencement and implement the plan throughout the project lifecycle.
- A Biodiversity Management Plan shall be finalized prior to the project appraisal and implement the plan throughout the project lifecycle.
- Chance Find Procedures shall be finalized prior to the project appraisal and implement the plan throughout the project lifecycle.
- Grievance Mechanism for both workers and community shall be prepared and finalized before engaging project workers and thereafter maintaining and operating it throughout the project lifecycle.
- MOT is responsible for compliance with all ESCP requirements during the project life cycle. MOT will establish and maintain a Project Implementation Unit (PIU) with qualified staff and resources to support management of environmental, social, health and safety, GVB and SEA/SH risks and impacts of the Project.
- MOT shall organize different capacity building training for PIU staff, stakeholders, communities, contractors, project workers on the relevant aspects of the project environmental and social risk management.
- Contractor shall prepare and submit monthly environmental and social monitoring reports to MOT and MOT PIUs shall be responsible for the preparation of quarterly reports to WB.
- MOT shall maintain collaboration with the relevant agencies including the Ministry of Environment and Forestry, Ministry of Labor, Ministry of Water and Irrigation, Ministry of Wildlife

Conservation and Tourism, Ministry of Land, Housing and Urban Development, Ministry of Humanitarian Affairs and Disaster Management to manage the project's environmental and social risks and impacts of the Project.

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

The ESIA of the proposed project revealed that the project will have significant economic benefits for the local, state, and national economies. There will be both positive and negative impacts due to the construction activities and operations of the Bor and Juba ports, their access roads, and clearing (dredging) in the White Nile River between Juba to Bor section. The proposed project will have significant beneficial impacts on the adjoining communities, respective counties and states at large as it will undoubtedly improve the accessibility to communities, markets, fish businesses, and processing centers in the project areas. Other benefits include improvement in the road network and inland water network, accessibility to the communities, markets, and fish businesses in the state, increase in fish exports to the surrounding region as well as surrounding countries including the Democratic Republic of Congo, Uganda, etc. Improvement in fish productivity and export will translate to economic empowerment, poverty reduction, and sociocultural well-being of the benefiting communities. Another contribution of the proposed project to the overall socio-economic well-being of the benefiting region is the provision of employment opportunities, income-generating sources, skills acquisition settlement development, and other multiplier effects.

Inevitably, the proposed project will have some adverse impacts on the biophysical and social environment during construction and operation. On the basis of the baseline data and associated project activities, the impacts of the project activities on environmental and social parameters were analyzed. It is predicted that the project preconstruction and construction/clearing (dredging) related activities will have an impact on land acquisition and resettlement (physical and economical), livelihoods, air quality (dust), noise and vibration level, surface water quality, soil erosion, siltation, and contamination, aquatic ecosystem and biodiversity, fish, protected areas, IBAs, hydrology and drainage, land use and land cover changes, waste generation and disposal (solid, liquid, and hazardous), traffic and transport, occupational and community health and safety, child and forced labor, etc. Impacts during operation will include air quality (boat and vehicles emission), noise, traffic and transport, aquatic ecosystem and biodiversity, waste generation and disposal, natural hazards, occupational and community health and safety, etc. However, mitigation measures and management plans are proposed for mitigating the anticipated negative impacts of the project.

Environment and social management plans are prepared to prevent/control/abatement of pollution resulting from project activities in different stages. Environment and social management plan define the institutional framework responsible for implementation of ESMP, environment and social monitoring plan, and environment and social management budget.

As per the ESIA study, it is concluded that the development of the proposed project is beneficial for the economic development of the local, state, and national economy by increasing freight transportation and is beneficial for the environment by shifting freight loads from roads to waterways and cutting down carbon emissions. However, project development will have many impacts on environmental and social parameters. Mitigation measures and management plans are prepared in line with the impacts anticipated. If the proposed mitigation measures are taken and the environment and social management plan is implemented, anticipated negative impacts of the project can be reduced and benefits can be further enhanced. The project will overall bring development in the area.

10.2 Recommendations

It is recommended that MOT should provide the desired resources for the implementation of ESMPs and ensure that EMPS are effectively implemented. It must institutionalize the system of period monitoring against the defined performance indicators and establish a system of half-yearly reporting. It should also develop its own EHS guidelines and protocols for managing all the projects uniformly from an environment, health, and safety perspective. The system should be self-responding in nature for initiating timely corrective and preventive action if any required for the protection of the environment.

Priority should be given to local workers during the project implementation in order to limit the number of migrant workers. This will reduce threats to community culture, health, safety, and security as well as stimulate local socioeconomic activities, improve livelihood, and reduce poverty in the affected communities.

A Resettlement Action Plan (RAP) including a Livelihood Restoration Plan (LRP) should be prepared and implemented following the national legal frameworks and applicable WB's E&S standards in order to deliver proper compensation and resettlement of the affected people.

Community-based grievance mechanisms should be developed and implemented to promptly and effectively resolve grievances from affected groups or persons.

The safeguard team of PIU should coordinate active monitoring to ensure the contractor(s)/ subcontractor(s) adhere strictly to the requirements of the ESMP, especially in the application of mitigation measures during project design and implementation.

The implementation of the proposed project should involve a well-established community relation to create a sense of ownership of the project by the communities and make the project more sustainable.

Gender, occupational, and environmental health issues need to be emphasized by the various stakeholders in the project during the implementation and operational phases.

Adequate training shall be imparted as proposed under the environmental and social management plan to enhance the capability of concerned PIU officials. An awareness program for the contractor(s)/ subcontractor(s) and workers shall also be organized for the effective implementation of ESMP.

The ESIA was carried out while the hydrodynamic and bathymetric study, pre-feasibility study, preliminary engineering design, and preparation of cost estimates for IWT ports along the river Nile was ongoing parallel. Therefore, the detailed engineering design was not available. In this regard, any major changes during detailed design, or any major additional work other than the proposed project activities will require updating this environmental and social assessment. Also, it may have to be sent to the World Bank for concurrence before work commences.

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APPENDICES

APPENDIX A

Appendix A: ENVIRONMENTAL MONITORING RESULT SHEET

Appendix A-1: Ambient Air Quality Monitoring Result

Ref: EQMS/Ambient Air Quality/ 202428091171

EQMS ENVIRONMENTAL LABORATORY

Monitoring Results of Ambient Air Quality

Project Name : Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads and for Clearing (Dredging) Works between the Juba-Bor Section of the River Nile
Monitoring Activity : Ambient Air Quality
Monitoring Personnel : Md. Zahidul Islam, Principal Consultant, EQMS
Monitoring Location :

Monitoring Code	Monitoring Locations	Geographical Coordinates
AAQ-1	Existing port site at Bor	6°13.154'N and 31°32.820'E
AAQ-2	Leudier area (Settlement area)	6°13.340'N and 31°32.779'E
AAQ-3	Royal Junior School	6°13.011'N and 31°33.409'E
AAQ-4	Settlement area on the south of the port	6°13.030'N and 31°32.907'E
AAQ-5	Settlement area on the south-east of the port	6°12.942'N and 31°33.258'E
AAQ-6	Inside of the Juba port	4°49.845'N and 31° 36.855'E
AAQ-7	Entry gate of the Juba port	4° 49.932'N and 31°36.825'E
AAQ-8	Residential & commercial area on the north of the Juba port	4° 50.105'N and 31°36.872'E
AAQ-9	Access road on the south of the Juba port	4° 49.688'N and 31°36.665'E
AAQ-10	Access road at konyo-konyo market area	4° 49.983'N and 31°36.644'E

Monitoring Date : 10.08.2024-20.08.2024
Reporting Date : 07.09.2024

Head Office: H # 53, R # 04, B # C, Banani, Dhaka -1213, Bangladesh
Lab Office: Flat # F1, House # 1o-134/A, Bolshakhi Sarani, Gulshan-Badda Link Road, Dhaka – 1212
Toronto Office: 7 Arnot Street, Scarborough Ontario, M1K4B5 Canada

Ref: EQMS/Ambient Air Quality/ 202428091171

Description of Analysis

Monitoring Code	Parameters					
	$PM_{2.5}$	$PM_{1.0}$	PM_{10}	CO	O_3	TVOC
	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	mg/m³
AAQ-1	12.1	6.5	23.5	0.01	7.4	0.012
AAQ-2	9.8	5.2	16.3	0.00	5.2	0.004
AAQ-3	9.5	5.1	16.5	0.00	8.1	0.001
AAQ-4	8.2	5.9	14.5	0.00	3.6	0.158
AAQ-5	13.9	6.2	22.6	0.00	5.8	0.023
AAQ-6	8.5	3.3	12.4	0.00	5.2	0.001
AAQ-7	14.4	8.6	28.1	0.01	11.5	0.086
AAQ-8	17.6	9.0	31.2	0.00	9.1	0.020
AAQ-9	18.2	10.9	34.8	0.01	8.3	0.011
AAQ-10	21.7	12.3	42.9	0.01	10.2	0.164
WHO Guidelines	25	-	50	4	100	-
Method of Analysis	*Light Scattering Nephelometer*	*Light Scattering Nephelometer*	*Light Scattering Nephelometer*	*High Sensitivity Electrochemical*	*High Sensitivity Electrochemical*	*High Sensitivity Electrochemical*

Note: Regular Checkup and calibration of the equipment are done by the manufacturers and EQMS Consulting Limited personnel to avoid any error. Legend: SPM -Suspended Particulate Matter, PM10 -Particulate Matter of a diameter of 10 micron or less, PM2.5 - Particulate Matter of a diameter of 2.5 micron or less, SO2 -Sulphur Di-Oxide, NO_2 -Nitrogen Dioxide, CO - Carbon Monoxide.

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Appendix A-2: Ambient Noise Level Monitoring Result

Ref: EQMS/Ambient Air Quality/ 202428091172

EQMS ENVIRONMENTAL LABORATORY

Monitoring Results of Ambient Noise level

Project Name : Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads and for Clearing (Dredging) Works between the Juba-Bor Section of the River Nile

Monitoring Activity : Ambient Noise Level

Monitoring Personnel : Md. Zahidul Islam, Principal Consultant, EQMS

Monitoring Location :

Monitoring Code	Monitoring Location	Geographical Coordinates
ANL-1	Existing port site at Bor	6°13.155'N and 31°32.824'E
ANL-2	Leudier area	6°13.338'N and 31°32.785'E
ANL-3	Royal Junior School	6°13.019'N and 31°33.409'E
ANL-4	Settlement area on the south of the port	6°13.029'N and 31°32.910'E
ANL-5	Settlement area on the south-east of the port	6°12.944'N and 31°33.260'E
ANL-6	Inside of the Juba port	4°49.838'N and 31°36.856'E
ANL-7	Entry gate of the Juba port	4°49.930'N and 31°36.825'E
ANL-8	North of the Juba port	4°50.103'N and 31°36.875'E
ANL-9	Access road on the south of the Juba port	4°49.687'N and 31°36.667'E
ANL-10	Access road at konyo-konyo market area	4°49.983'N and 31°36.646'E

Monitoring Date : 10.08.2024-20.08.2024

Reporting Date : 07.09.2024

Ref: EQMS/Ambient Air Quality/ 202428091172

Description of Analysis :

Monitoring Code	Category of Area/Receptor	Parameters			WHO Standards
		Leq_{day}	L_{max}	L_{min}	
ANL-1	Commercial	54.6	69.4	45.7	70
ANL-2	Residential	47.2	58.1	41.5	55
ANL-3	Educational	44.8	65.8	40.4	55
ANL-4	Residential	46.3	67.4	40.1	55
ANL-5	Residential	44.1	62.7	40.0	55
ANL-6	Commercial	42.9	54.2	38.8	70
ANL-7	Commercial	52.6	71.2	45.9	70
ANL-8	Mixed	55.2	70.5	48.2	-
ANL-9	Commercial	51.7	68.4	44.8	70
ANL-10	Commercial	57.5	74.6	48.9	70

***Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999; As per IFC EHS noise level guidelines, Noise impacts should not exceed the levels presented in the above table.*

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Appendix A-3: Surface Water Quality Testing Result

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Web: www.analabs.co.ke

Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water- SW Q1		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water- SWQ 1		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-001		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141242	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***0.14***	
Boron~	AN-CM-PR-69	mg/L	***0.08***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.03***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.01***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.030***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***6.91***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***31.00***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***10.30***	Max 30

*These results only apply to the above sample number as submitted; the comments and action recommended in this report are Analabs opinion. This document may only be reproduced in full with written permission from Analabs Management.*Parameter not accredited. ~Subcontracted*

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Web: www.analabs.co.ke

Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water- SW Q1		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water- SWQ 1		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-001		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141242	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.15***	
Total Organic Carbon~	ISO 8245	ppm	***3.78***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***4***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***7***	Nil
Total N*	Kjeldhal	mg/L	***3.83***	-
Turbidity~	KS 02 -459	NTU	***24.90***	
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.34***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***3.65***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.12***	
Ammonium~	KS 05- 459	mg/L	***0.06***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water- SW Q1		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water- SWQ 1		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-001		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141242	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	
Colour*	KS 05-459	CU	***11.80***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Available Oxygen, (as H2O2)~	KS 2502:2013	w/v	***3.08***	2.8 Min
Total Dissolved Solids*	Potentiometric	mg/L	***77.00***	Max 2000
Chlorides~	Titrimetric	mg/L	***14.76***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water- SWQ 2		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 2		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-002		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141243	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***0.18***	
Boron~	AN-CM-PR-69	mg/L	***0.43***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.06***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***<0.01***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***<0.01***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***6.78***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***34.10***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***11.30***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water- SWQ 2		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 2		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-002		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141244	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.15***	
Total Organic Carbon~	ISO 8245	ppm	***1.08***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***14***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***5***	Nil
Total N*	Kjeldhal	mg/L	***3.11***	-
Turbidity~	KS 02 -459	NTU	***33.30***	
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.78***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***2.09***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.13***	
Ammonium~	KS 05- 459	mg/L	***0.89***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water- SWQ 2		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 2		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-002		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141244	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	
Colour*	KS 05-459	CU	***10.40***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Available Oxygen, (as H2O2)~	KS 2502:2013	w/v	***2.98***	2.8 Min
Total Dissolved Solids*	Potentiometric	mg/L	***76.90***	Max 2000
Chlorides~	Titrimetric	mg/L	***7.38***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

ANALABS LTD Version: 04 Effective Date: 21 .05.2023 Document No: AN – GEN – FM -026

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 3		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 3		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-003		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141246	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***0.17***	
Boron~	AN-CM-PR-69	mg/L	***0.89***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.04***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.01***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.160***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***6.80***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***32.60***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***13.70***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 3		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 3		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-003		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141246	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.15***	
Total Organic Carbon~	ISO 8245	ppm	***3.98***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***3***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***<1***	Nil
Total N*	Kjeldhal	mg/L	***4.45***	-
Turbidity~	KS 02 -459	NTU	***6.90***	
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.32***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***4.12***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.24***	
Ammonium~	KS 05- 459	mg/L	***0.09***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 3		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 3		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-003		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141246	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	
Colour*	KS 05-459	CU	***9.54***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Available Oxygen, (as H2O2)~	KS 2502:2013	w/v	***4.11***	2.8 Min
Total Dissolved Solids*	Potentiometric	mg/L	***77.10***	Max 2000
Chlorides~	Titrimetric	mg/L	***7.38***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 4		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 4		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-004		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141247	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***2.98***	
Boron~	AN-CM-PR-69	mg/L	***0.91***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.03***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***<0.01***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.220***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***7.04***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***29.60***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***10.10***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 4		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 4		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-004		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141247	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.14***	
Total Organic Carbon~	ISO 8245	ppm	***4.66***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***20***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***11***	Nil
Total N*	Kjeldhal	mg/L	***3.09***	-
Turbidity~	KS 02 -459	NTU	***2.98***	
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.49***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***2.97***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.12***	
Ammonium~	KS 05- 459	mg/L	***<0.001***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 4		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 4		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-004		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141247	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	
Colour*	KS 05-459	CU	***10.40***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Available Oxygen, (as H2O2)~	KS 2502:2013	w/v	***2.09***	2.8 Min
Total Dissolved Solids*	Potentiometric	mg/L	***72.40***	Max 2000
Chlorides~	Titrimetric	mg/L	***14.76***	Max 250

Comments: Specifications as per NEMA 3rd and 4th Schedule.

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 5		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 5		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-005		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141250	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***3.15***	
Boron~	AN-CM-PR-69	mg/L	***1.32***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.04***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***<0.01***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.520***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***7.17***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***37.10***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***13.60***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 5		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 5		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-005		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141250	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.14***	
Total Organic Carbon~	ISO 8245	ppm	***4.12***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***2***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***161***	Nil
Total N*	Kjeldhal	mg/L	***3.94***	-
Turbidity~	KS 02 -459	NTU	***7.01***	
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.33***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***3.08***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.08***	
Ammonium~	KS 05- 459	mg/L	***0.78***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Surface water-SWQ 5		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Surface water-SWQ 5		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-005		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141250	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	
Colour*	KS 05-459	CU	***11.90***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Available Oxygen, (as H2O2)~	KS 2502:2013	w/v	***3.93***	2.8 Min
Total Dissolved Solids*	Potentiometric	mg/L	***72.00***	Max 2000
Chlorides~	Titrimetric	mg/L	***7.38***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Appendix A-4: Groundwater Quality Testing Result

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ1		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ1		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-006		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141252	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***<0.01***	
Boron~	AN-CM-PR-69	mg/L	***1.30***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.03***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.05***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.880***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***6.94***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***34.90***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***11.10***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ1		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ1		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-006		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141252	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.67***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***<1***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***11***	Nil
Total N*	Kjeldhal	mg/L	***2.58***	-
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.62***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***2.13***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.45***	
Ammonium~	KS 05- 459	mg/L	***<0.001***	
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ1		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ1		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-006		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141252	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Colour*	KS 05-459	CU	***12.40***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Total Dissolved Solids*	Potentiometric	mg/L	***334.00***	Max 2000
Chlorides~	Titrimetric	mg/L	***51.67***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Web: www.analabs.co.ke

Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ 2		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 2		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-007		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141253	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***<0.01***	
Boron~	AN-CM-PR-69	mg/L	***1.38***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.04***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.12***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.820***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***6.89***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***36.10***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***12.60***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ 2		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 2		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-007		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141253	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.25***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***<1***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***1***	Nil
Total N*	Kjeldhal	mg/L	***2.18***	-
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.74***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***1.99***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.19***	
Ammonium~	KS 05- 459	mg/L	***<0.001***	
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ 2		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 2		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-007		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141253	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Colour*	KS 05-459	CU	***8.67***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Total Dissolved Solids*	Potentiometric	mg/L	***126.00***	Max 2000
Chlorides~	Titrimetric	mg/L	***14.76***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ3		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 3		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-008		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141253	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***<0.01***	
Boron~	AN-CM-PR-69	mg/L	***1.34***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.04***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.15***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.850***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***7.00***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***39.10***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***13.60***	Max 30

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Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ3		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 3		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-008		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141253	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.27***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***<1***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***<1***	Nil
Total N*	Kjeldhal	mg/L	***3.14***	-
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.33***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***2.67***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.07***	
Ammonium~	KS 05- 459	mg/L	***0.67***	
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	

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Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ3		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 3		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-008		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141253	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Colour*	KS 05-459	CU	***7.54***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Total Dissolved Solids*	Potentiometric	mg/L	***135.00***	Max 2000
Chlorides~	Titrimetric	mg/L	***14.76***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ4		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 4		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-009		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141254	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***<0.01***	
Boron~	AN-CM-PR-69	mg/L	***1.42***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.03***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.08***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***0.510***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***6.99***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***29.50***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***10.10***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ4		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 4		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-009		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141254	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.16***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***1***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***11***	Nil
Total N*	Kjeldhal	mg/L	***3.40***	-
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.41***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***3.08***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.32***	
Ammonium~	KS 05- 459	mg/L	***<0.001***	
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ4		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ 4		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-009		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141254	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Colour*	KS 05-459	CU	***8.44***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Total Dissolved Solids*	Potentiometric	mg/L	***80.80***	Max 2000
Chlorides~	Titrimetric	mg/L	***14.76***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ5		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ5		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-010		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141256	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Aluminium~	AN-CM-PR-69	mg/L	***0.22***	
Boron~	AN-CM-PR-69	mg/L	***1.81***	Max 1.0
Cadmium~	AN-CM-PR-69	mg/L	***<0.01***	Max 0.5
Chromium~	AN-CM-PR-69	mg/L	***0.03***	Max 2.0
Copper~	AN-CM-PR-69	mg/L	***0.01***	Max 1.0
Nickel~	AN-CM-PR-69	mg/L	***1.090***	Max 3.0
Phosphorus~	AN-CM-PR-69	mg/L	***<0.01***	2 Max
Sulphide~	Calculation	mg/L	***<0.001***	2.0
pH*	ISO 10523	pH Units	***7.49***	6.5-8.5
Total Suspended Solids*	ISO 11923	mg/L	***<0.01***	Max 30
Chemical Oxygen Demand~	ISO 15705	mg/L	***33.50***	Max 50
Biological Oxygen Demand~	ISO 5815-1	mg/L	***11.60***	Max 30

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Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ5		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ5		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-010		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141256	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Oil & Grease*	ISO 6492	mg/L	***<0.01***	Nil
Electrical Conductivity*	ISO 7888	MS cm-1	***0.16***	
Faecal Coliform	ISO 9308-2	MPN/100ml	***2***	-
Escherichia coli	ISO 9308-2	MPN/100ml	***35***	Nil
Total N*	Kjeldhal	mg/L	***2.03***	-
Lead~	KS 05 - 459	mg/L	***<0.001***	
Fluorides~	KS 05- 459	mg/L	***0.31***	Max 1.5
Nitrate N (NO3-N)*	KS 05- 459	mg/L	***1.98***	20 Max
Nitrite (NO-2-N)*	KS 05- 459	mg/L	***0.05***	
Ammonium~	KS 05- 459	mg/L	***<0.001***	
Sulphur~	KS 05- 459	mg/L	***<0.001***	
Arsenic~	KS 05-459	mg/L	***<0.001***	

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Email: info@analabs.co.ke
Web: www.analabs.co.ke

Certificate of Analysis

Facility/Client Name:	Bonface Onyinkwa	**Sample Name:**	Ground water-GWQ5		
P.O. Box:		**Batch No:**	N/A	**Batch Size:**	N/A
Town:		**Mfg. Date:**	N/A	**Exp. Date:**	N/A
Phone:	0716623184	**SKU:**	N/A		
Email:	onyinkwabonface@gmail.com	**Client's Ref No:**	Ground water-GWQ5		
Contact Person:	Bonface Onyinkwa	**Lab Sample ID:**	2402054-010		
Phone:	0716623184	**Date of Sampling:**	22/08/2024	**Time:**	N/A
Email:	onyinkwabonface@gmail.com	**Submitting Officer:**	Bonface Onyikwa		
		Received by:	Linet Mitume	**Time:**	1558hrs
Report Number:	2409141256	**Date of Receipt:**	22/08/24	**Temperature:**	Room Temp.

Date of Analysis: 29/08/24 **Date of Results:** 11/09/24

Test	Method	Units	Results	Specification
Colour*	KS 05-459	CU	***10.10***	
Mercury~	KS 05-459	mg/L	***<0.001***	
Total Dissolved Solids*	Potentiometric	mg/L	***79.80***	Max 2000
Chlorides~	Titrimetric	mg/L	***14.76***	Max 250
Comments: Specifications as per NEMA 3rd and 4th Schedule.				

TECHNICAL REVIEW NAME Lillian Ngendo **AUTHORIZED BY** Marlvin Onyain

SIGN: **SIGN:**

These results only apply to the above sample number as submitted; the comments and action recommended in this report are Analabs opinion. This document may only be reproduced in full with written permission from Analabs Management."Parameter not accredited. ~Subcontracted

Appendix A-5: Soil Quality Testing Result

Soil Analysis

Aluminium in soil ,Barium Analysis,Heavy Metals in Soil (Aqua regia),Soil Texture Analysis

TL/21

CROPNUTS Laboratory Services ISO/IEC17025 Accredited

Report Ref#: CN-284005

Customer:	Bonface Onyunkwa Morang'a	**Crop:**	No crop	**Date Received:**	22-Aug-24
Address:	onyunkwabonface@gmail.com	**Crop Stage:**		**Analysis Start:**	23-Aug-24
Farm Name:	Bonface Onyunkwa	**Comments:**		**Report Date:**	3-Sep-24
Contact Person:	Bonface Onyunkwa	**Condition:**	Moist	**Sample ID:**	CB400SA0001

Field: SQ1 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: SQ1

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current				Method
Arsenic	mg/kg	< 0.20		< 20.0				As	< 0.20				Aqua regia - ICP
Cadmium	mg/kg	< 0.20		< 30.0				Cd	< 0.20				Aqua regia - ICP
Chromium	mg/kg	28.1		< 200				Cr	28.1				Aqua regia - ICP
Cobalt	mg/kg	7.24		< 30.0				Co	7.24				Aqua regia - ICP
Molybdenum	mg/kg	0.49		< 1.00				Mo	0.49				Aqua regia - ICP
Nickel	mg/kg	13.9		< 75.0				Ni	13.9				Aqua regia - ICP
Lead	mg/kg	6.92		< 450				Pb	6.92				Aqua regia - ICP
Aluminium	mg/kg	22100	0.00	1200				Al	22100				Aqua regia - ICP
*Barium	mg/kg	137						Ba	137				Aqua regia - ICP
*Sand	%	70.7						%Sand	70.7				Hydrometer
*Silt	%	9.28						%Silt	9.28				Hydrometer
*Clay	%	20.0						%Clay	20.0				Hydrometer

Jo Gakobo
Lab Manager

Cordingley Jeremy
Managing Director

Approval Date: 03/09/2024

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Soil Analysis

Aluminium in soil ,Barium Analysis,Heavy Metals in Soil (Aqua regia),Soil Texture Analysis

TL/21

CROPNUTS Laboratory Services ISO/IEC17025 Accredited

Report Ref#: CN-284005

Customer:	Bonface Onyunkwa Morang'a	**Crop:**	No crop	**Date Received:**	22-Aug-24
Address:	onyunkwabonface@gmail.com	**Crop Stage:**		**Analysis Start:**	23-Aug-24
Farm Name:	Bonface Onyunkwa	**Comments:**		**Report Date:**	3-Sep-24
Contact Person:	Bonface Onyunkwa	**Condition:**	Moist	**Sample ID:**	CB400SA0002

Field: SQ2 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: SQ2

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current				Method
Arsenic	mg/kg	< 0.20		< 20.0				As	< 0.20				Aqua regia - ICP
Cadmium	mg/kg	< 0.20		< 30.0				Cd	< 0.20				Aqua regia - ICP
Chromium	mg/kg	30.2		< 200				Cr	30.2				Aqua regia - ICP
Cobalt	mg/kg	7.87		< 30.0				Co	7.87				Aqua regia - ICP
Molybdenum	mg/kg	0.32		< 1.00				Mo	0.32				Aqua regia - ICP
Nickel	mg/kg	16.8		< 75.0				Ni	16.8				Aqua regia - ICP
Lead	mg/kg	9.20		< 450				Pb	9.20				Aqua regia - ICP
Aluminium	mg/kg	20900	0.00	1200				Al	20900				Aqua regia - ICP
*Barium	mg/kg	178						Ba	178				Aqua regia - ICP
*Sand	%	68.7						%Sand	68.7				Hydrometer
*Silt	%	7.28						%Silt	7.28				Hydrometer
*Clay	%	24.0						%Clay	24.0				Hydrometer

Jo Gakobo
Lab Manager

Cordingley Jeremy
Managing Director

Approval Date: 03/09/2024

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Soil Analysis

Aluminium in soil ,Barium Analysis,Heavy Metals in Soil (Aqua regia),Soil Texture Analysis

TL/21

CROPNUTS Laboratory Services ISO/IEC17025 Accredited

Report Ref#: CN-284005

Customer:	Bonface Onyinkwa Morang'a	**Crop:**	No crop	**Date Received:**	22-Aug-24
Address:	onyinkwabonface@gmail.com	**Crop Stage:**		**Analysis Start:**	23-Aug-24
Farm Name:	Bonface Onyinkwa	**Comments:**		**Report Date:**	3-Sep-24
Contact Person:	Bonface Onyinkwa	**Condition:**	Moist	**Sample ID:**	CB400SA0003

Field: SQ3 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: SQ3

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current	Method
Arsenic	mg/kg	< 0.20		< 20.0				As	< 0.20	Aqua regia - ICP
Cadmium	mg/kg	< 0.20		< 30.0				Cd	< 0.20	Aqua regia - ICP
Chromium	mg/kg	16.1		< 200				Cr	16.1	Aqua regia - ICP
Cobalt	mg/kg	3.19		< 30.0				Co	3.19	Aqua regia - ICP
Molybdenum	mg/kg	0.28		< 1.00				Mo	0.28	Aqua regia - ICP
Nickel	mg/kg	6.88		< 75.0				Ni	6.88	Aqua regia - ICP
Lead	mg/kg	7.69		< 450				Pb	7.69	Aqua regia - ICP
Aluminium	mg/kg	9970	0.00	1200				Al	9970	Aqua regia - ICP
*Barium	mg/kg	118						Ba	118	Aqua regia - ICP
*Sand	%	80.7						%Sand	80.7	Hydrometer
*Silt	%	11.3						%Silt	11.3	Hydrometer
*Clay	%	8.00						%Clay	8.00	Hydrometer

Jo Gakobo
Lab Manager

Cordingley Jeremy
Managing Director

Approval Date: 03/09/2024

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Soil Analysis

Aluminium in soil ,Barium Analysis,Heavy Metals in Soil (Aqua regia),Soil Texture Analysis

TL/21

CROPNUTS Laboratory Services ISO/IEC17025 Accredited

Report Ref#: CN-284005

Customer:	Bonface Onyinkwa Morang'a	**Crop:**	No crop	**Date Received:**	22-Aug-24
Address:	onyinkwabonface@gmail.com	**Crop Stage:**		**Analysis Start:**	23-Aug-24
Farm Name:	Bonface Onyinkwa	**Comments:**		**Report Date:**	3-Sep-24
Contact Person:	Bonface Onyinkwa	**Condition:**	Moist	**Sample ID:**	CB400SA0004

Field: SQ4 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: SQ4

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current	Method
Arsenic	mg/kg	< 0.20		< 20.0				As	< 0.20	Aqua regia - ICP
Cadmium	mg/kg	< 0.20		< 30.0				Cd	< 0.20	Aqua regia - ICP
Chromium	mg/kg	34.7		< 200				Cr	34.7	Aqua regia - ICP
Cobalt	mg/kg	6.92		< 30.0				Co	6.92	Aqua regia - ICP
Molybdenum	mg/kg	0.44		< 1.00				Mo	0.44	Aqua regia - ICP
Nickel	mg/kg	12.4		< 75.0				Ni	12.4	Aqua regia - ICP
Lead	mg/kg	11.5		< 450				Pb	11.5	Aqua regia - ICP
Aluminium	mg/kg	17900	0.00	1200				Al	17900	Aqua regia - ICP
*Barium	mg/kg	97.6						Ba	97.6	Aqua regia - ICP
*Sand	%	76.7						%Sand	76.7	Hydrometer
*Silt	%	7.28						%Silt	7.28	Hydrometer
*Clay	%	16.0						%Clay	16.0	Hydrometer

Jo Gakobo
Lab Manager

Cordingley Jeremy
Managing Director

Approval Date: 03/09/2024

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Soil Analysis

Aluminium in soil ,Barium Analysis,Heavy Metals in Soil (Aqua regia),Soil Texture Analysis

TL/21

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Report Ref#: CN-284005

Customer:	Bonface Onyinkwa Morang'a	**Crop:**	No crop	**Date Received:**	22-Aug-24
Address:	onyinkwabonface@gmail.com	**Crop Stage:**		**Analysis Start:**	23-Aug-24
Farm Name:	Bonface Onyinkwa	**Comments:**		**Report Date:**	3-Sep-24
Contact Person:	Bonface Onyinkwa	**Condition:**	Moist	**Sample ID:**	CB400SA0002

Field: SQ2 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: SQ2

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current				Method
Arsenic	mg/kg	< 0.20		< 20.0				As	< 0.20				Aqua regia - ICP
Cadmium	mg/kg	< 0.20		< 30.0				Cd	< 0.20				Aqua regia - ICP
Chromium	mg/kg	30.2		< 200				Cr	30.2				Aqua regia - ICP
Cobalt	mg/kg	7.87		< 30.0				Co	7.87				Aqua regia - ICP
Molybdenum	mg/kg	0.32		< 1.00				Mo	0.32				Aqua regia - ICP
Nickel	mg/kg	16.8		< 75.0				Ni	16.8				Aqua regia - ICP
Lead	mg/kg	9.20		< 450				Pb	9.20				Aqua regia - ICP
Aluminium	mg/kg	20900	0.00	1200				Al	20900				Aqua regia - ICP
*Barium	mg/kg	178						Ba	178				Aqua regia - ICP
*Sand	%	68.7						%Sand	68.7				Hydrometer
*Silt	%	7.28						%Silt	7.28				Hydrometer
*Clay	%	24.0						%Clay	24.0				Hydrometer

Jo Gakobo — *Lab Manager*

Cordingley Jeremy — *Managing Director*

Approval Date: 03/09/2024

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Soil Analysis

Aluminium in soil ,Barium Analysis,Heavy Metals in Soil (Aqua regia),Soil Texture Analysis

TL/21

CROPNUTS Laboratory Services ISO/IEC17025 Accredited

Report Ref#: CN-284005

Customer:	Bonface Onyinkwa Morang'a	**Crop:**	No crop	**Date Received:**	22-Aug-24
Address:	onyinkwabonface@gmail.com	**Crop Stage:**		**Analysis Start:**	23-Aug-24
Farm Name:	Bonface Onyinkwa	**Comments:**		**Report Date:**	3-Sep-24
Contact Person:	Bonface Onyinkwa	**Condition:**	Moist	**Sample ID:**	CB400SA0005

Field: SQ5 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: SQ5

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current				Method
Arsenic	mg/kg	< 0.20		< 20.0				As	< 0.20				Aqua regia - ICP
Cadmium	mg/kg	< 0.20		< 30.0				Cd	< 0.20				Aqua regia - ICP
Chromium	mg/kg	33.5		< 200				Cr	33.5				Aqua regia - ICP
Cobalt	mg/kg	6.77		< 30.0				Co	6.77				Aqua regia - ICP
Molybdenum	mg/kg	0.63		< 1.00				Mo	0.63				Aqua regia - ICP
Nickel	mg/kg	7.22		< 75.0				Ni	7.22				Aqua regia - ICP
Lead	mg/kg	11.5		< 450				Pb	11.5				Aqua regia - ICP
Aluminium	mg/kg	6850	0.00	1200				Al	6850				Aqua regia - ICP
*Barium	mg/kg	113						Ba	113				Aqua regia - ICP
*Sand	%	90.7						%Sand	90.7				Hydrometer
*Silt	%	5.28						%Silt	5.28				Hydrometer
*Clay	%	4.00						%Clay	4.00				Hydrometer

Jo Gakobo — *Lab Manager*

Cordingley Jeremy — *Managing Director*

Approval Date: 03/09/2024

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Date Issued:03/09/2024

SGS Kenya Limited Laboratory Services
SGS Kenya Ltd.
SGS House
Ali Punjani Street
P.O. Box 90264
80100 Mombasa
Kenya

BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.001

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-1

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TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/kg
Acenaphthylene		<0.10	mg/kg
Anthracene		<0.10	mg/kg
Benzo(a)anthracene		<0.10	mg/kg
Benzo(a)pyrene		<0.10	mg/kg
Benzo(b)fluoranthene		<0.10	mg/kg
Benzo(g,h,i)perylene		<0.10	mg/kg
Benzo(k)fluoranthene		<0.10	mg/kg
Chrysene		<0.10	mg/kg
Dibenz(a,h)anthracene		<0.10	mg/kg
Fluoranthene		<0.10	mg/kg
Fluorene		<0.10	mg/kg
Indeno(1,2,3-cd)pyrene		<0.10	mg/kg
Naphthalene		<0.10	mg/kg
Phenanthrene		<0.10	mg/kg
Pyrene		<0.10	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

03092024 0744 0000165325

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e: lab.kenya@sgs.com

Member of the SGS Group (Société Générale de Surveillance)

Date Issued:03/09/2024

SGS Kenya Limited Laboratory Services
SGS Kenya Ltd.
SGS House
Ali Punjani Street
P.O. Box 90264
80100 Mombasa
Kenya

BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.001

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-1

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TESTS	METHOD	RESULT	UNITS
Mercury as Hg	COLD VAPOUR	Not detected	mg/kg
Tin as Sn	EPA 3050B	1.04	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

03092024 0744 0000165325

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e: lab.kenya@sgs.com

Member of the SGS Group (Société Générale de Surveillance)

Date Issued:03/09/2024

SGS Kenya Limited Laboratory Services
SGS Kenya Ltd.
SGS House
Ali Punjani Street
P.O. Box 90264
80100 Mombasa
Kenya

BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.002

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-5

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TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/kg
Acenaphthylene		<0.10	mg/kg
Anthracene		<0.10	mg/kg
Benzo(a)anthracene		<0.10	mg/kg
Benzo(a)pyrene		<0.10	mg/kg
Benzo(b)fluoranthene		<0.10	mg/kg
Benzo(g,h,i)perylene		<0.10	mg/kg
Benzo(k)fluoranthene		<0.10	mg/kg
Chrysene		<0.10	mg/kg
Dibenz(a,h)anthracene		<0.10	mg/kg
Fluoranthene		<0.10	mg/kg
Fluorene		<0.10	mg/kg
Indeno(1,2,3-cd)pyrene		<0.10	mg/kg
Naphthalene		<0.10	mg/kg
Phenanthrene		<0.10	mg/kg
Pyrene		<0.10	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

03092024 0744 0000165325

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BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.002

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-5

The sample(s) to which the findings recorded herein (the "Findings") relate was[were] drawn and [or] provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is[are] said to be extracted.

TESTS	METHOD	RESULT	UNITS
Mercury as Hg	COLD VAPOUR	Not detected	mg/kg
Tin as Sn	EPA 3050B	5.39	mg/kg

SGS Kenya Limited

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

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Kenya

BONFACE ONYINKWA MORANG'A
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KISII
KENYA

Analysis Report MA24-05096.003

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-3

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TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/kg
Acenaphthylene		<0.10	mg/kg
Anthracene		<0.10	mg/kg
Benzo(a)anthracene		<0.10	mg/kg
Benzo(a)pyrene		<0.10	mg/kg
Benzo(b)fluoranthene		<0.10	mg/kg
Benzo(g,h,i)perylene		<0.10	mg/kg
Benzo(k)fluoranthene		<0.10	mg/kg
Chrysene		<0.10	mg/kg
Dibenz(a,h)anthracene		<0.10	mg/kg
Fluoranthene		<0.10	mg/kg
Fluorene		<0.10	mg/kg
Indeno(1,2,3-cd)pyrene		<0.10	mg/kg
Naphthalene		<0.10	mg/kg
Phenanthrene		<0.10	mg/kg
Pyrene		<0.10	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

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80100 Mombasa
Kenya

BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.003

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-3

The sample(s) to which the findings recorded herein (the "Findings") relate was[were] drawn and [or] provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is[are] said to be extracted.

TESTS	METHOD	RESULT	UNITS
Mercury as Hg	COLD VAPOUR	Not detected	mg/kg
Tin as Sn	EPA 3050B	2.85	mg/kg

SGS Kenya Limited

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

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Kenya

BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.004

PRODUCT DESCRIPTION:	SOIL
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	28/08/2024
ANALYSIS STARTED:	29/08/2024
ANALYSIS COMPLETED:	03/09/2024
SGS ORDERNO:	500001490
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK PRODUCT: SOIL CODE: SQ-2

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TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/kg
Acenaphthylene		<0.10	mg/kg
Anthracene		<0.10	mg/kg
Benzo(a)anthracene		<0.10	mg/kg
Benzo(a)pyrene		<0.10	mg/kg
Benzo(b)fluoranthene		<0.10	mg/kg
Benzo(g,h,i)perylene		<0.10	mg/kg
Benzo(k)fluoranthene		<0.10	mg/kg
Chrysene		<0.10	mg/kg
Dibenz(a,h)anthracene		<0.10	mg/kg
Fluoranthene		<0.10	mg/kg
Fluorene		<0.10	mg/kg
Indeno(1,2,3-cd)pyrene		<0.10	mg/kg
Naphthalene		<0.10	mg/kg
Phenanthrene		<0.10	mg/kg
Pyrene		<0.10	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

03092024 0744 0000165325

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BONFACE ONYINKWA MORANG'A
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KENYA

Analysis Report MA24-05096.004

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-2

The sample(s) to which the findings recorded herein (the "Findings") relate was[were] drawn and [or] provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is[are] said to be extracted.

TESTS	METHOD	RESULT	UNITS
Mercury as Hg	COLD VAPOUR	Not detected	mg/kg
Tin as Sn	EPA 3050B	3.35	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

03092024 0744 0000165325

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Date Issued:03/09/2024

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BONFACE ONYINKWA MORANG'A
P. O BOX 1383
KISII
KENYA

Analysis Report MA24-05096.005

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-4

The sample(s) to which the findings recorded herein (the "Findings") relate was[were] drawn and [or] provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is[are] said to be extracted.

TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/kg
Acenaphthylene		<0.10	mg/kg
Anthracene		<0.10	mg/kg
Benzo(a)anthracene		<0.10	mg/kg
Benzo(a)pyrene		<0.10	mg/kg
Benzo(b)fluoranthene		<0.10	mg/kg
Benzo(g,h,i)perylene		<0.10	mg/kg
Benzo(k)fluoranthene		<0.10	mg/kg
Chrysene		<0.10	mg/kg
Dibenz(a,h)anthracene		<0.10	mg/kg
Fluoranthene		<0.10	mg/kg
Fluorene		<0.10	mg/kg
Indeno(1,2,3-cd)pyrene		<0.10	mg/kg
Naphthalene		<0.10	mg/kg
Phenanthrene		<0.10	mg/kg
Pyrene		<0.10	mg/kg

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

030920240744 0000165325

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KENYA

Analysis Report MA24-05096.005

PRODUCT DESCRIPTION: SOIL
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 28/08/2024
ANALYSIS STARTED: 29/08/2024
ANALYSIS COMPLETED: 03/09/2024
SGS ORDERNO: 500001490
MARKS: CONDITION OF SAMPLE: DELIVERED IN A POLYTHENE PACK
PRODUCT: SOIL
CODE: SQ-4

The sample(s) to which the findings recorded herein (the "Findings") relate was[were] drawn and [or] provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is[are] said to be extracted.

TESTS	METHOD	RESULT	UNITS
Mercury as Hg	COLD VAPOUR	Not detected	mg/kg
Tin as Sn	EPA 3050B	5.15	mg/kg

SGSL SGS Kenya Limited P.O. Box 90264 - 80100, Mombasa Tel: +254(0)722202145/733611105

End of Analytical Results

Authorised Signatory — Anselm Riungu, Technical Manager
Chemist — Caroline Chege
Chemist — Erick Terer

030920240744 0000165325

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APPENDIX B

Appendix B: CHECKLIST AND PHOTOGRAPHS OF FLORA AND FAUNA SPECIES

Appendix B-1: Checklist of Aquatic Floral Species

SL#	English Name	Scientific Name	Family Name	Global IUCN Status
1.	Wild Sugarcane	*Saccharum spontaneum*	Poaceae	LC
2.	Papyrus	*Cyperus papyrus*	Cyperaceae	LC
3.	Reed Mace	*Typha latifolia*	Typhaceae	LC
4.	Common water Hyacinth	*Eichhornia crassipes*	Pontederiaceae	NE
5.	Canadian waterweed	*Elodea canadensis*	Hydrocharitaceae	LC
6.	Hornwort	*Ceratophyllum submersum*	Ceratophyllaceae	LC
7.	Spiny water nymph	*Najas marina*	Hydrocharitaceae	LC
8.	Water lily	*Nymphaea lotus*	Nymphaeaceae	LC
9.	Duckweed	*Lemna minor*	Araceae	LC
10.	Water Lettuce	*Pistia stratiotes*	Araceae	LC
11.	Giant salvinia	Salvinia molesta	Salviniaceae	NE
12.	Chinese water-spinach	*Ipomoea aquatica*	Convolvulaceae	LC
13.	Five-leaf cassia	*Chamaecrista mimosoides*	Fabaceae	LC
14.	Reed grass	*Phragmites mauritianus*	Poaceae	LC
15.	Arrowhead	*Limnophyton obtusifolium*	Alismataceae	LC
16.	Pink morning glory	*Ipomoea carnea*	Convolvulaceae	NE

Note: LC = Least Concern, NE = Not Evaluated

Source: EQMS Field Survey, August 2024

Appendix B-2: Photographs of Notable Floral Species



Five-leaf cassia (*Chamaecrista mimosoides*)



Chinese water-spinach (*Ipomoea aquatica*)



Egyptian lotus (*Nymphaea lotus*)



Common water Hyacinth (*Eichhornia crassipes*)



Soft hornwort (*Ceratophyllum submersum*)



Papyrus Sedge (*Cyperus papyrus*)

Source: EQMS Field Survey, August 2024

Appendix B-3: Checklist of Fish Species

SL#	English Name	Scientific Name	Family	IUCN Global Status
1.	African arowana	*Heterotis niloticus*	Osteoglossidae	LC
2.	African carp	*Labeo cylindricus*	Cyprinidae	LC
3.	African catfish	*Heterobranchus bidorsalis*	Clariidae	LC
4.	African sharptooth catfish	*Clarias gariepinus*	Clariidae	LC
5.	Bagrus catfish	*Bagrus docmac*	Bagridae	LC
6.	Blue tilapia	*Oreochromis aureus*	Cichlidae	LC
7.	Eastern bottlenose	*Mormyrus caschive*	Mormyridae	LC
8.	Freshwater rat-tail	*Gymnarchus niloticus*	Gymnarchidae	LC
9.	Giraffe catfish	*Auchenoglanis occidentalis*	Claroteidae	LC
10.	Lake Turkana sardine	*Chelaethiops bibie*	Cyprinidae	LC
11.	Nile carp	*Labeo niloticus*	Cyprinidae	LC
12.	Nile minnow	*Leptocypris niloticus*	Cyprinidae	LC
13.	Nile perch	*Lates niloticus*	Latidae	LC
14.	Nile tigerfish	*Hydrocynus brevis*	Alestidae	LC
15.	Nile tilapia	*Oreochromis niloticus*	Cichlidae	LC
16.	Ray-finned fish	*Enteromius pumilus*	Cyprinidae	LC
17.	Silversides	*Alestes baremoze*	Alestidae	LC

Note: LC = Least Concern

Source: EQMS Field Survey, August 2024

Appendix B-4: Checklist of Terrestrial Floral Species

SL#	English Name	Scientific Name	Family	Global IUCN Status
1.	Abogo tree	*Isoberlinia doka*	Fabaceae	LC
2.	African Moringa	*Moringa stenopetala*	Moringaceae	DD

SL#	English Name	Scientific Name	Family	Global IUCN Status
3.	African nightshades	*Solanum sp.*	Solanaceae	LC
4.	Babul tree	*Vachellia nilotica*	Fabaceae	LC
5.	Banana	*Musa sp.*	Musaceae	LC
6.	Benghal dayflower	*Commelina benghalensis*	Commelinaceae	LC
7.	Bermuda Grass	Cynodon dactylon	Poaceae	LC
8.	Borassus palm	*Borassus aethiopum*	Arecaceae	LC
9.	Buffalo thorn	*Ziziphus sp.*	Rhamnaceae	LC
10.	Castor Bean	*Ricinus communis*	Euphorbiaceae	LC
11.	Cluster Fig	*Ficus sycomorus*	Moraceae	LC
12.	Desert date	*Balanites aegyptiaca*	Zygophyllaceae	LC
13.	East African doum palm	*Hyphaene compressa*	Arecaceae	LC
14.	East Indian mallow	*Corchorus aestuans*	Malvaceae	LC
15.	Elephant Grass	*Pennisetum purpureum*	Poaceae	LC
16.	Giant Milkweed	*Calotropis procera*	Apocynaceae	LC
17.	Indian thornapple	*Datura metel*	Solanaceae	NE
18.	Israeli babool	*Acacia tortilis*	Fabaceae	NE
19.	Jackal berry	*Diospyros mespiliformis*	Ebenaceae	LC
20.	Jatropha	Jatropha curcas	Euphorbiaceae	LC
21.	Karira	*Capparis decidua*	Capparaceae	LC
22.	Kokilasha	*Hygrophila auriculata*	Acanthaceae	LC
23.	Mango	*Mangifera indica*	Anacardiaceae	DD
24.	Neem	*Azadirachta indica*	Meliaceae	LC
25.	Palmyra palm	*Borassus flabellifer*	Arecaceae	LC
26.	Papaya	*Carica papaya*	Caricaceae	DD
27.	Physalis angulata	*Cutleaf groundcherry*	Solanaceae	LC
28.	Sausage tree	*Kigelia Africana*	Bignoniaceae	LC
29.	Senegal mahogany	*Khaya senegalensis*	Meliaceae	VU
30.	Senna tora	*Foetid cassia*	Fabaceae	LC
31.	Sesbania	Sesbania sesban	Fabaceae	LC
32.	Shea butter nut tree	*Butyrospermum Paradoxum*	Sapotaceae	NE
33.	Shepherd's tree	*Boscia senegalensis*	Capparaceae	LC
34.	Speargrass	*Imperata cylindrica*	Poaceae	LC
35.	Yellow oleander	*Cascabela thevetia*	Apocynaceae	LC

Note: LC = Least Concern, NE = Not Evaluated, DD = Data Deficient

Source: EQMS Field Survey, August 2024

Appendix B-5: Photographs of Terrestrial Floral Species

		
Babul tree (*Vachellia nilotica*), Fabaceae	Cluster Fig (*Ficus racemosa*), Moraceae, LC	Mango (*Mangifera indica*), Anacardiaceae
		
East African doum palm (*Hyphaene compressa*)	Sausage tree (*Kigelia Africana*), Bignoniaceae	Palmyra palm (*Borassus flabellifer*), Arecaceae

Source: EQMS Field Survey, August 2024

Appendix B-6: Checklist of Avifauna

SL#	English Name	Scientific Name	Family	IUCN Global Status
1.	Abyssinian Roller	*Coracias abyssinicus*	Coraciidae	LC
2.	African Cuckoo	*Cuculus gularis*	Cuculidae	LC
3.	African Fish-Eagle	*Haliaeetus vocifer*	Accipitridae	LC
4.	African jacana	*Actophilornis africanus*	Jacanidae	LC
5.	African Openbill	*Anastomus lamelligerus*	Ciconiidae	LC
6.	African Pygmy-kingfisher	*Ispidina picta*	Alcedinidae	LC
7.	African sacred ibis	*Threskiornis aethiopicus*	Threskiornithidae	LC
8.	African Woollyneck	*Ciconia microscelis*	Ciconiidae	LC
9.	Black crake	*Amaurornis flavirostris*	Rallidae	LC
10.	Black-crowned Tchagra	*Tchagra senegalus*	Malaconotidae	LC
11.	Black-headed Gonolek	*Laniarius erythrogaster*	Malaconotidae	LC
12.	Black-headed Heron	*Ardea melanocephala*	Ardeidae	LC
13.	Bleating Camaroptera	*Camaroptera brachyura*	Cisticolidae	LC
14.	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC
15.	Common Bulbul	*Pycnonotus barbatus*	Pycnonotidae	LC

SL#	English Name	Scientific Name	Family	IUCN Global Status
16.	Common Waxbill	*Estrilda astrild*	Estrildidae	LC
17.	Ethiopian Swallow	*Hirundo aethiopica*	Hirundinidae	LC
18.	Fan-tailed Widowbird	*Euplectes axillaris*	Ploceidae	LC
19.	Goliath Heron	*Ardea goliath*	Ardeidae	LC
20.	Gray-backed Fiscal	*Lanius excubitoroides*	Laniidae	LC
21.	Great White Egret	*Ardea alba*	Ardeidae	LC
22.	Greater Blue-eared Starling	*Lamprotornis chalybaeus*	Sturnidae	LC
23.	Grey-headed Kingfisher	*Halcyon leucocephala*	Alcedinidae	LC
24.	Hamerkop	*Scopus umbretta*	Scopidae	LC
25.	Hooded vulture	*Necrosyrtes monachus*	Accipitridae	CR
26.	Little Bee-eater	*Merops pusillus*	Meropidae	LC
27.	Long-toed lapwing	*Vanellus crassirostris*	Charadriidae	LC
28.	Malachite Kingfisher	*Corythornis cristatus*	Alcedinidae	LC
29.	Mourning Collared-Dove	*Streptopelia decipiens*	Columbidae	LC
30.	Northern Grey-headed Sparrow	*Passer griseus*	Passeridae	LC
31.	Northern Masked-Weaver	*Ploceus taeniopterus*	Ploceidae	LC
32.	Northern red bishop	*Euplectes franciscanus*	Ploceidae	LC
33.	Piapiac	*Ptilostomus afer*	Corvidae	LC
34.	Pied Crow	*Corvus albus*	Corvidae	LC
35.	Pin-tailed Whydah	*Vidua macroura*	Viduidae	LC
36.	Purple Heron	*Ardea purpurea*	Ardeidae	LC
37.	Purple Heron	*Ardea purpurea*	Ardeidae	LC
38.	Red-billed Firefinch	*Lagonosticta senegala*	Estrildidae	LC
39.	Red-cheeked cordon-bleu	*Uraeginthus bengalus*	Estrildidae	LC
40.	Red-chested Sunbird	*Cinnyris erythrocercus*	Nectariniidae	LC
41.	Red-necked Buzzard	*Buteo auguralis*	Accipitridae	LC
42.	Reed cormorant	*Microcarbo africanus*	Phalacrocoracidae	LC
43.	Rüppell's starling	*Lamprotornis purpuroptera*	Sturnidae	LC
44.	Senegal Coucal	*Centropus senegalensis*	Cuculidae	LC
45.	Senegal Thick-knee	*Burhinus senegalensis*	Burhinidae	LC
46.	Shikra	*Accipiter badius*	Accipitridae	LC
47.	Speckled Mousebird	*Colius striatus*	Coliidae	LC
48.	Spur-winged lapwing	*Vanellus spinosus*	Charadriidae	LC

SL#	English Name	Scientific Name	Family	IUCN Global Status
49.	Squacco Heron	*Ardeola ralloides*	Ardeidae	LC
50.	Tawny-flanked Prinia	*Prinia subflava*	Cisticolidae	LC
51.	Village Weaver	*Ploceus cucullatus*	Ploceidae	LC
52.	White-browed robin-chat	*Cossypha heuglini*	Muscicapidae	LC
53.	White-faced Whistling-Duck	*Dendrocygna viduata*	Anatidae	LC
54.	Woodland Kingfisher	*Halcyon senegalensis*	Alcedinidae	LC

Note: LC = Least Concern, CR = Critically Endangered

Source: EQMS Field Survey, August 2024

Appendix B-7: Photograph of Avifauna Species



Hamerkop (*Scopus umbretta*)



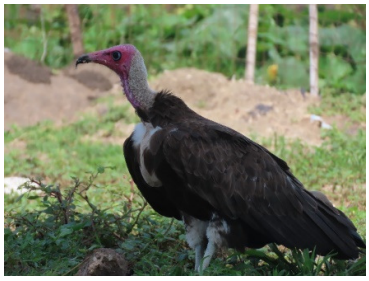
African Fish-Eagle (*Haliaeetus vocifer*)



African sacred ibis (*Threskiornis aethiopicus*)



Long-toed lapwing (*Vanellus crassirostris*)



Hooded vulture (*Necrosyrtes monachus*)



Spur-winged lapwing or spur-winged plover (*Vanellus spinosus*)



African jacana (*Actophilornis africanus*)



Black crake (*Amaurornis flavirostris*)



Northern red bishop (*Euplectes franciscanus*)



Greater Blue-eared Starling (*Lamprotornis chalybaeus*)



Woodland Kingfisher (*Halcyon senegalensis*)



Black-headed Heron (*Ardea melanocephala*)

Source: EQMS Field Survey, August 2024

Appendix B-8: Checklist of Herpetofauna

SL#	English Name	Scientific Name	Family	IUCN Global Status
		Reptiles		
1.	African Five-lined Skink	*Trachylepis quinquetaeniata*	Scincidae	LC
2.	African Rock Python	*Python sebae*	Pythonidae	NT
3.	African striped skink	*Trachylepis striata*	Scincidae	LC
4.	Common agama	*Agama agama*	Agamidae	LC
5.	Finch's Agama	*Agama finchi*	Agamidae	LC
6.	Flathead Leaf-toed Gecko	*Hemidactylus platycephalus*	Gekkonidae	LC
7.	Leopard tortoise	*Stigmochelys pardalis*	Testudinidae	LC
8.	Nile crocodile	*Crocodylus niloticus*	Crocodylidae	LC
9.	Nile monitor	*Varanus niloticus*	Varanidae	LC
10.	Nile softshell turtle	*Trionyx triunguis*	Trionychidae	VU
11.	Savannah Monitor	*Varanus exanthematicus*	Varanidae	LC
12.	Speckle-lipped Mabuya	*Trachylepis maculilabris*	Scincidae	LC
13.	Spotted Bush Snake	*Philothamnus semivariegatus*	Colubridae	LC
14.	Teita Mabuya	*Trachylepis perrotetii*	Scincidae	LC
15.	Tropical house gecko	*Hemidactylus mabouia*	Gekkonidae	LC
16.	White Spotted Gecko	*Tarentola annularis*	Gekkonidae	LC
		Amphibians		
1.	African river frogs	*Phrynobatrachus perpalmatus*	Phrynobatrachidae	LC
2.	African Crowned Frog	*Hoplobatrachus occipitalis*	Dicroglossidae	LC
3.	Broad-banded grassland frog	*Ptychadena bibroni*	Ptychadenidae	LC

SL#	English Name	Scientific Name	Family	IUCN Global Status
4.	Common African toad	*Sclerophrys regularis*	Bufonidae	LC
5.	Keller's Bubble-nest Frog	*Chiromantis kelleri*	Rhacophoridae	LC
6.	Mwanza frog	*Xenopus victorianus*	Pipidae	LC
7.	Nile Ridged Frog	*Ptychadena nilotica*	Ptychadenidae	LC

Note: LC = Least Concern, NT= Near Threatened, VU= Vulnerable

Source: EQMS Field Survey, August 2024

Appendix B-9: Photograph of Herpetofauna Species



Nile Ridged Frog (*Ptychadena nilotica*)



Finch's Agama (*Agama finchi*)



African Five-lined Skink (*Trachylepis quinquetaeniata*)



Speckle-lipped Mabuya (*Trachylepis maculilabris*)

Source: EQMS Field Survey, August 2024

Appendix B-10: Checklist of Mammals

SL#	English Name	Scientific Name	Family	IUCN Global Status
1.	African buffalo	*Syncerus caffer*	Bovidae	NT
2.	African bush elephant	*Loxodonta africana*	Elephantidae	EN
3.	Cheetah	*Acinonyx jubatus*	Felidae	VU
4.	Common patas monkey	*Erythrocebus patas*	Phrynobatrachidae	LC
5.	Common hippopotamus	*Hippopotamus amphibius*	Hippopotamidae	LC
6.	Four-toed hedgehog	*Atelerix albiventris*	Erinaceidae	LC

SL#	English Name	Scientific Name	Family	IUCN Global Status
7.	Giraffe	*Giraffa camelopardalis*	Giraffidae	VU
8.	Leopard	*Panthera pardus*	Felidae	VU
9.	Lion	*Panthera leo*	Felidae	VU
10.	Marsh mongoose	*Atilax paludinosus*	Herpestidae	LC
11.	Mongalla gazelle	*Eudorcas albonotata*	Bovidae	LC
12.	Nile lechwe	*Kobus megaceros*	Bovidae	EN
13.	Sitatunga	*Tragelaphus spekii*	Bovidae	LC
14.	Spotted hyena	*Crocuta crocuta*	Hyaenidae	LC
15.	Waterbuck	Kobus ellipsiprymnus	Bovidae	LC
16.	White-tailed mongoose	*Ichneumia albicauda*	Herpestidae	LC

Note: LC = Least Concern, NT= Near Threatened, EN = Endangered, VU= Vulnerable

Source: EQMS Field Survey, August 2024

APPENDIX C

Appendix C: ATTENDANCE SHEET AND PHOTOGRAPHS OF THE CONSULTATION

Appendix C-1: Attendance Sheet of the Public Consultation Meeting

REPUBLIC OF SOUTH SUDAN
MINISTRY OF TRANSPORT

SOUTH SUDAN TRANSPORT SECTOR DEVELOPMENT PROJECT (SSTSDP)
Activity/Meeting Attendance Sheet Public Consultation

Event Name: Meeting with EQMS Consultants, other Stakeholders and Ministry of Transport
Location...Dark...Palace...Hotel Date: 13/08/2024

	NAME OF PARTICIPANT IN FULL	Gender Female (F) Male (M)	ORGANIZATION/ INSTITUTION/ GROUP (spell out in full)	POSITION/ JOB TITLE	EMAIL ADDRESS	PHONE NUMBER	SIGNATURE
1	James Ngonpa	M	Juba Ladar	S/M		092699995	
2	Gatwech Gatluar	M	D/Adm & Fin. Road	Director	gatwechgatluar@gmail.com	0917795186	
3	Duath Nyuon Chan	M	D/Coordination Mydcandy			0928832260	
4	Chot Deng Both	M	Coordination office		chotdeng2017@gmail.com	0911029239	
5	Nuer Diang Yuot	M	ministry of Road	D/G	ndiangyuot@gmail.com	0922235408	
6	Mayian Biel Deng	M	Ministry of HLEPU	DG	biel.mayian@gmail.com	0984444029	
7	Nyak	M	D/DIRECTOR			0922066262	
8	Duel Gatner	M	Assistant Director			0917777331	
9	Luci Alcil	M	MG Kuach P Joint Force	Joint Force	Luciimoralg@gm	0925243411	
10	M.Gen Moses Machok	M	Acting Police commissio			09211515 15	
11	Hon Ibrahim Yuek	M	minister of finance	—	—	—	—
12	Gabriel Mabil	M	Bor CHD Director	CHD Director	gabrielmab1@gmail.com	0985194042	
13	Peter Ajik Ayom	M	Jonglei Civil Society Network	Deputy secretary	peterajikayom@gmail.com	0924506161	
14	Parang Philip	M	PIU/MOT	National Environmental Specialist	parangkom@gmail.com	0924687757	
15	Nancy paul	F	MOT	Inspector Risk management	nancybaato3@gmail.com	0920000365	
16	Rose Lino	F	MOT	IT officer	linorose13@gmail.com	0921114940	

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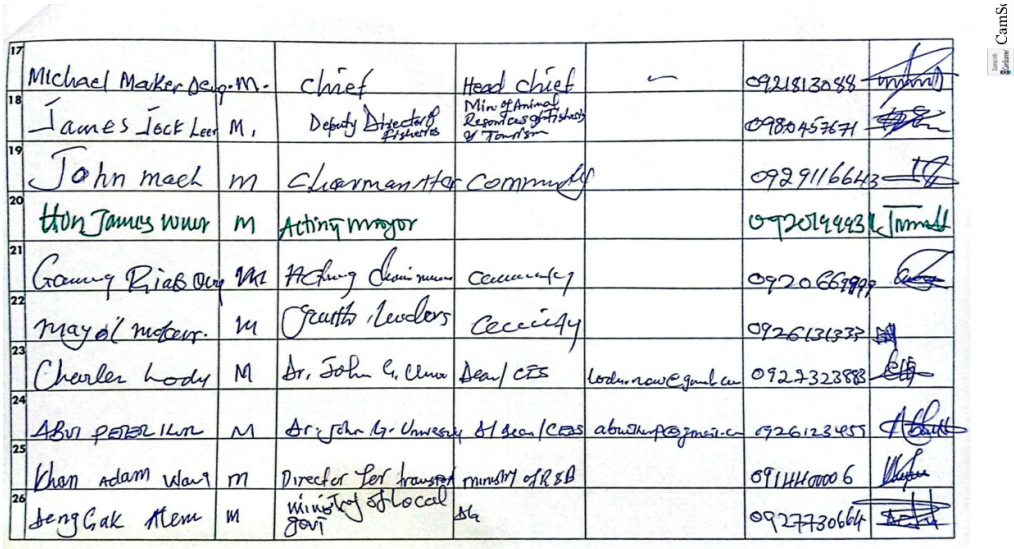
REPUBLIC OF SOUTH SUDAN
MINISTRY OF TRANSPORT

SOUTH SUDAN TRANSPORT SECTOR DEVELOPMENT PROJECT (SSTSDP)

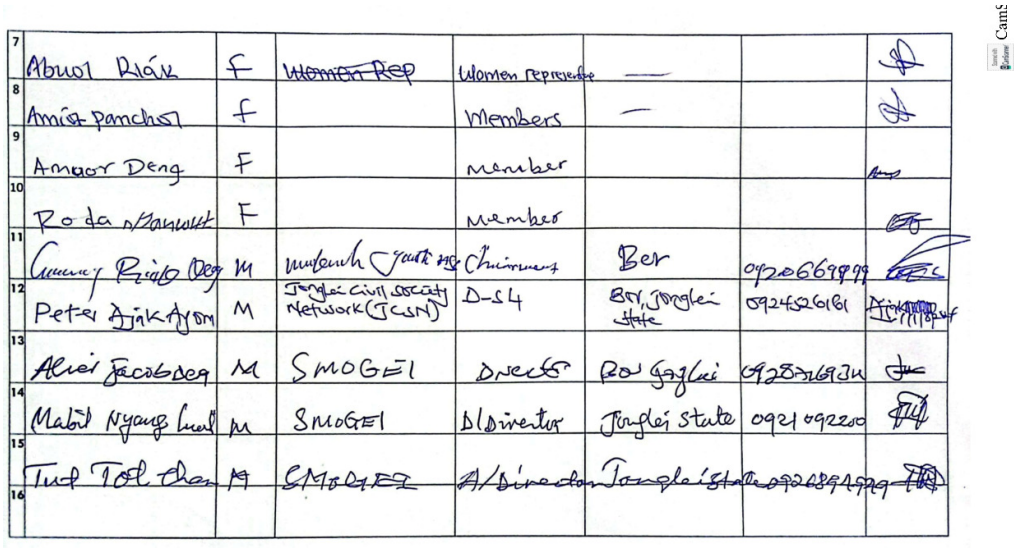
Activity/Meeting Attendance Sheet – Public Consultation

Event Name: Meeting with EQMS Consultants, other Stakeholders and Ministry of Transport
Location: Park Palace Hotel **Date:** 13/08/2024

	NAME OF PARTICIPANT IN FULL	Gender Female (F) Male (M)	ORGANIZATION/ INSTITUTION/ GROUP (spell out in full)	POSITION/ JOB TITLE	EMAIL ADDRESS	PHONE NUMBER	SIGNATURE
1	Deng Reath Thor	M	(MOAEF)	Director	Dengreathth@	0981320726	
2	Hon-Deng Nhial	M	MP	MP		0924846311	
3	Hon. Maker Chol	M	MP	MP	/	0925590330	
4	Hon: Luel Thon Nyok	M	MP	MP		0924680680	
5	HON. JESUS PANTHOR Deng	M	MP	MP	pandeng2005-gmail.com	092276MM95	
6	Tut Tot Chan	M	SMOLGET	A/Director tuttotchan@gmail		0928894949	
7	James Gai	M	Bor county	Commissioner	Belgale	0925711846	
8	Mabior Athieu	M	Bor county	Executive Director	"	0922777715	
9	Hon John Mabil	M	Js Partiament	Member	Jmabil2@gmail.com	0924489992	
10	Maker Panchol	M	Health chief warden	Porters Nyok Agan	-	0922700079	
11	Daniel Thon M	M	State min of finance	D/procurement	Hon.mabior@gmail.com	0922180722	
12	manyok panchol	M	chief	member		0921802238	
13	Ajak Angau	M	chief	member		0929975897	
14	James Kuoi	M	community Leader	me		0926669289	
15	KHOL ALIER DENG	M	Ministry of Animal Resources, Fisheries & Tourism	Director		0924415581	
16	Hon. Malith Mangwok	M	JSLA	MP		0925342628	



17	Michael Maker Deng	M.	chief	Head chief	—	0921813088	
18	James Jock Leer	M,	Deputy Director of Fisheries	Min of Animal Resources & Fisheries & Tourism		0980457671	
19	John mach	m	Chairman Hor	community		0929116643	
20	Hon James wuur	m	Acting mayor			0920194433	
21	Garang Riak Deng	M	Acting chairman	community		0920669999	
22	mayol mabior	M	Youth leaders	Ceccicity		0926131333	
23	Charles Lody	M	Dr. John G. Univ	Dean/CES	lodumnow@gmail.com	0927323888	
24	Abul peter Ilur	M	Dr; John G. University	Al Dean/CEAS	abulilur@gmail.com	0926123455	
25	Khan adam Wan	m	Director for transport	ministry of R&B		091HH0006	
26	Deng Gak Mem	M	ministry of local govi	Ast		0927730664	



7	Abuol Riak	f	~~Women Rep~~	Women representative	—		
8	Amira panchol	f		Members	—		
9	Amaor Deng	F		Member			
10	Roda Manuel	F		Member			
11	Garang Riak Deng	M	Murbench Youth Mg	Chairman	Bor	0920669999	
12	Peter Ajik Ayom	M	Jonglei civil society Network (JCSN)	D-S4	Bor, Jonglei state	0924526181	
13	Alrei Jacob Deng	M	SMOGEI	Director	Bor Jonglei	0928769310	
14	Mabil Nyang Lual	M	SMOGEI	D/Director	Jonglei State	0921092200	
15	Tut Tol Chan	M	~~SMOGEI~~	~~A/Director~~	~~Jonglei State~~	~~0924894999~~	
16							

Attendance Sheet

Public Consultation Meeting

FGD

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL# Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
1- Wilma Jeremiah.	F			
2- Joyce Poni'	F			
3- Ronia Saliba	F			
4- Sunday charles	F			
5- Emmanuella Al haj	F			
6- charity Lobe.	F			
7- Racheal kyney	F			

Attendance Sheet

Public Consultation Meeting

FGD.

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL# Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
8- Jacklin Paul	F			
9- Margret Peter	F			
10- Siama Ziedan	F			
11- Mary Gesma	F			
12- Estherina Jeremiah	F			
13- Omjima stanely	F			
14- Cici Alex	F			

Attendance Sheet

Public Consultation Meeting

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
15	Tabo Simon.	F			
16	Mary Emmanuella	F			
17	Selwa Escandel	F			
18	Alex Modi.	M			
19	AL-fonz Soka	M			
20	Mary Kadimaka	F			
21	Kokoya Ixlani	F			
22	Diana Ezbon	F			
23	Keji Daniel	F			
24	Cini Joseph.	M			

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Attendance Sheet

Public Consultation Meeting

FGD

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
29.	Jacklin Paul	Male		0922181079	
30.	Omjona Stanly	female		0924621757	
31.	Cicilia ALex	female			
32.	Tabo Simon	Male		09217640 98	
33.	Rania Salima	female			
34.	[illegible]	female		0981148806	
35.	MARY EMMANUEL	female		0933809486	

Attendance Sheet

Public Consultation Meeting

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
1.	Peter Kuol	M	Deputy Chairman Boat Union	0922018883	19/8/2024
2.	MAJIER MABOR	M	S/G Boat Union	0922267773	19/8/2024
3.	David Machak	M	Head of Admin Boat union	0915555768	DMRK
4.	Thayice Gach-wots	M	Dept S/G Boat Union	0922433775	
5.	AJak Beny	M	Sec/finance Boat Union	0926261109 60	
6.	SAMUEL CHAN M.C	M	JRPA	097w47GEE1	
7.	Dominic matin	M	BodBod	048112407 6	

Attendance Sheet

Public Consultation Meeting

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
8.	Atam Lues	m	Lukel Sec	0927050111	
9.	ALEX MODI	M	WKEL SA.	0926447186	
10.	Michael Gatkuoth	M	Lakes Sec	0923777961	
11.	Mursid yasib	M	fish seller	09 22 90 8899	
12.	JAMES SALBino	M	Boada boada	0925497798	
13.	Emmel Lolingo	M	boada boada	0928882199	
14.	Samuel Taban	M	boada boada	0926165859	

Attendance Sheet

Public Consultation Meeting

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Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
15.	Tom APOLLO	M	boada boada	0925460228	
16.	Deng Atem	M	charging centre	0927649922	
17.	John J	M	D F	0925628440	
18.	Ayor Changiok	F	D F	0923369800	
19.	Ayen Garang	F	D F	0928074606	
20.	HerJok Ayuen	M	D F	0926066083	
21.	Athok nyang	F	D F	092735[illegible]59	

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Attendance Sheet

Public Consultation Meeting

EQMS

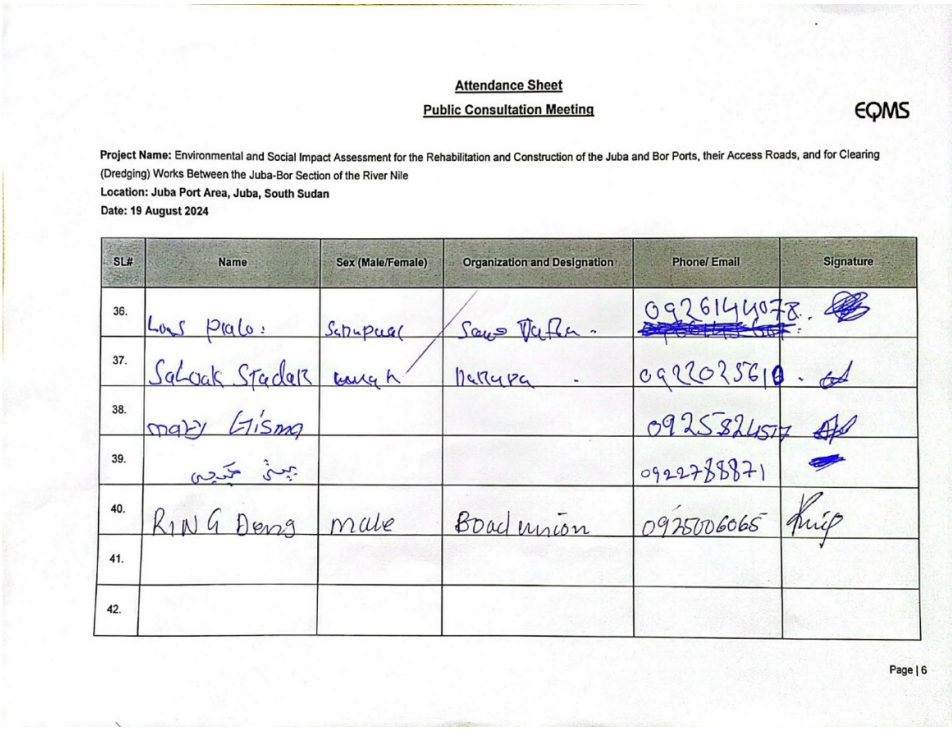
Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
22.	James bol		Lokolako	0921224990	
23.	AJak makur			0922031485	
24.	Emmanuella Al-haj	F	Resturant.	0925514609	
25.	Rachael konya	F		0929351675	
26.	Sunday charles	F		0980151134	
27.	Sabeg & PEEN			0927555104	2024/8/20
28.	mary Kadmello			0922671094	

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Attendance Sheet

Public Consultation Meeting

EQMS

Project Name: Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile

Location: Juba Port Area, Juba, South Sudan

Date: 19 August 2024

SL#	Name	Sex (Male/Female)	Organization and Designation	Phone/ Email	Signature
36.	Lous Pialo:	Southsud	Save Water.	0926164078.	
37.	Salaak Stader	Male	Nature.	0922025610.	
38.	Mary Gism			0925824577	
39.				0922788871	
40.	RING Deng	Male	Boad union	0925006065	
41.					
42.					

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Appendix C-2: Photographs of the Public Consultation Meeting



Glimpse of Public Consultation Meeting at Bor



Glimpse of Public Consultation Meeting at Bor



Question and answer session of the PCM



Question and Answer session of the PCM



Glimpse of Public Consultation Meeting at Juba



Question and Answer session of the PCM at Juba

Appendix C-3: Photographs of Focus Group Discussions and Key Informant Interviews



Discussion with the Deputy Governor of Jonglei State



Discussion with Minister of Roads and Bridges, Jonglei



Discussions with county-level stakeholders at Bor



Consultation with Bor Local Government



Consultation with Bor Boat Union



Consultation with Porters



Consultation with the Directorate of Education



Consultation with passenger



Consultation with Boat owner



Consultation with female group



Consultation with vendors and dry fish sellers



Consultation with Tea Seller



Discussion with PIU of MOT



Consultation with Contractor at Juba



Consultation with Jube University



Consultation with the local community



Consultation with the local community



Consultation with youth group



Consultation with local government



Consultation with the Boat Owner Association



Consultation with Bor Commissioner and Executive Director



Consultation with boda-boda riders



Consultation with the Ministry of Animal Resources and Fisheries



Consultation with the Ministry of Agriculture and Forestry at Jonglei State



Consultation with Civil Society Organization (Peace Canal)



Consultation with drivers



Consultation with John Garang Memorial University



Consultation with porters



Consultation with the Ministry of Wildlife Conversation and Tourism



Consultation with the Directorate of Wetlands and Biodiversity, MOEF



Consultation with youth group



Consultation with fishermen in Sudd Wetland



Consultation with the community in Sudd



Consultation with the Ministry of Roads and Bridges



Consultation with the community in Sudd Wetland



Consultation with Sudd Institute



Consultation with the Ministry of Wildlife Conversation and Tourism



Consultation with Bandinglo National Park Authority



Consultation with loading and unloading workers



Consultation with the local community



Consultation with Bandinglo National Park Authority



Consultation with Female Group



Consultation with the Boat Owner Association



Consultation with Payam Leaders



Consultation with Fisherman Association



FGD with Female Group

APPENDIX G

Appendix D: ENVIRONMENTAL MANAGEMENT PLANS

Appendix D-1: Occupational Health and Safety Plan

1.1 Introduction

This Occupational Health and Safety Plan (OHSP) outlines potential occupational health and safety risks associated with the construction and operational phases of the proposed port, access road, and river clearing and dredging project in South Sudan. The OHSP aims to:

- Evaluation and identification of hazards.
- Elimination and removal of hazards.
- Control of hazards that cannot be eliminated.
- Recovery from accidents.

1.2 Purpose and Scope

This plan provides guidance with respect to occupational risks (for both the construction and operation phases) and aims to achieve the following:

- Identification of hazards, associated risks and control measures for each activity.
- Defining responsibilities to ensure effective implementation of health and safety risk control measures.
- Avoid and/or minimize the impacts on workers and local communities' health due to various project activities.
- Provide and maintain safe working procedures and operations for workers.
- Reduce human injury and damage to property and the environment in case of an emergency.

1.3 Definitions

Competent Person: any person has the knowledge, training and experience specific to the work or task being performed.

Confined Space: means a compartment of small size and limited access which by its small size and confined nature can readily create or aggravate a hazardous exposure.

Emergency: an unforeseen occurrence, a sudden and urgent occasion for action

First Aider: a person who has received training and who holds a current first aid certificate from an organization or employer whose training and qualifications for first aiders are approved by the authority.

Hazard: a source, situation or act with a potential for harm in terms of:

- Ill health
- Damage to property, port, ships, etc.
- Production losses or increased liabilities

Hazardous Substance: means a substance which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritant, or otherwise harmful is likely to cause injury.

Health and Safety Plan: a documented plan that addresses hazards identified and includes safe work procedures to mitigate, reduce, or control the hazards identified.

Hot Work: means riveting, welding, burning, or other fire or spark-producing operations.

Incident: an event or occurrence occurring at work or arising out of or in connection with the activities of people at work, or in connection with the use of port or machinery.

Risk: the probability of injury or damage occurring.

Safe: free from any hazard.

1.4 Roles and Responsibilities

Site Supervisor (EPC Contractor)

The following tasks will fall within his/her responsibilities:

- Overall implementation of OHS plan and measures.
- Monitoring site activities weekly for compliance.
- Supervising work within the project boundary.
- Conducting internal audits against the Environmental and Social Management Plan (ESMP).
- Confined construction activities to designated areas.
- Ensuring EHS compliance at all times.
- Conducting regular HS&E audits and advising management on necessary actions.
- Maintaining first aid facilities and personal protective equipment (PPE).
- Investigating all accidents and reporting findings.
- Training workers and promoting safe work practices.
- Conducting Job Safety Analysis (JSA) to identify operational hazards and solutions.

Contractor's Project Manager

- Main Responsible staff for OHS management.
- Will be supported by the contractor's OHS officer.

Supervising Engineer

- Responsible for day-to-day monitoring of OHS plan implementation
- Will be supported by the resident engineer.

Regulatory bodies (Local Labor Offices)

- Monitor the project from time to time.

1.5 Risk Assessment, Mitigations, and Management Plan

A comprehensive risk assessment has been carried out to identify potential Occupational Health and Safety risks to the workers. The details of the risks and mitigation measures are given in the following Table-1.

Table-1: Potential Risks and Mitigation Measures

Risks	Description of Risks	Mitigation Measures
Construction Period OHS Risks		
Excavation risks including falling in and collapse of excavation and trapping workers in excavations	• The potential for workers to fall into deep excavations, which could lead to serious injury or fatality. • The collapse of excavation walls or trenches can trap workers, causing crushing injuries or suffocation.	• Implement proper shoring, sloping, or trench box systems to prevent excavation collapses. • Provide fall protection, including guardrails or safety nets, around excavation sites. • Regularly inspect excavation sites for stability and potential hazards. • Train workers on safe excavation practices and emergency response procedures. • Ensure the use of personal protective equipment (PPE), such as helmets, harnesses, and safety boots, during excavation activities.
Risk of work-at-height	• Work-at-height during the construction phase of the project presents significant occupational health and safety risks, including falls from elevated surfaces, scaffolding, or structures. These falls can result in serious injuries or fatalities, particularly when proper fall protection measures are not in place. • Workers may also be exposed to risks from unstable ladders, scaffolds, or improperly secured materials.	• Install guardrails, safety nets, and personal fall arrest systems on all elevated work surfaces. • Ensure proper scaffolding, ladders, and platforms are secure and regularly inspected. • Provide workers with fall protection equipment, such as harnesses and lanyards, and ensure proper usage. • Train workers on safe work-at-height practices, including the use of PPE and emergency procedures. • Implement a strict monitoring system to enforce safety standards and promptly address any hazards.
Hit or trapped by falling, moving, or rotating machines/equipment/objects	• This hazard can lead to severe injuries or fatalities, especially when machinery is not properly secured or when workers are not aware of their surroundings. • The operation of heavy machinery, such as cranes, excavators, or loaders, can cause objects to fall or swing	• Implement strict safety protocols for the operation of machinery, ensuring proper training and certification for operators. • Use barriers, safety zones, and warning signs to keep workers clear of moving or rotating equipment. • Secure tools, equipment, and materials to prevent them from falling or being dislodged during work. • Conduct regular inspections and maintenance of machinery to ensure proper functioning and prevent malfunctions.

Risks	Description of Risks	Mitigation Measures
	unexpectedly, posing additional dangers.	• Equip workers with personal protective equipment (PPE), such as hard hats and high-visibility clothing, to reduce injury risk.
Risk during heavy weightlifting operations	• Heavy weightlifting operations during construction pose substantial risks, including musculoskeletal injuries, strains, and accidents caused by overloading or improper lifting techniques. • Workers face the possibility of back, shoulder, and joint injuries, especially if they lift heavy loads manually without appropriate posture or assistance. • Additionally, lifting operations involving cranes or hoists can lead to dropped loads or mechanical failures, endangering those nearby.	• Provide training on proper lifting techniques and ergonomic practices to prevent injuries. • Use mechanical aids, such as cranes, hoists, or forklifts, to handle heavy loads whenever possible. • Limit manual lifting weight to safe thresholds and encourage team lifting for heavier items. • Regularly inspect lifting equipment for functionality and safety compliance. • Ensure workers wear supportive personal protective equipment (PPE) to reduce strain and injury risks.
Risk of hot work, electrocution, and fire	• Hot work, such as welding or cutting, can generate sparks and high temperatures that may ignite flammable materials, increasing fire risk. • Workers also face electrocution hazards from exposure to live wires, faulty equipment, or improper grounding, which can cause severe burns, cardiac arrest, or fatalities.	• Conduct hot work only in designated, controlled areas away from flammable materials, and have fire extinguishers readily available. • Require the use of appropriate personal protective equipment (PPE), such as fire-resistant clothing, gloves, and face shields, during hot work. • De-energize electrical circuits before work and use lockout/tagout procedures to prevent accidental re-energization. • Regularly inspect electrical equipment and ensure proper grounding and insulation. • Train workers on fire and electrical safety procedures, including emergency response and evacuation protocols.
Risk of drowning while dredging and performing other water-based activities	• Drowning is a serious risk during dredging and other water-based activities, especially when workers are exposed to deep water, strong currents, or unstable footing.	• Equip all workers with personal flotation devices (PFDs) when working near or over water. • Provide training on water safety, emergency rescue, and self-rescue techniques.

Risks	Description of Risks	Mitigation Measures
	• The risk is heightened if workers are not equipped with proper flotation devices or lack awareness of water safety protocols. • Additionally, sudden equipment malfunctions or accidental slips can lead to unexpected immersion in water, increasing the danger of drowning.	• Ensure that rescue equipment, such as lifebuoys and ropes, is readily available and accessible on-site. • Implement continuous supervision and monitoring during all water-based activities. • Conduct regular inspections of boats, barges, and dredging equipment to ensure stability and safe operation.
Exposure to air emission, noise, and vibration	• Air emissions from equipment, including dust, exhaust gases, and particulates, can lead to respiratory issues, eye irritation, and long-term health effects if inhaled regularly. • High noise levels from machinery and equipment may cause hearing loss or stress, while prolonged exposure to vibration can result in musculoskeletal disorders and reduced hand-arm function.	• Use dust suppression methods, such as water spraying, to minimize airborne particles at the worksite. • Equip workers with respiratory protection, earplugs, and earmuffs to reduce exposure to emissions and noise. • Regularly maintain machinery to ensure efficient operation and minimize excessive emissions, noise, and vibration. • Limit exposure time to noisy or vibrating equipment and implement job rotation where feasible. • Monitor air quality, noise, and vibration levels on-site to ensure they remain within safe limits, adjusting work practices as necessary.
Exposure to hazardous materials and waste	• Workers may come into contact with toxic chemicals, fuels, or contaminated soil and water, leading to respiratory issues, skin irritation, and long-term health effects. • Improper handling or disposal of hazardous waste can also contaminate surrounding ecosystems.	• Provide workers with appropriate personal protective equipment (PPE), such as gloves, masks, and protective suits, when handling hazardous materials. • Implement strict storage, labeling, and disposal protocols for hazardous materials and waste, following regulatory guidelines. • Train workers on safe handling procedures, spill response, and the potential health risks associated with hazardous substances. • Ensure proper ventilation in areas where hazardous materials are used to reduce inhalation risks. • Conduct regular inspections and audits of hazardous material storage and disposal practices to prevent leaks, spills, or contamination.

Risks	Description of Risks	Mitigation Measures
Poor Housekeeping	• Poor housekeeping on construction sites can lead to significant safety hazards, including tripping, slipping, or falling accidents. • Cluttered work areas, improperly stored materials, and debris can obstruct walkways or create fire risks, while the accumulation of waste may attract pests or cause environmental contamination.	• Implement regular site cleaning schedules to ensure work areas remain free of debris and clutter. • Establish designated storage areas for materials and tools to prevent obstruction of walkways and workspaces. • Ensure proper disposal of waste and hazardous materials in compliance with environmental regulations. • Provide workers with appropriate training on maintaining cleanliness and proper waste management. • Conduct routine site inspections to identify and address potential housekeeping issues before they become safety hazards.
Biological risks (venomous animals, insects, predators)	• These risks include bites or stings from snakes, or insects like mosquitoes, which can lead to allergic reactions, infections, or the transmission of diseases. • Workers may also be exposed to larger predators in certain regions.	• Provide workers with protective clothing, such as gloves, boots, and long sleeves, to reduce the risk of bites or stings. • Implement regular site inspections and pest control measures to identify and remove venomous animals or insects. • Educate workers on identifying dangerous wildlife and appropriate response procedures in case of an encounter. • Use insect repellent and deploy mosquito nets or screens in areas prone to insect-borne diseases. • Establish emergency protocols, including first aid training and access to medical treatment, for bites or stings from venomous creatures.
Operation Period OHS Risk		
Risk from use of heavy equipment and machinery to handle cargo	• Workers may be exposed to crushing injuries, falls from heights, or being struck by moving machinery or falling cargo. • The risk is also heightened if safety protocols are not followed, or equipment is not regularly maintained.	• Conduct regular maintenance and inspections of all heavy equipment to ensure it is in proper working condition. • Implement clear traffic management and safety protocols to prevent collisions between machinery, workers, and cargo. • Provide operators and workers with thorough training on safe handling and operating procedures for heavy equipment. • Use spotters or signal persons to direct the movement of machinery and ensure proper load positioning.

Risks	Description of Risks	Mitigation Measures
		• Equip workers with appropriate personal protective equipment (PPE), including helmets, high-visibility clothing, and safety boots.
Risk of work-at-height, particularly during operation of cranes and other weightlifting machines	• Workers may be exposed to the dangers of falling from elevated platforms, scaffolding, or crane operators' cabins, especially if safety measures are inadequate. • Accidents can also occur from dropped loads or equipment malfunctions while working at heights.	• Ensure that all workers operating at heights are equipped with fall protection systems, such as harnesses, lanyards, and guardrails. • Regularly inspect cranes and weightlifting machines for maintenance issues to prevent malfunctions during operation. • Provide training in safe work-at-height practices, including the use of fall arrest systems and proper handling of loads. • Establish clear safety zones around cranes and other lifting equipment to protect workers from falling objects. • Ensure all crane operators and riggers are properly certified and follow strict safety protocols during lifting operations.
Risk during lifting of loads	• During the operation phase, the lifting of loads presents several risks, including the potential for dropped loads, equipment failure, or improper load distribution, which can cause injuries or fatalities. • Workers may also be exposed to crushing or pinning hazards if they are in the wrong position while the load is being moved. • Additionally, improper use of lifting equipment, such as cranes or hoists, or overloading can lead to accidents.	• Ensure all lifting equipment is regularly inspected, maintained, and certified to meet safety standards. • Use proper load securing techniques to prevent loads from shifting or falling during lifting operations. • Implement strict weight limits for lifting equipment and ensure operators are aware of these limits. • Establish clear communication protocols between crane operators, riggers, and workers on the ground to coordinate lifting activities safely. • Provide workers with proper training on lifting techniques, load distribution, and emergency procedures to handle lifting-related risks.
Confined space entry including entry in vessels, storage silos, and tanks	• The confined space environment may have inadequate ventilation, hazardous atmospheres, or the presence of flammable materials, increasing the potential for fires, explosions, or poisoning.	• Conduct a thorough risk assessment and atmospheric testing before entering confined spaces to ensure safe air quality. • Provide proper ventilation systems to ensure a continuous supply of fresh air and reduce the risk of toxic gas buildup. • Implement a permit-to-work system that includes clear authorization and monitoring for confined space entry.

Risks	Description of Risks	Mitigation Measures
	• Without proper precautions, workers may become trapped or disoriented.	• Equip workers with appropriate personal protective equipment (PPE), including respiratory protection, safety harnesses, and communication devices. • Ensure continuous supervision and establish emergency rescue procedures, with trained personnel ready to respond to any incidents.
Safety risk of vessels including fire, explosion, capsize, and drowning	• Fire and explosion risks may arise from fuel leaks, cargo instability, or electrical malfunctions. The threat of capsize exists due to unstable loading, rough water conditions, or poor vessel maintenance. • Drowning is a risk if workers fall overboard or in the event of a vessel sinking or capsizing.	• Ensure regular maintenance, inspection, and certification of vessels to prevent mechanical failures and ensure stability. • Install fire suppression systems, including extinguishers and alarms, and ensure proper handling and storage of flammable materials. • Implement proper loading and unloading procedures to maintain vessel stability and prevent capsizing. • Equip all workers with personal flotation devices (PFDs) and ensure their use when on or near the water. • Conduct regular safety drills, including fire, evacuation, and man-overboard scenarios, to ensure workers are prepared for emergencies. • Monitor weather and water conditions regularly to avoid operations in hazardous environments.
Fugitive dust, exhaust fumes, and noise emissions in ports, logistic areas, vessels, etc.	• Fugitive dust can cause respiratory problems for workers and nearby communities, while exhaust fumes from machinery and vessels contribute to air pollution and may lead to chronic health conditions. • High noise levels from equipment, machinery, and vessels can cause hearing loss, stress, and fatigue for workers.	• Implement dust suppression measures, such as water spraying or dust control agents, to minimize airborne particulate matter. • Use cleaner fuels or implement emission control technologies, such as exhaust filters or catalytic converters, to reduce exhaust fumes. • Provide workers with personal protective equipment (PPE), such as respirators and ear protection, to minimize exposure to harmful air pollutants and noise. • Install noise barriers, silencers, or mufflers on equipment and machinery to reduce noise levels in high-traffic or work areas. • Regularly maintain and service equipment to ensure efficient operation and lower emissions of dust, fumes, and noise. • Schedule noisy operations during off-peak hours to reduce the impact on surrounding communities and workers.

Risks	Description of Risks	Mitigation Measures
Exposure to chemicals (such as fossil fuel) used for operation of ports and vessels, and during hazardous goods handled	• Inhalation or skin contact with fuels, solvents, or other toxic chemicals can lead to respiratory problems, skin irritation, or long-term health conditions. • Spills or leaks may also pose environmental risks.	• Provide workers with appropriate personal protective equipment (PPE), such as gloves, masks, and protective suits, when handling chemicals or working near hazardous goods. • Implement proper storage, labeling, and containment procedures for hazardous chemicals and fuels to prevent spills or leaks. • Use chemical fume hoods, ventilation systems, or enclosed spaces to minimize inhalation risks. • Conduct regular training on safe handling, emergency response procedures, and spill containment for workers. • Ensure that all hazardous materials are properly stored in compliance with environmental regulations and safety standards. • Regularly inspect equipment and machinery to prevent fuel leaks and have spill containment kits readily available. • Monitor air quality and provide decontamination stations to manage exposure and remove hazardous materials from workers.
Traffic risk in ports and logistic areas, as well as road safety risk on last mile connections	• These risks include accidents involving trucks, cranes, or other vehicles, potentially causing injuries, fatalities, or cargo damage. • Congestion, poorly designed traffic flow, inadequate signage, and lack of proper safety barriers increase the likelihood of collisions and pedestrian accidents. • Additionally, road conditions and traffic management on last-mile routes can contribute to accidents.	• Implement clear traffic management plans, including designated routes for vehicles and separate pedestrian pathways to reduce the risk of collisions. • Install proper signage, warning systems, and traffic control measures to guide vehicle and pedestrian movement in ports and logistic areas. • Provide regular training for drivers and workers on road safety, safe driving practices, and emergency response procedures. • Ensure the maintenance of roads, access points, and last-mile connections to minimize accidents due to poor road conditions. • Use traffic barriers, speed bumps, and safety zones to control vehicle speeds and protect pedestrians in high-traffic areas. • Conduct regular safety audits and traffic flow assessments to identify and address potential hazards or bottlenecks. • Enforce strict regulations for vehicle maintenance to ensure that trucks and machinery are in good working condition to prevent accidents.

Risks	Description of Risks	Mitigation Measures
Ergonomic and manual handling risks.	• These risks arise from repetitive movements, improper lifting techniques, or handling heavy or awkward loads. • Workers may experience back, shoulder, or joint pain, as well as increased fatigue, especially if proper ergonomic practices and equipment are not in place.	• Implement mechanical aids, such as forklifts, cranes, or conveyors, to reduce the need for manual lifting and handling. • Design workstations and equipment to suit ergonomic principles, minimizing awkward postures and repetitive movements. • Provide training on safe manual handling techniques, including proper lifting, bending, and carrying practices. • Encourage job rotation to reduce the strain of repetitive tasks and allow workers to recover from physical exertion. • Ensure workers have access to supportive personal protective equipment (PPE), such as back supports, gloves, and anti-fatigue mats. • Regularly assess the workplace for ergonomic hazards and adjust tasks or equipment accordingly to improve worker comfort and reduce injury risk.

1.6 Training

The Site Supervisor should ensure that every employee/worker (direct or contractual) is aware of the EHS risks associated with the work being carried out at the site and is trained and competent in the relevant work practices and maintenance procedures.

Procedures to identify training need to be established and adequate safety training to be provided to all the employees/ workers on site. The safety training should provide staff with the knowledge and skills necessary for organizing and managing occupational safety and health programs; implement and apply occupational safety and health activities; and workers with the knowledge, skills and right attitudes to enable them to work safely.

HSE training proposed for the project to include:

- Induction training on HSE
- Toolbox training or pre-task briefings, highlighting hazards and the method of dealing with them
- Special job hazard training including entry into confined spaces and other hazardous environments
- Hot work
- Working at height
- Electrical safety
- Fire safety
- First aid
- Emergency response
- Use of PPEs

1.7 Documentation and Report Keeping

The Site Supervisor should maintain data and records concerning the identification of hazards, assessment, and control of risks of the ongoing activities. The document should establish and maintain procedures for controlling all relevant EHS documents and data. Such documents can include but not limited to:

- Hazard identification record
- Risk register
- Legal register
- Licenses, Certificates, Permits
- Control methods including process control and machine design, safe work procedures, in-housework rules
- Work permit system
- Training reports
- Drill Reports
- MoM of HSE meetings
- Inspection and audit records
- Medical and health surveillance records

1.8 Communication and Information Dissemination

Supervisor(s) should communicate and inform any person affected by the risks about:

- The nature of the risks involved.
- The control measures or safe work procedures to be taken to address the risks involved.

1.9 OHS Monitoring Plan

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Monitoring During Construction Phase							
Excavation	- Presence of protective barriers - Shoring/bracing inspections - Training records	Project Construction Site	Visual inspections, safety checklists, training logs	Daily/Weekly	Labor Act and OHS Policies, ISO 45000	Contractor's Project Manager	MOT
Risk of work-at-height	- Use of fall protection systems - Inspection of scaffolds/ladders - PPE compliance	Project Construction Site	Visual inspections, worker interviews, compliance audits	Daily	Labor Act and OHS Policies, ISO 45000	Contractor's Project Manager	MOT
Hit or trapped by machinery/equipment	- Guarding on machines - Emergency stop button functionality - Incident records	Project Construction Site	Equipment logs, visual inspections, worker feedback	Daily	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Heavy weightlifting operations	- Use of certified lifting equipment - Load limits adherence - Inspection logs	Project Construction Site	Equipment certification records, operator checklists	Weekly/Before Operations	Labor Act and OHS Policies, ISO 45000	Contractor's Project Manager	MOT
Hot work, electrocution, and fire risks	- Availability of extinguishers	Project Construction Site	Visual inspections, compliance audits	Weekly	Labor Act and OHS Policies, ISO 45000	Contractor's Project Manager	MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
	- Electrical installation inspections - PPE						
Drowning during water activities	- Use of life vests - Rescue equipment - Water safety training	Project Construction Site	Safety equipment logs, visual inspections, worker interviews	Daily	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Exposure to air emissions, noise, vibration	- Monitoring records - PPE usage	Project Construction Site	Air/noise/vibration monitoring devices	Monthly	Labor Act and OHS Policies, ISO 45000	Contractor's Project Manager	MOT
Exposure to hazardous materials	- Waste disposal records - PPE compliance	Project Construction Site	Visual inspections, hazardous waste logs	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Poor housekeeping	- Cleanliness - Proper storage of tools - Incident records	Project Construction Site	Site audits, visual inspections	Daily	IFC General EHS Guidelines	Site Supervisor	MOT
Biological risks	- Pest/animal control measures - Incident records	Entire project site	Visual inspections, incident records	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Monitoring During Operation Phase							
Heavy equipment and machinery handling	- Maintenance logs - Operator certifications	Project area	Visual inspections,	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
	- Incident records		maintenance records review				
Risk of work-at-height	- Inspection of lifting machines - Use of fall arrest systems - PPE	Project area	Visual inspections, safety checklists	Daily	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Lifting of loads	- Proper load securing - Equipment checks - Incident records	Project area	Equipment checklists, operator logs	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Confined space entry	- Entry permits - Oxygen level monitoring - Incident records	Project area	Confined space entry permits, gas monitoring equipment	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Vessel safety risks	- Fire suppression inspections - Emergency drill records	Project area	Visual inspections, emergency drill reports	Monthly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Fugitive dust, exhaust fumes, noise emissions	- Monitoring records - PPE usage	Project area	Air/noise monitoring devices, PPE inspections	Monthly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Exposure to chemicals	- Spill response records	Project area	Visual inspections, incident records	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT

Aspects/Env. Attributes/Issues	Parameters/Units	Monitoring Locations	Means of Monitoring	Frequency	Standards	Responsibility	
						Implementation	Supervision
Traffic risks	- Road signage - Vehicle maintenance logs - Incident records	Project area	Road audits, vehicle maintenance records	Weekly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT
Ergonomic and manual handling risks	- Ergonomic assessments - Training compliance	Project area	Worker interviews, visual inspections	Monthly	Labor Act and OHS Policies, ISO 45000	Site Supervisor	MOT

Appendix D-2: Community Health and Safety Plan

1.1 Introduction

The South Sudan Port, Port Access Road, and River Clearing (dredging) Project recognizes the importance of adhering to Environmental and Social Management Plan (ESMP) policies and procedures to ensure compliance with international best practices. This includes integrating robust community health and safety measures into project management to safeguard the well-being of communities directly and indirectly affected by the project's activities. The development of port infrastructure, access roads, and river clearing activities may increase potential risks to nearby communities, such as accidents, environmental hazards, and other safety concerns.

The project team is committed to prioritizing risk prevention to minimize health and safety risks to affected communities. The Community Health and Safety Plan (CHSP) outlines measures to avoid or reduce risks associated with the project's construction and operations phases, with special attention to vulnerable groups.

1.2 Objectives

The CHSP aims to establish preventive measures to protect nearby communities and individuals using port facilities and vessels from incidents and accidents during different phases of the project. The specific objectives include:

- Address changes in community health, such as exposure to diseases or water contamination.
- Mitigate security risks, including emergencies, crime, or conflicts.
- Implement property and personnel safeguards without endangering community safety.
- Protect community health from water contamination, air pollution, and vector-borne diseases.
- Ensure safety through road safety measures, hazardous material handling, and traffic management.
- Safeguard vulnerable groups, including women, children, and marginalized populations.
- Foster transparent communication to inform communities about risks and safety measures.

1.3 Scope of Application

This CHS Plan applies to all project phases, including construction, operation, and decommissioning. It is the responsibility of project management to ensure that contractors and subcontractors adhere to this plan, aligned with national regulations and international standards.

The geographical scope covers:

- **Direct Impact Zone:** The physical footprint of the port, access road, and river clearing and dredging areas.
- **Zone of Impact:** Neighboring communities affected by traffic, construction, and economic shifts due to project activities.

1.4 Roles and Responsibilities

To ensure proper implementation, various roles are designated for managing health and safety impacts on the community as outlined in Table-1.

Table-1: Roles and Responsibilities

SL#	Role	Associated Entities for Each Position	Responsibilities
1.	Project Coordinator	PIU	Oversee overall compliance with the CHS Plan, ensure resources for its implementation.
2.	Health and Safety Manager	PIU	Lead the identification of risks and manage emergency preparedness.

SL#	Role	Associated Entities for Each Position	Responsibilities
3.	Environmental and Social (E&S) Manager	PIU	Ensure social safeguards and ESS compliance; review and approve safety plans.
4.	Community Liaison Officer	PIU/ Contractor	Act as the primary communication link between the project and affected communities.
5.	Contractors	Contractor	Develop and implement site-specific health and safety measures in line with this plan.
6.	Workers and Subcontractors	Contractor	Adhere to all health and safety protocols outlined in the CHS Plan.

1.5 Health and Safety Risk Identification and Management

A comprehensive risk assessment has been carried out to identify potential health and safety risks to the community. The details of the risks and mitigation measures are given in Table-2.

Table-2: Identified Risks and Management Plans

Risks	Description of Risk	Mitigation Measures
Water contamination or scarcity	• Contaminating water through pollutants from construction waste, sediment release, and potential chemical spills, endangering community health by increasing waterborne diseases and disrupting aquatic food sources. • Increased water use and disruption of natural flow may reduce water availability, impacting hygiene, agriculture, and local livelihoods.	• Implement strict waste management protocols and treat wastewater before discharge to prevent contamination. • Establish spill prevention and emergency response measures for construction activities. • Employ controlled dredging practices to minimize sediment release into the water. • Provide alternative water sources to communities if construction impacts local water availability. • Conduct regular water quality monitoring to detect and address potential issues promptly. • Engage with local communities to ensure health and safety standards are maintained and concerns are addressed.
Air and noise pollution	• Air pollution from dust, vehicle emissions, and equipment exhaust can lead to respiratory issues and degrade air quality. • Constant noise from heavy machinery, construction, and activities can cause stress, sleep disturbances, and hearing impairment, particularly affecting nearby communities.	• Use dust suppression methods, such as water spraying, to reduce airborne dust during construction. • Ensure all machinery and vehicles are well-maintained to minimize emissions and reduce air pollution. • Set up noise barriers or screens around high-noise areas to reduce sound levels affecting nearby communities. • Limit construction hours to daytime to minimize noise disturbance during evening and nighttime.

Risks	Description of Risk	Mitigation Measures
		• Provide personal protective equipment (PPE), such as earplugs and masks, to workers and advise nearby communities on protective measures. • Conduct regular air and noise quality monitoring to ensure compliance with health and safety standards.
Increased local population due to worker migration.	• The influx of workers migrating for the project may lead to an increase in the local population, straining community resources and infrastructure. This population rise may heighten demand for housing, water, and healthcare, potentially creating competition with local residents and increasing the risk of social tensions, public health issues, and pressure on local services.	• Develop a comprehensive worker accommodation plan to avoid excessive demand on local housing. • Coordinate with local authorities to enhance healthcare, water, and sanitation services in areas impacted by worker influx. • Promote local hiring to reduce worker migration and support community employment. • Establish community engagement programs to address potential social tensions and encourage positive interactions between workers and residents. • Implement health and safety protocols, including regular health screenings, to prevent the spread of diseases and protect public health.
Community exposure to communicable diseases	• The increased movement of workers and construction activities for the project can expose local communities to communicable diseases, as the close proximity of workers and residents may increase the risk of disease transmission. This could lead to outbreaks of illnesses such as respiratory infections, or other transmissible conditions, placing additional strain on local healthcare systems and affecting community health.	• Ensure proper sanitation and waste disposal systems are in place at worker camps and surrounding communities. • Provide access to clean drinking water and regularly monitor water quality to prevent contamination. • Conduct health education campaigns for workers and locals on hygiene practices, including handwashing and safe food handling. • Provide adequate healthcare services, including treatment for communicable diseases, and ensure rapid response to any outbreaks. • Regularly disinfect shared facilities like kitchens, bathrooms, and dining areas to reduce the risk of disease transmission. • Implement disease surveillance and reporting systems to detect and address potential outbreaks promptly.
Road safety issues, especially	• The increased movement of construction vehicles, heavy machinery, and workers can	• Develop and implement a comprehensive traffic management plan

Risks	Description of Risk	Mitigation Measures
near construction sites.	lead to accidents, such as vehicle collisions, pedestrian injuries, or fatalities, especially in areas with limited traffic control and safety measures. • The construction zones may create hazards like poor road conditions, inadequate signage, and lack of proper barriers, increasing the likelihood of road-related incidents.	with clear signage and designated vehicle routes. • Install visible road signs, warning lights, and barriers around construction zones to alert drivers and pedestrians. • Provide safe walkways or pedestrian lanes to separate workers and locals from moving vehicles. • Conduct safety training for workers and drivers on safe road practices and hazard recognition. • Ensure regular maintenance of roads near construction sites to prevent accidents caused by poor conditions. • Employ traffic controllers or flaggers to manage traffic flow through construction zones. • Raise awareness in local communities about road safety and the risks around construction sites.
Changes in social value and dynamics	• The influx of workers and new economic opportunities during construction may lead to shifts in social structures, creating inequalities, altering power relations, and potentially causing social tensions. • During the operation period, ongoing employment opportunities and increased economic activity could further transform local dynamics, potentially exacerbating social disparities or leading to dependence on port-related industries. • The interaction between workers, local communities, and the broader economy could lead to cultural changes, strain on resources, and potential conflicts, especially if social benefits are not equally distributed.	• Prioritize local hiring and offer training programs to ensure local communities benefit from employment opportunities. • Establish regular communication with local communities to address concerns and ensure participation in decision-making. • Implement community development projects, healthcare, and educational programs to improve local quality of life. • Set up a transparent conflict resolution system to address disputes between workers and locals or within the community. • Monitor social impacts regularly and adapt strategies to ensure equitable benefits for all. • Provide cultural sensitivity training to workers and project managers to respect local customs and traditions. • Ensure responsible management of local resources like water and housing to prevent scarcity or competition issues.
Security Personnel Management	• Inadequate training, lack of coordination, or improper conduct by security personnel could lead to conflicts with local communities, accidents, or violations of workers' rights.	• Provide security personnel with training on conflict resolution, human rights, and cultural sensitivity. • Establish and enforce a strict code of conduct for security personnel to ensure professionalism.

Risks	Description of Risk	Mitigation Measures
	• The presence of armed or overly aggressive security forces may escalate tensions, creating an unsafe environment for both project staff and residents. • Poor security management could also result in theft, vandalism, or sabotage of project equipment, impacting progress and safety.	• Coordinate with local law enforcement to ensure security personnel follow legal and ethical guidelines. • Use non-violent security measures and minimize the presence of armed personnel. • Engage with local communities to build trust and address security concerns. • Monitor security personnel regularly and establish a reporting system for incidents. • Ensure adequate staffing to manage security risks without intimidating the local population.
Hazardous materials handling and emergency preparedness	• Improper storage, transportation, or disposal of hazardous substances such as fuels, chemicals, and construction waste can lead to spills, contamination, and fires, threatening both worker safety and environmental health. • Inadequate emergency preparedness, including insufficient training or response plans, can delay or worsen the impact of accidents, leading to greater damage to property, injury, or even fatalities. • Additionally, the lack of proper protective equipment and safety protocols can put both workers and surrounding communities at risk during unforeseen emergencies.	• Implement strict protocols for the storage, handling, and disposal of hazardous materials to prevent spills and contamination. • Provide regular emergency response training to workers and establish clear evacuation procedures. • Ensure that all workers are equipped with appropriate personal protective equipment (PPE) for handling hazardous materials. • Develop and regularly update an emergency preparedness plan, including spill containment and fire safety measures. • Conduct regular safety drills and inspections to ensure readiness in case of hazardous material incidents. • Establish a dedicated team to monitor hazardous materials and respond promptly to any emergencies. • Ensure that safety signage and labels are clearly displayed on hazardous materials and storage areas.
Project infrastructure safety risk	• Poor workmanship, use of substandard materials, or improper construction practices can lead to damage or collapse of structures, posing safety hazards to workers and the public. • In the operation phase, lack of proper maintenance, wear, and tear, or unforeseen natural events (e.g., floods or	• Ensure high-quality construction practices, using certified materials and adhering to safety standards. • Conduct regular safety inspections and maintenance to identify and address any structural issues. • Implement a preventive maintenance program to reduce wear and tear on infrastructure during the operation phase.

Risks	Description of Risk	Mitigation Measures
	earthquakes) may weaken the infrastructure, increasing the risk of accidents, equipment failure, or operational disruptions that could affect both the workforce and surrounding communities.	• Use qualified engineers and supervisors to oversee construction and ensure compliance with safety regulations. • Design infrastructure to withstand potential natural hazards like floods or earthquakes. • Establish emergency response plans to address any infrastructure failures or accidents promptly. • Provide regular training to workers on infrastructure safety and emergency procedures.
Risk due to vessel operation including vessel capsizing and drowning.	• Poorly maintained vessels, inexperienced crew members, or adverse weather conditions can lead to accidents, such as capsizing, especially during loading or unloading activities. This could result in injury or loss of life for crew members or workers involved in port operations. • Additionally, unsafe boarding or disembarking procedures may expose workers and local communities to the risk of drowning, particularly if proper safety equipment and procedures are not in place.	• Ensure regular maintenance and safety checks for all vessels to prevent mechanical failures and ensure seaworthiness. • Provide thorough training for crew members on safe vessel operation, emergency procedures, and weather monitoring. • Equip vessels with life-saving equipment, such as life jackets, lifeboats, and flotation devices. • Establish clear safety protocols for loading, unloading, and boarding vessels to prevent accidents. • Conduct regular safety drills, including man-overboard and emergency evacuation exercises. • Implement a risk management system to monitor weather conditions and adjust operations accordingly. • Enforce strict safety measures for workers involved in vessel operations, ensuring proper PPE is used.

1.6 Emergency Preparedness and Response

The Emergency Preparedness and Response Plan (EPRP) is designed to ensure swift, effective, and coordinated actions in response to emergencies that could affect community health and safety during the Port, Port Access Road, and Dredging and Clearing Project. This plan outlines the procedures, roles, and responsibilities for responding to emergencies such as spills, fires, accidents, or other incidents that could potentially impact local communities.

Identification of Emergency Scenarios:

Spills (Hazardous Materials, Fuel, etc.): Risk of hazardous materials or fuel spillage during transportation, construction, and dredging operations.

Fires: Fires could occur from construction machinery, fuel storage areas, or electrical equipment.

Accidents: Accidents involving construction vehicles, heavy equipment, or workers may result in injuries or fatalities.

Flooding: Uncontrolled water release during dredging or heavy rains affecting local communities.

Environmental Incidents: Environmental impacts like air pollution, dust storms, or unexpected material discharge that affect nearby populations.

Response Procedures:

Roles and Responsibilities:

- **Project Implementation Unit (PIU):**
  - Oversee emergency response actions and ensure compliance with emergency plans.
  - Activate emergency protocols in coordination with contractors and local authorities.
  - Facilitate communication between project teams, local authorities, and the affected community.
- **Contractor:**
  - Implement emergency response actions according to the defined procedures.
  - Ensure workers are trained and equipped to handle emergency situations.
  - Provide regular reports on the implementation and effectiveness of the emergency response.
- **Local Authorities:**
  - Support in response coordination (police, fire brigade, emergency medical services).
  - Provide assistance with evacuation, safety measures, and law enforcement during emergencies.
- **Emergency Services:**
  - Provide immediate medical care, firefighting, and rescue operations in case of accidents or environmental emergencies.
  - Collaborate with project teams for incident reporting and mitigation.

Specific Emergency Response Procedures:

- **Spill Response:**
  - Immediately stop the source of the spill if safe to do so.
  - Deploy spill containment materials such as booms, barriers, and absorbent pads.
  - Notify local environmental authorities and emergency response teams.
  - Monitor and remediate affected areas, ensuring community water sources are protected.
- **Fire Response:**
  - Sound the emergency alarms and initiate an evacuation if necessary.
  - Deploy fire extinguishers or call fire services to control the fire.
  - Ensure workers are trained in fire safety and evacuation procedures.
- **Accident Response:**
  - Assess the situation and provide first aid to the injured.
  - Alert emergency medical teams for more severe injuries.
  - Evacuate the area if needed to avoid further hazards (e.g., hazardous material exposure).
- **Flooding Response:**
  - Activate flood barriers or other containment measures.
  - Evacuate affected community areas if required.

- Coordinate with local emergency teams to secure temporary shelters and provide assistance.

Community Engagement:

- **Awareness Campaigns:**
  - Educate the local community about potential emergency scenarios (e.g., spill hazards, fire risks, flooding) through local media, community meetings, and outreach programs.
  - Distribute printed emergency guidelines in local languages, including evacuation routes, emergency contacts, and safety measures.
- **Community Participation:**
  - Involve the community in emergency drills and simulations to familiarize them with response procedures.
  - Establish a community-based emergency response group to provide support during actual emergencies.
  - Set up a dedicated community hotline for reporting emergencies or seeking help.
- **Notification System:**
  - Develop a system (e.g., mobile alerts, local radio) to notify the community about ongoing emergencies and instructions for action.
  - Ensure that vulnerable populations (e.g., children, elderly, pregnant women) receive specific instructions based on their needs.

Drills and Simulations:

- **Regular Drills:**
  - Conduct annual emergency drills, simulating different emergency scenarios such as spills, fires, accidents, and flooding, involving both project staff and local community members.
  - Include role-playing exercises for local emergency services and PIU staff to practice coordination during an actual incident.
- **Emergency Simulation:**
  - Simulate real-life scenarios to test the preparedness of all involved parties, from the contractor and PIU to local authorities and the community.
  - Conduct joint reviews after each drill to identify gaps and improve the response protocol.

Plan Review and Updates:

The EPRP will be reviewed annually, or after any significant incident, to ensure its relevance and effectiveness. Updates will be made based on lessons learned from drills, simulations, or real incidents.

1.7 Community Health and Safety Measures

To effectively manage community health and safety concerns arising from the Port, Port Access Road, and Clearing and Dredging Project in South Sudan, the following specific mitigation measures have been developed, in alignment with the project's activities and potential impacts. These measures focus on ensuring the well-being of surrounding communities during the construction and operation phases.

Traffic Management Plan (TMP)

To manage road safety and reduce risks to local communities living near or along the access roads, clearing and dredging are used for transporting construction materials and goods.

- Establish specific routes for construction vehicles, avoiding residential areas to reduce accidents and congestion, minimizing disruptions to the local community and infrastructure.
- Implement speed limits (e.g., 30 km/h) in residential and sensitive areas (e.g., near schools or healthcare facilities) to reduce accident risks.
- Deploy trained traffic marshals and flagmen to direct traffic during peak hours or at construction zones for the safe movement of vehicles and pedestrians.
- Install clear and visible road signage and warning systems for speed limits, construction zones, and pedestrian crossings to reduce potential accidents.
- Regularly inform the local community of construction schedules, traffic rerouting plans, and changes to road conditions through notices, meetings, and radio broadcasts.
- Use water trucks to suppress dust in construction and dredging areas, with temporary barriers or windbreaks to minimize airborne particles.
- Install noise barriers for noisy equipment and schedule high-noise operations during daytime hours (e.g., 8 AM to 6 PM).
- Conduct regular inspections and maintenance of machinery to reduce unnecessary noise and emissions.
- Monitor air quality and noise levels at key locations, ensuring compliance with standards and taking immediate action if thresholds are exceeded.
- Engage in community awareness campaigns, informing residents about planned activities, distributing educational materials, and addressing concerns through local leaders.

Noise and Dust Control Plan:

The Noise and Dust Control Plan aims to minimize the impact of construction activities on the health and quality of life of nearby communities. This includes measures to reduce air and noise pollution during construction, dredging, and clearing operations to ensure compliance with environmental standards.

- Use water trucks to suppress dust in construction areas.
- Install noise barriers near sensitive areas and residential zones.
- Limit noisy activities to daytime hours (8 AM–6 PM).
- Maintain machinery regularly to reduce noise and emissions.
- Monitor air and noise quality regularly near residential zones.
- Minimize dust with frequent site watering.
- Ensure compliance with noise standards using barriers and monitoring.
- Protect community health with well-maintained machinery.

Hazardous Material Management Plan (HMMP)

The purpose of this plan is to ensure the safe handling, transportation, and disposal of hazardous materials, such as fuel, chemicals, and other potentially dangerous substances, during the construction and operation phases. It aims to prevent spills, accidents, and exposure to both workers and local communities.

- Store hazardous materials in secured, labeled facilities with spill containment.
- Use approved transport routes to avoid populated areas.
- Install spill kits at storage sites and along transport paths.
- Conduct regular training for workers handling hazardous materials.
- Dispose of hazardous waste following environmental regulations.
- Prevent spills and leaks through secure storage and transport.
- Train workers on safe handling and emergency response.
- Minimize environmental and community exposure risks.

Public Health Management Plan

This plan is designed to address public health risks associated with the project by monitoring and mitigating potential health impacts caused by the construction and operational activities. The focus is on water quality, disease prevention, and providing medical support to local communities.

- Test and monitor water quality regularly to detect contamination.
- Conduct health awareness campaigns focusing on hygiene and disease prevention.
- Distribute mosquito nets and sanitation kits to communities.
- Provide health services through mobile medical units.
- Collaborate with local health authorities for vaccination drives.
- Protect water sources from contamination during dredging.
- Raise awareness about health and sanitation practices.
- Prevent vector-borne diseases with community outreach and resources.

1.8 Communication and Stakeholder Engagement

Transparent communication with the affected communities is critical. The Community Liaison Officer will facilitate information sharing on the project's risks and health and safety measures through:

- Public meetings: To update the community on project progress and potential risks.
- Information materials: Distributed via local media, printed materials, and community meetings.
- Feedback mechanisms: Communities will be able to provide feedback through grievance mechanisms (GM), and concerns will be addressed promptly.

1.9 Training and Capacity Building

All project personnel and contractors will receive training on the CHS Plan, including emergency response procedures and health and safety measures. Community training sessions will be conducted to ensure local populations are aware of health and safety risks, how to respond in emergencies, and how to engage with the project safely.

MOT and Contractor will ensure that personnel responsible for the execution of tasks and requirements in this Plan are competent on the basis of education, training, and experience.

This Plan requires training to be provided to workers who may be exposed to hazards (health, safety or security) associated with Project activities. The training and increase in Project worker awareness associated with health, hygiene and sanitation, communicable diseases, STIs and HIV/AIDS education campaigns are a key component in minimizing health risks to the community posed by the presence of the Project.

This Plan requires a workforce awareness program/training to be provided as part of the camp initiation as well as incorporated into ongoing and regular training commitments, particularly with regard to the management of communicable diseases. This training is applicable to all MOT, Contractor, and sub-contractor personnel and will be developed and implemented by the Contractor following MOT review and approval. Training will include, but not be limited to:

- Safety training for workers and drivers on safe road practices and hazard recognition.
- Cultural sensitivity training for workers and project managers to respect local customs and traditions.
- Training security personnel on conflict resolution, human rights, and cultural sensitivity.
- Training the workers on Emergency Response and Infrastructure Safety
- Training for crew members on safe vessel operation, emergency procedures, and weather monitoring
- Adverse impacts of Drug and Alcohol usage
- STI and HIV/AIDS prevention and awareness training for all employees

1.10 Monitoring and Reporting

The Health and Safety Manager, alongside the Community Liaison Officer, will monitor the implementation of the CHS Plan and provide regular reports to the Project Manager. Key performance indicators (KPIs) will include the number of incidents, grievances, and training sessions conducted. These reports will also be shared with relevant stakeholders, including local authorities and communities.

1.11 Conclusion

This CHS Plan ensures the protection and well-being of local communities throughout the port, access road, and river clearing and dredging project's lifecycle, aligning with international standards and South Sudan's regulatory framework.

Appendix D-3: Dredging Management Plan

1.1 Introduction

This Dredging Management Plan (DMP) has been developed to detail the requirements for the clearing (dredging) to be conducted between Juba and Bor Section of the White Nile River. The DMP outlines the process to be implemented to manage the clearing/dredging and placement of dredged materials from the White Nile River between the Juba to Bor section. Clearing/Dredging shall be carried out in the river to improve the navigational channel and construction of Bor Leudier Port at Jonglei State and rehabilitation of Juba port in Central Equatoria State.

The appointed Clearing/Dredging Contractor (hereinafter called "Contractor") shall develop a site-specific dredging management plan to include the specific details of the proposed dredging program and means to meet the objectives set out below.

This will be assisted by the provision of results from investigations of spoil contamination status, disposal site selection, and plume modelling needed to support the application for a dredging permit prior to the commencement of works.

1.2 Objectives

The objectives of this Dredging Management Plan are as follows:

- To protect environmental values from effects due to dredging-related water quality effects.
- To reduce impacts to aquatic flora and fauna, and their habitat during clearing/dredging and dredge material placement activities.
- To adopt best practice management for the handling and storage of waste materisls on board the dredger.
- To manage the risk of translocation of organisms in ballast water by the dredgers.
- To reduce the risk of an environmental incident occurring such an oil spill, vessel collision or similar to prevent damage to the surrounding aquatic environment and the public.
- To reduce nuisance noise on surrounding sensitive receptors from the dredging; and
- To reduce the air emissions produced during dredging operations and thereby reduce potential effects on the natural airshed.

The DMP should be read in conjunction with the following management plans prepared under ESIA:

- Community Health and Safety Plan
- Occupational Health and Safety Plan
- Biodiversity Management Plan
- Chance Find Procedures

1.3 Legal and Other Requirements

The contractor shall comply with applicable South Sudan Laws and Regulations including but not limited to Draft Environmental Protection Bill 2023, Environment (Protection) Act 2001, Land Act 2009, Local Government Act 2009, Child Act 2008, Forests Bill 2009, Wildlife Conservation and National Parks Act 2003, Freshwater Fisheries Act 1954, Traffic Act 2003, Public Grievances Act 2011, etc., contains numerous provisions that promote environmental protection, health and safety management, forest and wildlife management, regulate environmental impacts associated with development activities, and safeguard the life supporting capacity of air, water, land, and ecosystems.

Several Conventions, Protocols, and Treaties that promote the maintenance of a viable environment and achieve sustainable development have been endorsed by South Sudan including the Treaty of the East African Community, United Nations Convention on Biological Diversity, Convention on Illegal Trade of Endangered Species, Ramsar Convention, Conservation of Nature and Natural Resources, UN Framework Convention on Climate Change, Paris Agreement, etc. shall be considered.

In addition, applicable World Bank Environmental and Social Standards (ESS1-10) requirements, World Bank Group Environmental, Health, and Safety (EHS) General Guidelines 2007, EHS Guidelines for Ports Harbours and Terminals 2017, etc. will also be complied.

1.4 Selection of Disposal Sites

Clearing/dredge soil shall not be disposed along the riverbank as they are sensitive habitat for various aquatic species and provide as the spawning and breed ground also. Dredge material shall be tested for its quality before dredging begins, in-situ, i.e., while the material is on the riverbed. Then based on the test result disposal options will be selected. If the dredged material is free from contaminants, then reuse or other land-based disposal options can be selected. If the dredged material has contaminants, the confined disposal should be considered.

The locations of disposal sites have to be selected such that:

- Public perception about the location of the dredge/debris disposal site has to be obtained before finalizing the location.
- Permission from the village/payams/bomas/local community to be obtained for the disposal site selected.
- Disposal sites are located at least 1000m away from any sensitive locations like settlements, waterbodies, notified forest areas, wildlife/birds/mammals/fish sanctuaries, or any other sensitive locations.
- Disposal sites shall not contaminate any water sources, rivers, etc. so the site should be located away from the waterbody, and the disposal site should be lined up properly to prevent infiltration of water. If the dredge material has contaminants, then confined disposal should be considered.
- Environmental safeguard specialist of PIU and Project Coordinator must approve the plan before the commencement of clearing (dredging) work.

1.5 Survey Requirements

Surveys will be required to assess the status of contamination of the material to be dredged. Further, modelling studies will also be required to determine potential extent of plumes from dredging and disposal of spoil in order to identify an appropriate area where spoil can be placed to with minimal impact to sensitive habitats. The results will provide further background information for the development of the site-specific dredge management plan.

The contractor shall confirm that hydrodynamic and bathymetric study have been completed. Additional surveys may be required as detailed in this plan.

In relation to the contamination status of the material to be dredged, the permit for dredging and placement of spoil requires that the dredged material is shown to be free from contaminants and meets the sediment quality guidelines as per USEPA standards.

The contaminants of interest include:

- Metals and metalloids - antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc (and iron and manganese to allow normalization calculations).
- Total polychlorinated biphenyls (PCBs).
- Organochlorine pesticides - DDD, DDE, total DDT, Dieldrin, Chlordane, Lindane, Endrin.
- Polynuclear aromatic hydrocarbons (PAHs) - Acenapthene, Acenapthalene, Anthracene, Fluorene, Naphthalene, Phenanthrene, Fluoranthene, Benzo[a]anthracene, Benzo[a]pyrene, Dibenz[a]anthracene, Chrysene, Pyrene, low molecular weight PAHs, high molecular weight PAHs, Total PAHs.
- Radionuclides
- Tributyltin (TBT)

In relation to the site for the placement of dredge spoil, this will be selected on the basis of the most appropriate equipment and achievement of least impact of sedimentation to the aquatic environment.

Potential sites will be identified on the basis of results of modelling of dispersion of dredge and spoil plumes.

1.6 Potential Impacts

The following sections describe the potential impacts:

Aquatic Fauna

Impacts to aquatic cetaceans during dredging and/or piling, including direct vessel strike and underwater noise. Introduction of aquatic pests via biofouling on the vessel hull. Potential impacts include establishment of non-indigenous aquatic pest species, competition for food and space with native species, and removal of native species. Dredging removes bottom habitat and may lead to a loss of fishery resources.

Disturbance from dredging activities may cause displacement of fishery resources and other mobile bottom biota. Dredging removes bottom biota and dumping of dredged material covers bottom habitat, both of which may reduce fishery resources. Settlement of resuspended sediments on fragile aquatic fauna and flora damages the ecosystem particularly coral reefs, which are formed by the extracellular product of symbiotic plants. A great number of plants need sunlight for photosynthesis.

Benthic Communities and Habitat

The potential impacts to benthic communities and habitats include direct loss by removal or burial, and/or indirect impacts from the effects of sediments introduced to the water column by the dredging and disposal. Dumping of dredged material directly alters bottom configuration and biota and may disperse toxic or harmful chemicals around the disposal site.

Water Quality

During dredging the main environmental effect is the increase in the suspended sediments and thereby turbidity in the water column.

Sediment Quality

The potential impacts of the proposed activities include mobilization of contaminants via sediment disturbance and hydrocarbon spill from working vessels. Dredging disturbs bottom sediments and induces resuspension, dispersal and settlement of such sediments. All methods of excavation release suspended sediments in the water column during the excavation itself and during the flow of sediments through barges. The increase in turbidity decreases the depth of the light penetration in the water column.

Vessel Wastewater

Wastewater will be generated in the vessels. Improper management and disposal may impact on surface water, sediment quality as well as aquatic environment.

Wastes

Solid waste will be generated at the vessels and improper management and disposal may impact the aquatic environment.

Fuel Management

During dredging operation fuel will be required. During the transfer of fuel accidental spillage may impact surface water quality, sediment and aquatic environment. Leakage or spill of oil from dredger and other dredging vessels is envisaged during the dredging. The release of oil in the long run may cause bioaccumulation of these substances in sediment as well as aquatic flora and fauna. The constituents of oil are toxic to marine life and release of oil contents on to water will result in formation of a shining film on the surface of water which prevents dissolution of oxygen across the surface of water. Moreover, oil gets accumulated on the body of the small species of fish or invertebrates and coat feathers and fur, reducing birds' and mammals' ability to maintain their body temperatures.

Noise

The noise will be generated due to the operation of instruments used for dredging. Dredging activities will increase the underwater noise level and impact on aquatic fauna including fish, aquatic mammals, and avifauna. The noise generated during this activity will also affect the workers who will be deployed in the dredger.

Air Quality

Dredging activity will emit pollutants by burning fuel (diesel).

1.7 Management and Monitoring

Table-1 presents a summary of the potential impacts related to clearing/dredging and disposal of sediments together with mitigation and management measures to avoid or reduce these impacts.

The contractor shall develop a Site-Specific Dredging Management Plan, which will as a minimum incorporate the measures described in Table-1 but shall not be limited to these measures.

Due to differing scopes of work and work locations, not all management and mitigation measures in the Dredging Management Plan are applicable to all Contractors.

Table 1: Management and Monitoring

Impacts/ Issues	Mitigation Measures	Monitoring	Frequency	Responsibility	
				Implementation	Supervision
Aquatic Fauna	• Prior to commencement of dredging activities, employees responsible for aquatic fauna spotting will be appropriately trained. • Aquatic mammal and turtle observation and response procedures including the application of a 300 m exclusion zone will be implemented during dredging activities. Dredging operations shall be stopped where these faunas are observed within 300 m of the operating dredge until the animals have moved further than 300 m or have not been sighted for 15 minutes. • A lookout will be maintained for cetaceans while the dredge sails between the dredging area and reclamation. In the event that a cetacean is sighted, vessel speed and direction will be adjusted to avoid impact on the observed individual (within the safety constraints of the vessel). • Aquatic mammal and turtle observation during night dredging will be undertaken using appropriate lighting. • Light levels from the dredging works will be limited to those lights that are necessary for the safe operation of the vessel, for spotting marine megafauna at night, and the health and safety of those on board. • Any injury to aquatic fauna shall be recorded and reported immediately.	Aquatic mammal and turtle activity will be performed by a person at a suitable location on each vessel.	During the clearing/dredging operation	Dredging Contractor	PIU of MOT
Water Quality	• Cells are to be established in a manner that maximizes settlement of sediments and reduces further erosion and mobilization of sediments. • Development of a turbidity/TSS relationship to enable in situ turbidity readings to be taken on site and	Implement a program, comprising the following: Turbidity/TSS and pH monitoring of water. Visual observations to	During the clearing/dredging operation	Dredging Contractor	PIU of MOT

Impacts/ Issues	Mitigation Measures	Monitoring	Frequency	Responsibility	
				Implementation	Supervision
	correlated to a TSS concentration. To achieve this, samples for TSS and turbidity are required to be taken at the same time, over a period long enough to provide a sufficient dataset necessary to determine a good correlation between the two parameters. • If turbidity/TSS exceeds the performance criteria in the tailwater ponds, the control measures on site will be promptly reviewed to ensure that all reasonable and practicable measures are being taken.	check for scum formations, oil spills etc. Plume validation monitoring of turbidity/TSS in receiving waters adjacent to the discharge point.			
Sediment Quality	• Use appropriate methods to excise any contaminated sediment hot spots identified by detailed sediment quality testing. • Noncontaminated sediment shall be reused and disposed of in land area. For the contaminated sediment confined disposal shall be considered.	Monitoring will be undertaken following USEPA guidelines.	Before dredging begins	Dredging Contractor	PIU of MOT
Vessel Wastewater	• Washdown of the deck and/or dredge head shall only be undertaken in accordance with relevant permits and approvals. • Degreasers only to be used if other methods, such as sweeping or watering the deck/equipment, is not appropriate or practicable.	Visual inspection for contamination of waters while washing deck or equipment.	During the clearing/dredging operation	Dredging Contractor	PIU of MOT
Wastes	• Vessel fitted with appropriately sized waste disposal bins. • These bins are to be secured and fitted with secure lids to prevent material being blown overboard during storage or handling. • Where practicable, ensure material compacted to further prevent unintentional loss. • Ensure the bins are collected and emptied at appropriate intervals.	Dredge crew to carry out regular visual inspections of collection points and visual inspection of on-deck bins. Monitoring of treatment system as required by legislation.	During the clearing/dredging operation	Dredging Contractor	PIU of MOT

Impacts/ Issues	Mitigation Measures	Monitoring	Frequency	Responsibility	
				Implementation	Supervision
	• Must comply with relevant national regulations requirements depending on the types of waste. • Where possible, material is to be held on board and disposed of onshore. • The holding tank is to be pumped out by appropriate licensed contractors while the dredge is in the river. • Hazardous waste must be stored in an appropriate and secure manner and clearly marked in accordance with legislative requirements. • Where required, hazardous waste shall be transferred to appropriate containers and transported to an appropriate facility for disposal. • Collection and transport of designated hazardous wastes is to be undertaken only by a licensed contractor. • Procedures to reduce spills or leakage during storage and transfer shall be followed. Spill response equipment must be easily identifiable and conveniently located so as to respond to a spill if it occurs.	Dredge crew to carry out regular visual inspections of hazardous waste storage containers to determine their integrity and identify if any spills or leakage has or is occurring.			
Fuel Management	• Fuel levels are being monitored both by the contractor and the dredge vessel. • Vessel to apply for and give notification as to the transfers of bulk liquids to vessels as per appropriate forms.	Visual inspections of fuel-dispensing equipment and surrounding water are undertaken during operations and after fuel transfer.	During the clearing/dredging operation	Dredging Contractor	PIU of MOT
Noise	• Ensure that engines and equipment on board the dredge are properly maintained in good working order. • Maintain and operate all equipment on board the dredge in a safe and efficient manner.	Noise monitoring will be conducted in response to non-vexatious noise complaints received during the dredging	During the clearing/dredging operation	Dredging Contractor	PIU of MOT

Impacts/ Issues	Mitigation Measures	Monitoring	Frequency	Responsibility	
				Implementation	Supervision
	• Carry out non-essential maintenance during daylight hours. • Contractor staff are aware of noise requirements in relevant permits and/or approvals. • Operate a complaints management system.	operations. Noise monitoring will be conducted at the location / receiver considered to be most affected during the works.			
Air Quality	• Ensure that engines and equipment on board the dredge are properly maintained in good working order. • Maintain and operate equipment on board the dredge in a safe and efficient manner. • Contractor staff are aware of air quality requirements in relevant permits and/or approvals.	Investigation of complaints and review of equipment versus relevant standards/ requirements	During the clearing/dredging operation	Dredging Contractor	PIU of MOT
Emergency Management	• The dredge vessel has and maintains a shipboard oil pollution emergency plan (or equivalent) which outlines the role, responsibilities, and actions to be followed should an uncontrolled release of oils/fuels occur. • A risk assessment regarding potential environmental incidents that could occur during the dredge operation is to be prepared by the dredge contractor prior to commencing work. The risk assessment will: a) identify the incidents/hazards that may occur during the campaign, b) identify the environmental consequences of the hazard occurring, c) for each hazard, identify measures that can be implemented to prevent the likelihood of the hazard occurring and/or will reduce the severity of consequences, and d) Contingency measures that are to be implemented in the event of an incident occurring.	Availability of emergency management procedure	During the clearing/dredging operation	Dredging Contractor	PIU of MOT

Impacts/ Issues	Mitigation Measures	Monitoring	Frequency	Responsibility	
				Implementation	Supervision
	• On-board procedures are to be made available to the crew. • The vessel is to have at least two lines of communication (VHF and mobile phone) with port control and maintain constant contact.				

1.8 Precautions to be adopted during Disposal

The contractor shall take the following precautions while disposing of the spoil:

- Contractor will take full care to ensure that public and private properties are not affected.
- In the event of any spoil from the sites beginning disposed on any adjacent land, the contractor will immediately remove all such spill and restore the affected area to the original state to the satisfaction of the PIU of MOT.
- Contractor will at all times ensure that the entire existing drains within and adjacent to the site are kept safe and free from any debris.
- Any diversion required for traffic during disposal shall be provided with traffic control signals and barriers after the discussion with the local people and with the permission of PIU/MOT.
- Contractor will take into account the wind direction and location of settlements to ensure against any dust problems.
- Contractor should display the board at the disposal site stating the name of the project, usages of the site, and types of spoil being disposed of.

1.9 Record Keeping

Site approved by the site engineer only can be used as disposal site. Record of all such site should be maintained along with the area of disposal site, type and quantity of material disposed daily and capacity of disposal site.

1.10 Penalties

Stringent action and penalties should be imposed on the Contractor for dumping of materials in locations other than the approved locations. Grievance Mechanism should be the place for taking note and action on such complaints.

1.11 Roles and Responsibilities

Contractor shall ensure sufficient resources are allocated on an ongoing basis to achieve effective implementation of the Site-Specific Dredging Management Plan.

Contractor's Site-Specific Dredging Management Plan shall describe the resources allocated to and the responsible personnel for the execution of each task and requirement contained therein and shall describe how roles and responsibilities are communicated to relevant personnel.

MOT shall ensure sufficient resources are allocated on an ongoing basis to achieve effective implementation of MOT's responsibilities in the Dredging Management Plan.

1.12 Training and Awareness Requirements

Contractor's Site-Specific Dredging Management Plan shall describe the training and awareness requirements necessary for its effective implementation.

Contractor's training activity associated with the Site-Specific Dredging Management Plan shall be appropriately implemented by means of a training needs assessment, training matrix/plan and by keeping records of training undertaken.

MOT shall ensure that all MOT/PIU personnel responsible for the execution of MOT's tasks and requirements in the Dredging Management Plan are competent on the basis of education, training and experience.

MOT's training activity associated with the Dredging Management Plan shall be appropriately documented by means of a training needs assessment, training matrix/plan and records of training undertaken.

1.13 Performance Indicators

Table 2 outlines indicators for measuring and verifying performance in relation to dredging.

Table 2: Performance Indicators

SL#	Performance Indicator	Measurement
1.	Dredge materials quality	Parameters mentioned in section 1.5
2.	Selection dredge spoil placement location	Demonstration by monitoring of avoidance of impacts to sensitive areas Validate that conditions are within those predicted by modelling
3.	Approved/permit to dredge and place	Detailed monitoring program for compliance with permit conditions

Note: Performance indicators are to be further developed and agreed between MOT and Contractor

1.14 Reporting and Notification

Notification and reporting requirements will be defined by MOT following the completion of the contamination assessment surveys and the generation of Contractor's Site-Specific Dredging Management Plan.

Appendix D-4: Biodiversity Management Plan

The main purpose of the Biodiversity Management Plan (BMP) is to identify project-specific actions that need to be undertaken by the project authority to mitigate the specific impacts on biodiversity components identified in the proposed project. These actions will be incorporated into the project management system and integrated into various stages of project development. This BMP is based on the impacts and mitigation measures for aquatic and terrestrial biodiversity identified in the Project Description and the impact assessment provided in the project's ESIA report.

The BMP outlines both generic good practice measures and site-specific actions aimed at mitigating potential impacts associated with project activities. The mitigation measures in this plan are aligned with the Environmental and Social Standard 6 (ESS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources under the World Bank's Environmental and Social Framework (ESF) (WB, 2016). It is anticipated that the BMP will be periodically updated as the project design progresses and as improvements and adaptive management approaches are identified throughout all stages of the project.

1.1 Objectives of the Biodiversity Management Plan

The main objective of the Biodiversity Management Plan (BMP) is to ensure that project development within the identified study area is carried out in conjunction with the prudent conservation of biodiversity and ecosystems. It also aims to ensure that the stress or load on the ecosystem remains within its permissible assimilative capacity, i.e., it is carrying capacity. An effective BMP ensures that ecological requirements and objectives are met throughout all phases of the project. The long-term objectives of the BMP for all environmental attributes are as follows:

- To comply with all regulations and applicable laws stipulated by the Ministry of Environment and Forestry, South Sudan.
- To encourage and achieve the highest performance and response from individual employees and contractors.
- To plan out the complete strategy to take care of stakeholder engagement.
- To budget and allocate funds for biodiversity management.
- To continuously develop and search for innovative technologies for a green and better future environment.
- To contribute significantly to sustainable development.

1.2 Scope

This plan is part of the ESIA for the project “Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile.” It covers all project activities with the potential to impact aquatic and terrestrial ecosystems and biodiversity.

1.3 Comprehensive Biodiversity Assessment

The baseline biodiversity study of the project suggests that the project area includes a combination of modified and natural habitats along the White Nile River between Juba and the Bor stretch. According to ESS6, both the terrestrial and aquatic habitats near the proposed Juba and Bor port areas are classified as modified, as human activity has significantly altered the primary ecological functions and species composition. In contrast, project areas outside the proposed ports and human settlements especially the terrestrial and aquatic habitat adjacent to Bandingilo National Park are classified as natural habitats under ESS6, as they support viable populations of mostly native species of flora and fauna, with minimal modification to the area's ecological functions and species composition.

1.3.1 Current Conditions of the Habitats

The proposed construction sites for the Juba and Bor ports and their associated waterways along the White Nile River are located in an area characterized by diverse aquatic and terrestrial habitats. These

habitats support a variety of species, including diversified flora, fish, amphibians, reptiles, birds, and mammals.

Our field survey at both proposed Juba and Bor port construction sites revealed that the surrounding habitats are ecologically sensitive, with both modified and natural environments being impacted by ongoing activities. These areas are home to significant biodiversity, including aquatic species in the White Nile and terrestrial habitats near Bandingilo National Park. The surrounding ecosystems, particularly riparian and woodland habitats, are vulnerable to pollution, noise, and encroachment from construction activities. Human-wildlife conflict and pollution from waste may further stress these natural habitats. Given the proximity to Bandingilo National Park, there is also a heightened risk of habitat fragmentation due to access road preparation, dredging, and clearing work. However, these habitats are experiencing increasing pressure from various human activities and environmental changes:

- **Overgrazing and Overgrazing:** Overgrazing by livestock is a significant threat in many parts of Juba to Bor stretch of the project study area along White Nile River of South Sudan, leading to the degradation of grasslands, riparian zones, and other natural habitats. In some areas, this has resulted in soil erosion and the loss of vegetation, affecting both terrestrial and aquatic ecosystems.
- **Urban and Agricultural Expansion:** Rapid urbanization and the expansion of agriculture near key habitat areas, especially around Juba and Bor, contribute to habitat loss and fragmentation. Agricultural practices, such as deforestation for farmland, exacerbate the degradation of forests and wetlands, leading to reduced biodiversity.
- **Invasive Species Proliferation:** The introduction of invasive species could pose another significant threat. Invasive plants and animals can outcompete native species, disrupt food chains, and alter ecosystem functions. The proposed construction activities at both port sites could increase the risk of further invasive species introduction through the movement of machinery, workers, and materials.
- **Pollution and Waste:** Pollution from construction activities, waste from workers, and runoff from agricultural and urban areas degrade water quality in the White Nile and surrounding wetlands. This affects aquatic species and migratory birds that rely on these habitats. Noise and air pollution from construction machinery also stress terrestrial wildlife.
- **Habitat Fragmentation:** Infrastructure development, including national highway, already fragmented terrestrial habitats. The disruption of corridors, especially in sensitive areas like those near Bandingilo National Park, heightens the risk of reduced wildlife movement, which can have negative impacts on species survival and biodiversity.

1.3.2 Historical and Current Habitat Status

Historically, project areas natural habitats were relatively untouched by large-scale industrial development, but in recent years, South Sudan has seen an increase in urban growth, agricultural expansion, and infrastructure projects due to ongoing peace and development efforts. The biodiversity in these areas has been affected by years of conflict, which hindered effective management and conservation. In addition, climate change has contributed to water scarcity and shifting agricultural practices that further stress local ecosystems. An overview of GIS based habitat change status between 2017 & 2024 in the project study area has been shown in Figure-1. In addition, habitat change trends in the study area has been shown in Figure-2.

Figure-1: Habitat Change Between 2017 & 2024 in the Project Area

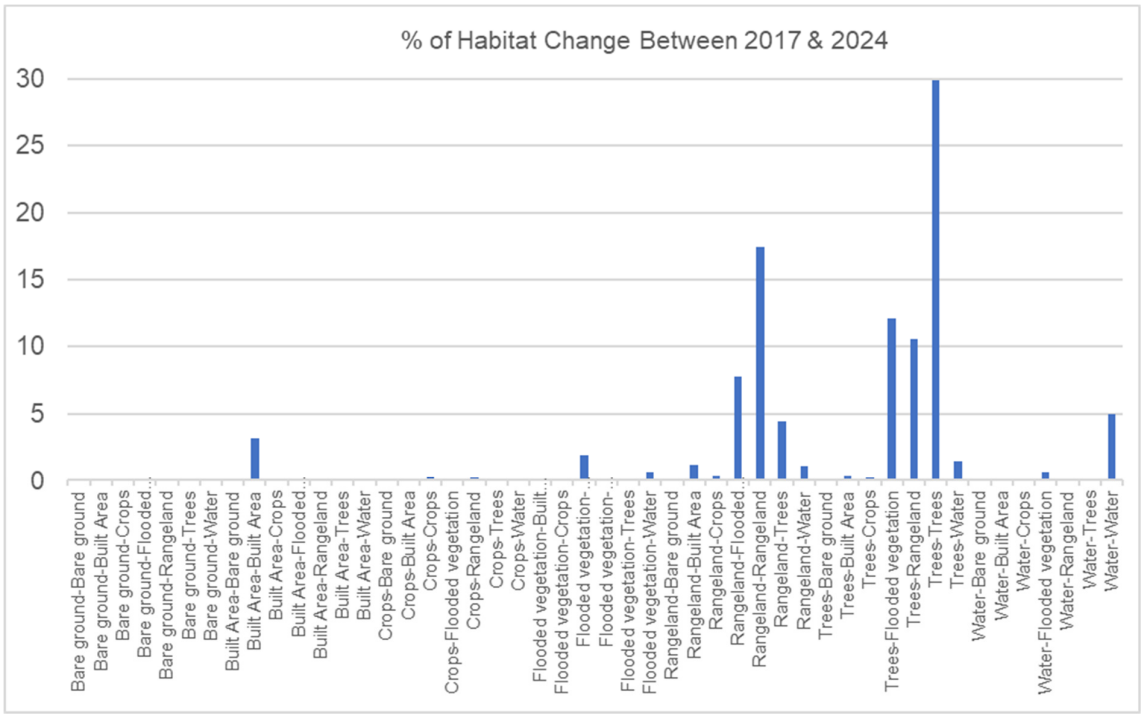
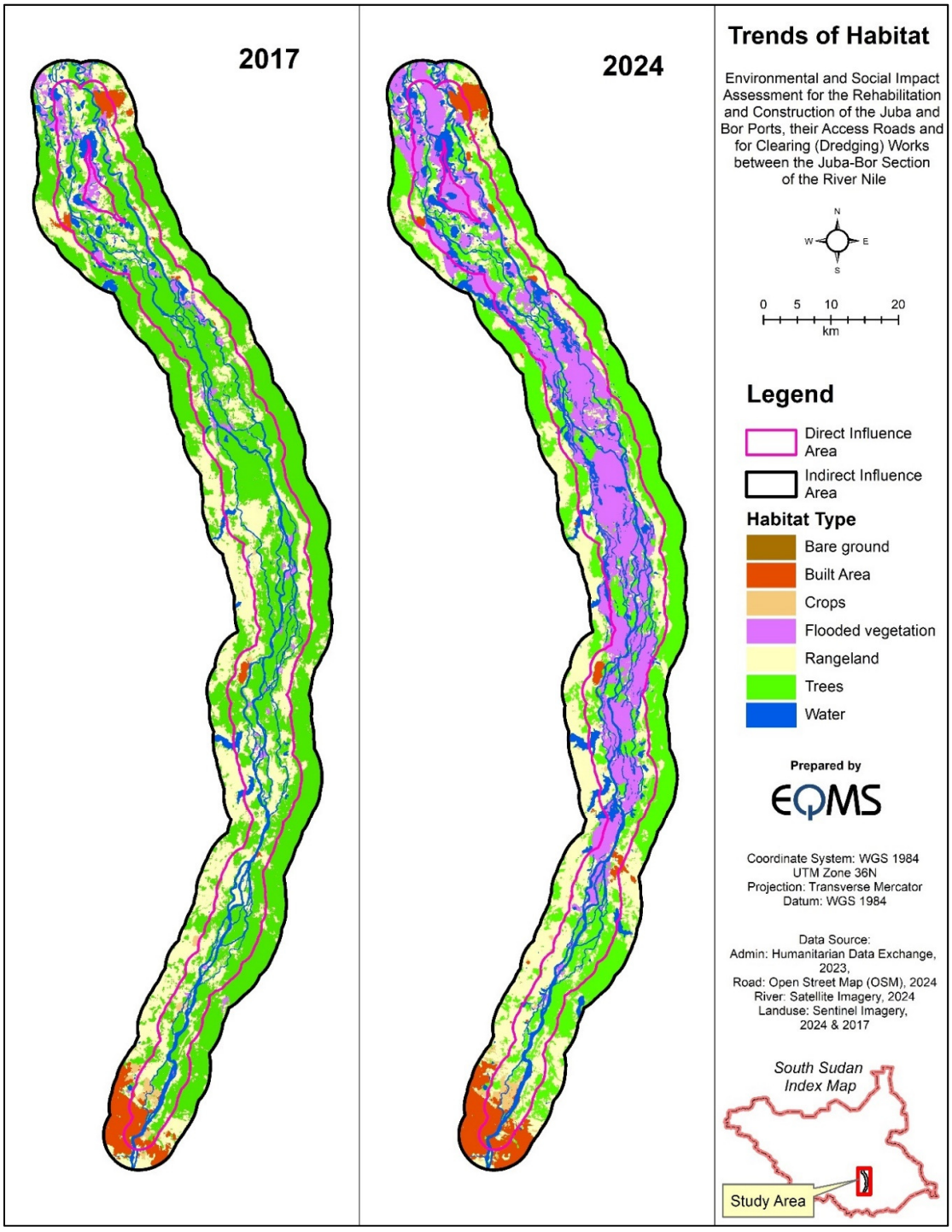


Figure-2: Map Shows the Habitat Change Trends in the Study Area Between 2017 & 2024



Source: GIS and RS Department EQMS

1.3.3 Habitat Structure

To assess the habitat structure within and surrounding the project area, the quadrat sampling method was employed. A total of six quadrats were established for phytosociological analysis. The sampling plot sizes were as follows: 10 m x 10 m for trees, 5 m x 5 m for shrubs, and 1 m x 1 m for herbs. Within each plot, all trees, herbs, and shrubs were enumerated and taxonomically identified. The locations and GPS coordinates of the quadrat sites are detailed in Table 0 1.

Table-1: Details of Quadrates for Floral Species

SL#	Quadrate No.	Latitude	Longitude	Habitat Type
1.	Q1	4°49'50.9"N	31°36'51.5E"	Modified Habitat
2.	Q2	5°12'44.7"N	31°46'37.6"E	Natural Habitat
3.	Q3	5°35'01.6"N	31°50'12.3"E	Natural Habitat
4.	Q4	6°13'26.0"N	31°32'47.4"E	Modified Habitat
5.	Q5	6°13'42.5"N	31°32'39.3"E	Modified Habitat
6.	Q6	5°49'35.1"N	31°46'0.3"E	Natural Habitat

Source: EQMS Field Survey, August 2024

1.3.3.1 Species Composition and Diversity

A total of 16 aquatic species of flora from 12 families and 35 species of terrestrial flora from 23 families were identified during field survey. Shannon Diversity index (H) is used to characterize species diversity for different quadrats. The biodiversity indices of different quadrates are presented in Table 0 2. The highest value of Shannon diversity index (H) was found for Quadrat Q2 (1.712) followed by Quadrat Q5 (1.673) and the lowest value was found for Quadrat Q1(1.309). If we compare these six quadrats, we can see that Q2 has a higher species diversity than the other quadrats, while Q1 exhibits lower diversity. However, the diversity index value, which ranges from 1 to 2, indicates a moderately diverse community where a variety of species are present, and they are relatively evenly distributed in terms of abundance. The value of Evenness (E) is highest in Quadrat Q6 followed by Quadrat Q2 and Q1. An evenness value of 0.8 to 0.9 suggests that the distribution of individuals among species is relatively balanced, with few species dominating the community and most species having comparable abundance levels. The highest species richness (7) was recorded in Quadrat Q5, and the greatest number of individuals (118) was also recorded in Quadrat Q5. As Quadrat Q1 was found to be woodlot plantations which were dominated by Mango (Mangifera indica) trees, the least values of Shannon diversity index (H) were observed for this quadrat. However, species richness value of 4-8 suggests a moderate level of diversity within the community or sample, reflecting the presence of several distinct species but not necessarily indicating exceptionally high biodiversity.

Table-2: Biodiversity Indices of Different Quadrats

Parameter	Quadrat 1 (Q1)	Quadrat 2 (Q2)	Quadrat 3 (Q3)	Quadrat 4 (Q)4	Quadrat 5 (Q5)	Quadrat 6 (Q6)
Shannon-Wiener Diversity Index (H)	1.309	1.712	1.458	1.38	1.673	1.55
Evenness (E)	0.944	0.946	0.906	0.858	0.86	0.963
Species Richness (S)	4	6	5	5	7	5
Total Abundance	12	19	19	89	118	27

Source: EQMS Field Survey, August 2024

1.3.4 Critical Habitat Assessment Against ESS6 of ESF

1.3.4.1 Definitions and Concepts of Critical Habitat

Environmental and Social Standard 6 (ESS 6): Biodiversity Conservation and Sustainable Management of Living Natural Resources of The World Bank Environmental and Social Framework (ESF) requires a differentiated risk management approach to habitats based on their sensitivity and values. ESS 6 addresses all habitats, categorized as 'modified habitat', 'natural habitat', and 'critical habitat'. As per article 23 of ESS 6 Critical habitat is defined as areas with high biodiversity importance or value, including:

a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches.
b) Habitat of significant importance to endemic or restricted range species.

c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species.
d) Highly threatened or unique ecosystems; and
e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

In areas of critical habitat, the Borrower will not implement any project activities that have potential adverse impacts unless all of the following conditions are met:

- No other viable alternatives within the region exist for development of the project in habitats of lesser biodiversity value.
- All due process required under international obligations or national law that is a prerequisite to a country granting approval for project activities in or adjacent to a critical habitat has been complied with.
- The potential adverse impacts, or likelihood of such, on the habitat will not lead to measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated.
- The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered, or restricted-range species, over a reasonable time period.
- The project will not involve significant conversion or significant degradation of critical habitats.
- The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.
- A robust and appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat is integrated into the Borrower's management program.

Screening and assessing critical habitats for a project are essential steps to ensure environmental sustainability, legal compliance, risk management, and stakeholder engagement throughout the project lifecycle. The first stage of the Critical Habitat Assessment (CHA) involves conducting a screening exercise to rapidly assess species of conservation concern or those with restricted ranges recorded within the Project Zone of Impact, or those considered potentially present. This screening assesses these species against thresholds for determining Conservation High (CH) status.

CHA screening has been conducted for all species considered present or potentially present within the study region of the project that are globally of conservation concern, including those classified as Critically Endangered, Endangered, and Vulnerable, or those with restricted ranges, as indicated in the literature search or from field surveys. Species with a global conservation status of Near Threatened or lower have been excluded from the CHA screening, unless they possess significant national or regional conservation status.

1.3.4.2 Constraints and Limitations of CHA

This Critical Habitat Assessment (CHA) leverages data available to EQMS Consulting Limited as of November 2024. Our data sources encompass:

- Publicly available information obtained through online searches and similar studies carried out in the East African region.
- Global biodiversity data retrieved from the Integrated Biodiversity Assessment Tool (IBAT).
- On-site biodiversity field surveys.

It's important to note that field surveys were not conducted throughout the year. Consequently, it was necessary to make some assumptions regarding species' presence and abundance during surveyed periods. Detailed field data on the presence and distribution of different ecosystems within the EAAA was limited. To address this, the mapping and calculations of occupied areas for threatened species primarily relied on publicly available data sources.

1.3.4.3 Critical Habitat-qualifying Species as per ESS 6 Criteria 23 (a), (b) and (c)

The 76 threatened species were identified as potentially occurring within a 50 km radius of both the Juba port and Bor port construction sites using the Integrated Biodiversity Assessment Tool (IBAT). However, no 'restricted range' species were found through IBAT screening. The identification of Critical Habitat-qualifying Species through IBAT is enhanced by a subsequent screening process. The list of species was further updated with data from the Global IUCN Red List of Threatened Species (ver. 3.1). Thereafter, the relevance of critical habitat was assessed for each species based on expert judgment. In this regard, we conducted Key Informant Interviews (KIIs) with relevant experts, Focus Group Discussions (FGDs) with locals, and conducted a secondary literature search. Additionally, the IUCN Red List of Threatened Species was used to examine the distribution of these CH-qualifying species. This Critical Habitat Assessment (CHA) evaluates the range of species with the potential to occur within the project's area of influence. This includes various wildlife species with significant mobility differences. Due to this variation, the assessment has employed various species specific EAAAs. Through this comprehensive approach, only the following species, out of the initially identified 76 species, were assessed to confirm their occurrence in the study region of the South Sudan Inland Water Connectivity for Growth Project. These are described below in Table-3.

Table-3: Species Screening Shortlist Considered Against ESS6 Critical Habitat Criteria, and Assessment Conclusions

1. African Savana/ bush Elephant (*Loxodonta africana*)		
Status	**Global IUCN: Critically Endangered (CR)**	**National IUCN Status: Not Available**
Notes	African Savana Elephants once occurred across all of Africa (Sikes 1971) and currently are found in 24 countries including South Sudan. Although knowledge of African Savanna Elephant distribution varies spatially and temporally, it is evident that the species' distribution is retracting and becoming increasingly fragmented across their range in the continent. There is very little information available on population levels at any level (local, national or global) with few exceptions, and there is a paucity of research on abundance. However, over the past century, African Savanna Elephant subpopulations have declined across most of their range. The African Elephant Status Report 2016 estimated a continental population of 415,428 (+/- 95% C.I. 20,111) for both African Savanna and African Forest Elephants combined and reported a continental decline of approximately 111,000 elephants since 2006. The distribution map of IUCN indicates that the species is not present along the Juba and Bor stretch of the White Nile River. During field study, no live specimens were recorded in the study area zone of the project and it is considered absent in the study region.	
Criteria (a)	The current range according to the IUCN indicates that its Area of Occurrence (AOO) doesn't overlap with Project AoI; The habitat requirements of this species suggest that the chance of their occurrence in the project AoI is very low. Unlikely that terrestrial habitat within the Project AoI would support ≥ 0.5% of the global population and as such the thresholds for determination of Critical Habitat under Criteria (a) are not met.	
Criteria (b)	African Savana Elephant is not endemic, or a range-restricted species and this Criteria is not relevant to this species.	
Criteria (c)	This criterion is not relevant to a resident African Savana Elephant species.	
2. Nile lechwe (*Kobus megaceros*)		
Status	**Global IUCN: Endangered (EN)**	**National IUCN Status: Not Available**
Notes	The Nile Lechwe is found only in South Sudan and Ethiopia. The largest part of its range occurs in the Sudd swamps along the Bahr-el-Ghazal (White Nile) and Sobat rivers. There is a smaller population in the Machar marshes near the Ethiopian border,	

	extending marginally into Gambella National Park (N.P.) in south-west Ethiopia, where its survival is highly precarious because of expanding human activities. Focus Group Discussions (FGDs) with local people, Key Informant Interviews (KIIs), relevant secondary literature, and IUCN data suggest that the Nile Lechwe is confined to seasonally flooded swamps and grasslands within the Sudd wetland, located 5 km from the proposed Bor port site. Therefore, this species is absent from the project study area.
Criteria (a)	According to the IUCN, the current range indicates that its Area of Occupancy (AOO) does not overlap with the Project Area of Influence (AoI). Considering these factors, it is highly likely that the thresholds for Criterion (a) are not met, and further assessment is not required.
Criteria (b)	This species is not endemic or range-restricted and as such Criteria (b) is not relevant to this species.
Criteria (c)	Nile Lechwe is not a congregatory or migratory species and as such this criterion is not relevant.
3. Cheetah (*Acinonyx jubatus*)	
Status	**Global IUCN: Vulnerable (VU)** / **National IUCN Status: Not Available**
Notes	Historically Cheetah is widespread across Africa and southwestern Asia, they are now known to occur in only 9% of their past distributional range, with their remaining strongholds in Southern and Eastern Africa. In Eastern Africa Cheetah are known to occur in only 11% of their historical range. IUCN data suggest that Cheetah is possibly Extinct from South Sudan. While some FGDs suggested their presence within the project's area of influence, our primary baseline survey results, along with subsequent key informant interviews (KIIs) with experts, indicate that cheetahs do not occur in the Juba to Bor stretch of the White Nile River or its adjacent Bandingilo National Park habitat.
Criteria (a)	Though the project study region overlaps with the past distribution range of the species, the current IUCN distribution map suggests that the cheetah is possibly extinct from South Sudan. Therefore, it is unlikely that the study area supports ≥0.5% of the global population, and as such, the thresholds for determining Critical Habitat under Criterion (a) are not met.
Criteria (b)	Since it's not a restricted-range or endemic species and suitable habitats are not present within the study region, Criteria (b) is not triggered, and no further assessment is required.
Criteria (c)	This is not a congregatory or migratory species and as such this criterion is not relevant.
4. Giraffe (*Giraffa camelopardalis*)	
Status	**Global IUCN: Vulnerable (VU)** / **National IUCN Status: Not Available**
Notes	Giraffes are the world's tallest land mammal and remain widespread across southern and eastern Africa, with smaller isolated populations in west and central Africa. Giraffes inhabit eighteen African countries including South Sudan. Giraffes are most often found in savanna/woodland habitats. While local FGDs and KIIs indicated the potential presence of this species in the study area, field surveys conducted by the study team and relevant literature did not confirm their occurrence.
Criteria (a)	The IUCN distribution map of this species indicates that the species' range does not overlap with the project study area. Therefore, it is certain that the project site and its

	area of influence do not support this globally threatened species. Consequently, the criteria for determining Critical Habitat under Criterion (a) are not met.
Criteria (b)	Since it's not a restricted-range or endemic species and suitable habitats are not present within the study area, Criteria (b) is not triggered, and no further assessment is required.
Criteria (c)	This is not a congregatory or migratory species and as such this criterion is not relevant.

5. Leopard (*Panthera pardus*)		
Status	**Global IUCN: Vulnerable (VU)**	**National IUCN Status: Not Available**
Notes	Leopards are widely distributed across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range. Due to their wide geographic range, secretive nature and habitat tolerance, Leopards are difficult to categorize as a single species. Evidence suggests that Leopard populations have been dramatically reduced due to continued persecution from increased human populations; habitat fragmentation; increased illegal wildlife trade; excessive harvesting for medicinal use and ceremonial use of skins, spiritual and cultural use of the body parts including skin, claws, teeth, tail, paws, skin and fat; prey base declines; and poorly managed trophy hunting. There are no robust estimates of the total number of mature individuals globally. Over the past three generations (22.3 years) their number decreased at an alarming rate within it range countries including South Sudan. It should also be noted that Focus Group Discussions (FGDs) with locals and relevant Key Informant Interviews (KIIs) suggested their presence in the study area of the project. However, the study team did not record their occurrence in the project's area of influence during field surveys.	
Criteria (a)	The IUCN distribution map of this species suggests that the species is extinct from the Juba site and possibly extinct from other sites within the project's area of influence. As the study area does not support suitable habitats for this species, Criterion (a) is not relevant to this species.	
Criteria (b)	Since it's not a restricted-range or endemic species and suitable habitats are not present within the study area, Criteria (b) is not triggered, and no further assessment is required.	
Criteria (c)	This is not a congregatory or migratory species and as such this criterion is not relevant.	

6. Lion (*Panthera leo*)		
Status	**Global IUCN: Vulnerable (VU)**	**National IUCN Status: Not Available**
Notes	Lions are the carnivores that have undergone the largest range contraction, with about 85% of Lion range lost since CE 1500. Outside sub-Saharan Africa, the Lion formerly ranged from North Africa through Southwest Asia (where it disappeared from most countries within the last 150 years), west into Europe (where it became extinct almost 2,000 years ago), and east into India. The IUCN data suggests that the total number of adult and subadult lions to be between 22,000 and 25,000 lions in Africa. Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their presence in the Bandingilo National Park. However, It should also be noted that the results of recent studies, and field trips at study regions confirmed their absence in the Juba to Bor stretch project AoI of the White Nile River.	
Criteria (a)	The IUCN distribution map of this species suggests that this species still exists in the Bandingilo National Park area, which is close to Juba City but outside the project's area of influence. However, the distribution map also suggests that they are possibly	

	extinct from other parts of the White Nile stretch, including Bor. Therefore, it is unlikely that the project site could support ≥0.5% of the global population, and as such, the thresholds for determining Critical Habitat under Criterion (a) are not met.
Criteria (b)	Since it's not a restricted-range or endemic species, Criterion (b) is not triggered, and no further assessment is required.
Criteria (c)	This species is migratory and gregarious; however, their EAAA, as per the IUCN, does not overlap with the study region, and as such, this species cannot be assessed under this criterion.

7. Nile softshell turtle (*Trionyx triunguis*)		
Status	**Global IUCN: Vulnerable (VU)**	**National IUCN Status: Not Available**
Notes	The Nile softshell turtle ranges widely in Africa and the eastern Mediterranean. It occurs in the coastal regions of southern Turkey from Dalyan to Asi River, and in the Mediterranean coastal area of Israel from Tel Aviv northwards. It inhabits fairly deep water in permanent lakes, rivers, estuaries, coastal lagoons and coastal waters, down to 80 m depth. Limited population data are available through most of the range of Nile softshell turtle. The species is considered fairly common in Sudan, while no population data are available for South Sudan. The species is occasionally caught by fishermen and adults and eggs may be consumed locally. Focus Group Discussions (FGDs) with locals and relevant Key Informant Interviews (KIIs) suggested the presence of the study area of the White Nile River from Juba to Bor. However, despite efforts to prove their presence through direct field surveys, we could not find them, and no species were also observed at fish landings or in markets in Bor or Juba.	
Criteria (a)	Limited population data are available for the Nile softshell turtle throughout most of its range. The population status in East Africa is also unclear. Therefore, it is highly unlikely to comment that Project AoI supports ≥0.5% of the global population concentrations of this species. Thus, the thresholds for determining Critical Habitat under Criterion (a) are not met.	
Criteria (b)	This species is not endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	This is not a congregatory or migratory species and as such this criterion is not relevant.	

8. Hooded vulture (*Necrosyrtes monachus*)		
Status	**Global IUCN: Critically Endangered (CR)**	**National IUCN Status: Not Available**
Notes	The Hooded vulture is often associated with human settlements north of the Equator, but is also found in open grassland, forest edge, wooded savanna, desert and along coasts; and tends to occur at higher densities in areas where populations of larger Gyps vultures are low or nonexistent. Home range size appears closely correlated with commensal breeding, which is connected to human tolerance to vultures. Given evidence of recent declines in various parts of its range, the species' population is estimated to number a maximum of 197,000 individuals. This equates to a maximum of 131,320 mature individuals, rounded here to 131,000. Several individuals of this species were recorded at the Bor port site during our field survey.	
Criteria (a)	Although the area of occurrence (AOO) and distribution map shown in the IUCN Red List of Threatened Species for this species overlap with the Juba to Bor stretch of the White Nile River, it is unlikely that the project study area supports ≥0.5% of the global population concentrations of this species. Thus, the thresholds for determining Critical Habitat under Criterion (a) are not met.	

Criteria (b)	This species is not endemic or range-restricted and as such Criteria (b) is not relevant to this species.
Criteria (c)	This Criterion is not relevant to a resident species.

1.3.4.4 Criterion (d): Highly Threatened or Unique Ecosystems

Guidance Note of ESS 6 defines highly threatened or unique ecosystems as

- At risk of significantly decreasing in area or quality
- With a small spatial extent and/or
- Containing unique assemblages of species including assemblages or concentrations of biome-restricted species.

A comprehensive IUCN assessment of ecosystems within the project's zone on impacts is absent, and no equivalent South Sudan evaluation exists. Consequently, a formal assessment against Criterion 4 is excluded. However, preliminary evaluation of primary habitats within the Juba to Bor stretch of the White Nile River project site and its AoI indicates an absence of habitats qualifying under Criterion (d).

Definition	Assessment
Risk of significantly decreasing in area or quality	The proposed port construction sites in Juba and Bor, along with associated access roads and clearing (dredging) work, may decrease both the extent and quality of the habitat. However, given the wide distribution of this natural habitat type along the White Nile River, it is not currently considered to pose a significant risk.
Small spatial extent	The habitat is widespread.
Containing unique assemblages of species including assemblages or concentrations of biome-restricted species	The vegetation type does not support unique assemblages or a concentration of biome-restricted species.

Based on this assessment, it can be concluded that the project area does not trigger Critical Habitat (CH) concerns under ESS 6 of ESF, Criterion (d).

1.3.4.5. Criterion (e): Ecological Functions or Characteristics that are Needed to Maintain the Viability of the Biodiversity Values Described in ESS6 Critical Habitat Criteria (a) to (d).

ESS6 Criterion (e) focuses on identifying the ecological functions and characteristics essential for the long-term viability of the biodiversity values described in earlier criteria (a) to (d). These values include:

- Habitat of significant importance to Critically Endangered or Endangered species as listed in the IUCN Red List of Threatened Species or equivalent national approaches.
- Habitat of significant importance to endemic or restricted-range species.
- Habitat supports globally or nationally significant concentrations of migratory or congregatory species.
- Highly threatened or unique ecosystems.

In essence, Criterion (e) aims to pinpoint the specific ecological attributes that maintain the viability and integrity of these crucial habitats and the species they support. Quantitative significance thresholds are not established for this criterion. Therefore, expert judgment and qualitative assessment are paramount. The project study area was screened using expert advice. Given the widespread distribution of natural vegetation and the absence of a large number (≥0.5% of the global population) of Critically Endangered or Endangered species, endemic or restricted-range species, migratory or congregatory species, and highly threatened or unique ecosystems, the project area does not qualify for Criterion (e).

1.3.4.6 Conclusions and Recommendation

For determining whether the project port construction sites and the Juba to Bor stretch of the White Nile River comprise a critical habitat, the following guidelines must be applied as per the applicable reference frameworks:

To determine the critical habitat of an area, only the Criterion and thresholds provided for defining a CH are indicative for decision-making as there is no universally accepted or automatic formula.

- To identify critical habitat in the study area or project area, the project type, scale, anticipated impacts or mitigation strategy is irrelevant. Critical habitat identification is based only on the presence of high biodiversity values in the Study Area or project area.
- The assessment of critical habitat must not focus solely on the Project Site but on the whole landscape.
- The CHA must consider the distribution and connectivity of features important to the CH trigger species concerned, as well as the ecological processes that support these features.

Although eight (8) species were reported from the study area as potential trigger species for Critical Habitat (CH), comprising two (02) Critically Endangered (CR) and one (01) Endangered (EN) species according to the global IUCN status. In addition, a comprehensive IUCN Red List of Threatened Species for South Sudan is absent, and no equivalent evaluation exists. According to the assessment conducted following the Environmental and Social Standard 6 (ESS 6) of The World Bank Environmental and Social Framework (ESF) and its Guidance Note (2018), none of the species in the study area meet the threshold limit for Criterion (a). Moreover, the study area does not qualify for CH Criteria (b) to (e) and does not overlap fully or partially with any threatened ecosystems.

Thus, it has been concluded that the proposed project site and study area are not a Critical Habitat for any of the identified species, because the study area does not meet any of the ESS 6 of ESF, 2017 and its Guidance Note (2018) criteria during the critical habitat screening study. Hence, the Project study area does not qualify for critical habitat areas.

1.4 Key Impacts

Direct and indirect impacts on aquatic and terrestrial ecosystems and biodiversity may occur during the following project phases: Construction, Operation, and Decommissioning.

1.4.1 Impacts during the Construction Phase

Habitat Loss and Fragmentation

The construction of ports, access roads, and associated infrastructure will lead to the clearing of vegetation and alteration of landscapes, causing loss and fragmentation of natural habitats. This disrupts terrestrial ecosystems and displaces wildlife, especially in riparian zones, potentially impacting species dependent on these habitats.

Disturbance to Wildlife

Construction activities, including noise, vibrations, and increased human presence, can disturb terrestrial and aquatic wildlife. Sensitive species may be forced to relocate, altering their natural behavior patterns such as feeding, breeding, and migration. Increased movement of machinery and vehicles could also result in direct harm to animals.

Sediment Mobilization and Water Quality Degradation

Dredging and construction near the riverbanks can result in sediment mobilization, increasing turbidity levels in the River Nile. This reduces light penetration, affecting aquatic plants and disrupting fish habitats. Increased sedimentation can also smother aquatic organisms and damage spawning grounds.

Disruption of Aquatic Habitats

Dredging operations can alter the physical structure of riverbeds and riverbanks, potentially destroying aquatic habitats, including fish spawning areas and invertebrate communities. This can affect the biodiversity of aquatic species, particularly fish and invertebrates that rely on these habitats for survival.

Introduction of Invasive Species

Construction activities often involve the movement of materials, equipment, and personnel. This increases the risk of introducing invasive plant or animal species into both terrestrial and aquatic ecosystems, potentially disrupting local biodiversity and outcompeting native species.

Pollution from Construction Activities

Pollutants such as oil, fuel, chemicals, and construction waste can contaminate soil and water resources. Runoff from construction sites may lead to the introduction of toxic substances into the River Nile, affecting water quality and threatening aquatic organisms, particularly fish and amphibians.

1.4.2 Impacts during the Operation and Maintenance Phase

Increased River and Road Traffic and Collision Risks

The operation of the ports, access roads, and rehabilitated waterways will increase river and road traffic, raising the risk of collisions between vessels and aquatic wildlife, as well as between road transport and terrestrial wildlife such as fish, turtles, mammals, and other large aquatic and terrestrial species. This can lead to injury or death of species, particularly in areas where wildlife is abundant.

Water Pollution from Vessel Discharges

Increased vessel activity at the Juba and Bor ports can result in pollution from accidental spills of fuel, oil, or wastewater discharges. These pollutants can degrade water quality, harming aquatic ecosystems and impacting sensitive species such as fish, amphibians, and aquatic plants.

Disruption of Aquatic Habitat from Continued Dredging

Maintenance dredging to keep waterways navigable can continuously disturb riverbed ecosystems. This can disrupt aquatic habitats, particularly those of fish and invertebrate organisms, reducing biodiversity and altering the composition of aquatic species over time.

Noise Pollution from Port Operations

Ongoing operations at the ports, including the movement of ships and the use of heavy equipment, generate noise that can disturb both terrestrial and aquatic wildlife. Noise pollution can interfere with the natural behaviors of species such as communication, mating, and migration, particularly affecting birds, fish, and amphibians.

Light Pollution

Ports and access roads will likely require lighting during nighttime operations. Artificial lighting can disorient nocturnal wildlife, especially birds. It can also disrupt natural behaviors such as navigation, feeding, and breeding, leading to long-term impacts on local biodiversity.

Habitat Disturbance and Encroachment

Operational activities, such as increased human traffic, cargo handling, and road use, can lead to further disturbance of surrounding terrestrial habitats. Wildlife may be displaced, and ecosystems along access roads may be further degraded by vehicle emissions, dust, and encroachment into natural areas. Increased river traffic could facilitate bush meat extraction from Bandingilo National Park for foreign markets, exacerbating unsustainable hunting and potentially leading to the local extinction of certain wildlife species.

Spread of Invasive Species

The movement of goods and vessels through the ports increases the risk of introducing and spreading invasive species. Non-native species could be transported via ballast water or as stowaways on ships

and cargo. These species may outcompete native species, leading to reduced biodiversity in both terrestrial and aquatic ecosystems.

1.4.3 Impacts During the Decommissioning and Dismantling Phase

Habitat Disturbance from Removal of Infrastructure

The decommissioning of ports and access roads may involve the removal of structures, leading to further disturbance of terrestrial and aquatic habitats. This could result in the displacement of wildlife and damage to vegetation in riparian zones and surrounding ecosystems.

Disturbance to Wildlife from Noise and Human Activity

Decommissioning activities, including heavy machinery use and increased human presence, will likely generate noise and vibrations that can disturb both terrestrial and aquatic wildlife, disrupting natural behaviors such as feeding, breeding, and migration.

Waste Generation and Disposal

Decommissioning will generate significant waste, including construction materials and potentially hazardous waste. Improper disposal of this waste could lead to contamination of nearby ecosystems, harming both terrestrial and aquatic species.

1.5 National/ International Standards

National standards and action plans relevant to biodiversity protection and management that are established under the laws and regulations of the Republic of South Sudan include the following:

- Wildlife Conservation and National Parks Act (2003)
- Wildlife Conservation and Protected Areas Bill (2015)
- Forests Bill (2009)
- Freshwater Fisheries Act (1954)
- Forest Policy (2019)
- Fisheries Policy (2012 – 2016)

Republic of South Sudan is a signatory to various international conventions related to biodiversity:

- United Nations Convention on Biological Diversity (CBD).
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Ramsar Convention on Wetlands of International Importance

In addition to the above international conventions, the World Bank Environmental and Social Standard (WB ESS 6) requires that project sponsors avoid, minimize, and restore threats to biodiversity arising from their operations. WB ESS6 also requires project developers to develop and implement a monitoring and evaluation program to document the project's progress in implementing the agreed-upon controls, restoration, and mitigation measures, and their effectiveness at mitigating impacts.

1.6 Management Plan for Construction Phase

Table-4: Management Plan for Construction Phase

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
Management Plan for Ecosystem Services				
Ecosystem Services	• Reduced fish stocks due to habitat disruption and pollution from construction activities. • Damage to wetlands and riparian vegetation, reducing flood control and water purification capacity. • Increased flooding risks for downstream communities due to impaired water flow management. • Compromise of the Nile's cultural and spiritual significance, impacting local recreational and spiritual practices. • Diminished appeal for ecotourism and recreation due to disruption of the river's natural beauty, affecting the local economy and community identity. • Loss of wildlife habitats, reducing breeding grounds and shelters for fish, birds, and other wildlife.	• Implement sediment control measures (e.g., silt fences) to reduce pollution from dredging and construction runoff. • Test dredged materials for contaminants before disposal; dispose of toxic materials in a controlled manner. • Designate disposal sites away from sensitive habitats (wetlands, riparian zones) to protect aquatic life and maintain water quality. • Relocate and rehabilitate the business community involved in the fishing and dry fish industry to ensure their livelihoods are preserved. • Restore disturbed habitats by replanting native vegetation and rehabilitating affected areas. • Provide alternative fuel sources (e.g., gas cylinders) to reduce pressure on park vegetation. • Implement erosion control techniques (e.g., vegetation buffers) to prevent soil degradation and protect agricultural land. Encourage community engagement to preserve cultural and spiritual values associated with the river and surrounding environment.	Contractor	PIU of MOT

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	• Decreased biodiversity undermining ecosystem resilience and essential ecological processes (e.g., pollination, nutrient cycling).			
Habitat Types	• Dredging and sediment transport can degrade water quality, harm fish populations, and damage vital spawning grounds of the fish species. • Sediment disruption may impact migratory birds and other species that rely on the wetlands. • Noise and pollution from construction activities may disturb sensitive riparian and woodland habitats, affecting key wildlife species. • Worker camps and storage areas may increase encroachment, waste pollution, and human-wildlife conflicts, negatively impacting natural habitats nearby. • Emissions from diesel generators and vehicles could harm both wildlife and vegetation, reducing overall	• Implement silt curtains and sediment traps during dredging to minimize sediment dispersal and protect water quality in sensitive aquatic habitats. • Schedule construction activities during non-breeding seasons for key wildlife species to reduce disturbance to fish spawning grounds and migratory bird habitats. • Limit access to natural habitats, especially near Bandingilo National Park to prevent encroachment and reduce human-wildlife conflict. • Use low-emission machinery and regularly maintain equipment to reduce air pollution and minimize noise impact on nearby wildlife. • Develop a waste management plan to ensure safe disposal of solid, hazardous, and sewage waste, preventing contamination of soil and water in sensitive habitats.	Contractor	PIU of MOT

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	habitat quality and ecological stability.			
Management Plan for Aquatic Ecosystem and Biodiversity				
Aquatic flora	• Disturb or destroy aquatic plant communities. • Can stir up fine sediment particles, which can reduce water clarity and light penetration, negatively affecting some aquatic plant species • Accidental spilled oil and chemicals from dredgers can also impact negatively the aquatic flora. • Ignorance of dredge workers and the use of heavy machinery and equipment during dredging can damage plants or their root systems, leading to their death.	• Employ techniques to control sedimentation, such as silt curtains and sediment traps. • Stabilize riverbanks during and after construction to prevent erosion and sedimentation, which could further impact aquatic flora. • Ensure proper handling of hazardous materials, solid waste, and sewage to prevent contamination of the river. • Develop and implement a plan to prevent the introduction and spread of invasive species. • Establish a comprehensive water quality monitoring program to track changes in water parameters and identify potential pollution sources. • Train dredge workers on the importance of preserving aquatic flora and the potential impacts of their activities.	Contractor	PIU of MOT
Aquatic Wildlife	• Physical injury or mortality due to contact with dredging equipment. • Noise pollution can have adverse effects on the behavior and health of aquatic megafauna. • Cause changes to the habitat of aquatic megafauna, including	• Avoid elimination of the aquatic habitats, breeding, and feeding areas of the wildlife species. • Schedule dredging and construction during times when aquatic and semi-aquatic wildlife species are less likely to be present, such as outside the nesting and breeding seasons. • Use noise-reducing technologies such as mufflers or bubble curtains around pile-driving	Contractor	PIU of MOT

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	changes to the substrate, water quality, and food availability; • Changes to water quality, such as increased sedimentation and turbidity, can also have negative impacts on crocodiles and monitor lizards by reducing the availability of food or causing respiratory problems.	equipment to minimize underwater noise pollution. • Limit the use of heavy machinery during sensitive periods such as nesting or hibernation seasons. • Implement sediment control measures, such as silt curtains, to minimize turbidity and avoid the release of trapped pollutants. • Regularly monitor water quality to detect changes in pollutant levels that could harm aquatic species. • Implement a comprehensive biodiversity monitoring plan to track the presence and health of aquatic megafauna before, during, and after construction. • Provide environmental awareness training for workers on the importance of aquatic megafauna conservation, encouraging safe practices to avoid unnecessary harm to these species during construction and dredging activities.		
Fisheries Resources	• Turbidity, sedimentation, resuspension, and release of contaminants impact local fish and crustacean populations. • Loss of natural habitat can render new dredged habitats unsuitable for shallow-water species. • Deeper habitats may make a river more vulnerable to	• Use silt curtains or other barriers to limit the spread of sediments during construction and dredging. • Schedule construction and dredging activities to avoid critical fish breeding and migration seasons. • Employ noise and vibration reduction techniques, such as bubble curtains or dampeners, to minimize the impact of underwater noise on fish.	Contractor	PIU of MOT

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	exploitation by invasive non-native species.	• Implement continuous water quality monitoring during construction and dredging to ensure that key parameters (turbidity, dissolved oxygen, pollutants) remain within acceptable limits. • Properly manage hazardous materials and waste, ensuring that spills are prevented, and any waste materials are handled and disposed of in compliance with environmental standards.		
Plan for Terrestrial Ecosystems and Biodiversity				
Terrestrial Flora	• Damage of habitat for many plant species, leading to their displacement • Construction activities will fragment habitats, ultimately leading to habitat loss. • Affect the growth and survival due to dust emission from loose stockpiles, soil excavation, and soil compaction and erosion. • There will be a high risk of introducing invasive species by construction and dredging workers.	• Reduce unnecessary clearance of vegetation cover for construction of ports, access roads, and preparation of dredged materials disposal site. • Regular water spraying should be implemented in the construction areas to suppress the generated dust. • Replanting native tree species, especially those that were removed during the construction phase. Priority should be given to ecologically important native species. • Proper management of dredged materials and erosion control measures, such as silt fences and vegetation barriers. • Proper handling, storage, and disposal of hazardous materials and waste will help prevent contamination of soil and vegetation. • Plant health monitoring should be conducted.	Contractor	PIU of MOT
Avifauna	• Site clearance for the port and access road could potentially	• Minimize the extent of habitat clearance and avoid clearing areas of high ecological		

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	reduce the avifauna foraging and breeding ground. • Dredging can remove or alter important habitats for birds. • Alter the food chains in aquatic ecosystems. • Noise, vibrations, and other disturbances can disrupt the behavior of birds. • Sediment and other dredged materials can contain toxins, heavy metals, and other pollutants that can accumulate in the food chain and harm bird populations.	importance, such as wetlands and riverbanks, which are crucial for birds. • Limit noisy activities, such as construction and dredging, during sensitive periods for birds, particularly breeding and nesting seasons. • Implement strict pollution control measures to prevent fuel, oil, and hazardous material spills from contaminating the river. • Ensure proper waste disposal and sewage treatment from construction camps to prevent water pollution. • Use silt curtains or other barriers during dredging to contain sediment resuspension and prevent the degradation of water quality in areas used by birds for feeding. • Establish a bird monitoring program to track the impacts of construction and dredging on bird populations. • Train construction workers on the importance of protecting avifauna and their habitats.	Contractor	PIU of MOT
Herpetofauna	• Alter the aquatic and terrestrial habitats of herpetofauna. • Disrupt the breeding cycles of herpetofauna. • Harm herpetofauna, particularly during excavation and dredging operations. • Can cause changes in water quality, leading to the loss of suitable habitats for aquatic herpetofauna.	• Minimize habitat destruction by designating and protecting areas of high ecological importance, such as riparian zones and wetlands. • Schedule construction activities to avoid critical periods, such as the breeding and nesting seasons of amphibians and reptiles. • Implement strict pollution control measures to prevent fuel, oil, and hazardous material spills.		

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	• Increase the risk of predation for herpetofauna by disturbing their natural habitats and making them more vulnerable to predators.	• Limit noise pollution by using quieter machinery where possible and installing noise barriers around construction sites. • Restrict nighttime activities to avoid disturbing amphibians and reptiles. • Use silt curtains or other sediment control measures during dredging to reduce turbidity and prevent sediment from smothering aquatic habitats. • Design access roads and infrastructure to allow for the free movement of reptiles and amphibians. • Install wildlife crossings or culverts to facilitate the safe passage of herpetofauna species across roads and other barriers. • Establish a herpetofauna monitoring program to assess the impacts of construction and dredging activities on local populations.	Contractor	PIU of MOT
Terrestrial Mammals	• Destruction of habitats by clearing the vegetation. • Habitat will be fragmented due to construction activities and can create an edge effect. • Excessive light during construction activities can disrupt the natural behavior of wildlife. • Carelessness by construction workers may lead to forest fires, resulting in wildlife death. • Disrupt the food sources.	• Minimize habitat destruction by limiting site clearance to essential areas and preserving wildlife corridors to maintain habitat connectivity. • Noise and light control measures to reduce disturbance to wildlife. • Speed limits and warning signs on access roads to prevent vehicle collisions with mammals. • Proper waste and hazardous materials management to prevent contamination of soil and water sources.	Contractor	PIU of MOT

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	• Noise pollution and vibration can disturb behavior and communication.	• Rehabilitation of disturbed habitats post-construction, including replanting native vegetation to restore habitats. • Establish a monitoring program to assess the impacts of construction and dredging activities on local populations.		
Protected Areas	• Potential vegetation clearance for temporary access road preparation may cause habitat fragmentation. • Dredging work can disturb wildlife, particularly birds • Improper disposal of hazardous construction waste in the protected area can harm floral and faunal species. • Oil spills, construction waste, and wastewater discharge can harm ecosystems. • Changes in water quality or availability (e.g., from construction or pollution) can create conditions that allow non-native/ invasive species to thrive. • Dredged material disposal near protected areas can smother habitats	• Dispose of dredged material away from sensitive habitats of the protected areas (wetlands, riparian zones, wildlife corridors). • Test dredged material for contaminants; treat or dispose of toxic material in a controlled manner. • Use sediment control techniques (silt fences, vegetation buffers) to prevent erosion and runoff. • Restore affected areas by replanting native trees and rehabilitating disturbed habitats. • Provide gas cylinders to workers to reduce pressure on park vegetation. • Continuously monitor disposal sites and surrounding habitats; implement corrective actions as needed.	Contractor	PIU of MOT/

Issues/ Components	Potential Impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	• Clogging of wetlands, altered water levels, and disruption of biodiversity • Dredged material may contain pollutants that can poison plants and animals • Dredged material disposal can degrade habitats used by migratory birds, affecting food availability and population decline			

1.6.1 Management Plan for Operation Phase

Table-5 Management Plan for the Operation Phase

Issues/ Components	Potential impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
Management Plan for Ecosystem Services				
Ecosystem Services	• Impacts on fisheries, freshwater supply, and economic livelihoods • Increased access to biodiverse regions leading to unchecked development • Pollution from port operations affecting drinking water, irrigation, and livestock use • Displacement of dry fish processing centers impacting food security and the local economy • Facilitation of bush meat extraction for foreign markets.	• Implement sustainable fishing practices and establish protected zones to preserve fish stocks. • Enforce regulations to control unchecked development and protect key habitats around Bor. • Establish pollution controls, including waste management systems, to prevent fuel spills and runoff from degrading the Nile's water quality. • Develop alternative livelihoods for the displaced dry fish processing community to minimize economic hardship.	MOT	MOWI, Ministry of Wildlife Conservation and Tourism, Ministry of Animal Resources and Fisheries

Issues/ Components	Potential impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	• Impacts on flood control, water purification, and erosion prevention • Diminished aesthetic value of the Nile and negative impact on tourism and cultural identity. • Loss of habitats, reduced biodiversity, and weakened ecosystem resilience.	• Enforce strict wildlife protection laws to prevent illegal bush meat extraction and unsustainable hunting. • Promote ecotourism and cultural preservation initiatives to protect the Nile's cultural and spiritual significance. • Establish biodiversity conservation programs to protect key habitats and enhance ecosystem resilience.		
Management Plan for Aquatic Ecosystems and Biodiversity				
Aquatic flora and fauna	• Continuous port operations and increased river traffic can affect fish breeding grounds and biodiversity. • Fuel spills, waste discharge, and runoff can contaminate the river. • Disruption of wetlands and riverbanks can reduce breeding grounds and weaken ecosystem resilience. • Increased river traffic may introduce invasive species that outcompete native species. • Improved access could lead to overfishing and unsustainable resource extraction. • Dredging can result in more frequent maintenance dredging and altered river flow, leading to erosion and further impacts on species.	• Implement sustainable dredging practices to minimize habitat disruption and maintain natural river flow patterns. • Establish pollution control measures to prevent fuel spills and regulate waste discharge, protecting water quality. • Create protected zones for wetlands and riparian areas to preserve key breeding grounds and maintain biodiversity. • Monitor and control invasive species introduction, implementing rapid response plans to mitigate their impact on native species. • Develop and enforce sustainable fishing regulations to prevent overfishing and protect key fish species. • Conduct regular biodiversity monitoring to assess the health of the ecosystem and the status of vulnerable species. • Promote ecological restoration programs to rehabilitate degraded habitats and restore natural ecosystem functions.	MOT	Ministry of Wildlife Conservation and Tourism

Issues/ Components	Potential impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
Management Plan for Terrestrial Ecosystems and Biodiversity				
Terrestrial flora and fauna	• Increased river traffic affects birds, mammals, and herpetofauna. • Impacts on riverine islands and floodplains, disrupting migratory bird behavior. • Greater access leads to displacement of large mammals, increased poaching, and human-wildlife conflict. • Roads, port operations, and maintenance dredging altering riparian habitats • Human activity and infrastructure contributing to the degradation of native ecosystems • Port operations disrupt wildlife behavior and potentially cause habitat abandonment.	• Implement noise reduction technologies on vessels and machinery to minimize disturbances to wildlife. • Use directional lighting and shielded fixtures to reduce light pollution and its impact on nocturnal and migratory species. • Limit infrastructure expansion and access roads to prevent further fragmentation of critical ecosystems. • Conduct community awareness programs to educate local populations about wildlife conservation and the importance of protecting habitats. • Establish wildlife corridors to facilitate safe movement and migration of species between fragmented habitats. • Monitor and restore degraded vegetation areas through replanting and management of invasive species. • Develop and enforce strict regulations against poaching and illegal hunting to protect vulnerable species. • Promote the use of native plant species in landscaping and restoration projects to maintain ecosystem integrity. • Establish protocols for the proper handling and disposal of solid, liquid, and hazardous wastes generated from port operations. • Implement air quality monitoring to assess and mitigate the effects of emissions from vehicles and machinery.	MOT	Ministry of Wildlife Conservation and Tourism,

Issues/ Components	Potential impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
		• Conduct regular ecological assessments to evaluate the impacts of port operations on terrestrial ecosystems and biodiversity.		
Protected Areas	• Disrupting wildlife behavior and affecting breeding success • Oil spills, wastewater discharge, and pollutants can harm ecosystems • Sediment accumulation smothering vegetation and disrupting habitats • Altered water levels and disrupted hydrological processes • Dredged material disposal introduces harmful substances • Habitat loss and food scarcity leading to a decline in populations • Increased presence raises the risk of illegal activities and habitat degradation	• Implement noise-reducing technologies for vessels and equipment. • Schedule operational activities to minimize nighttime operations and reduce light pollution. • Establish spill prevention and response plans for oil spills and wastewater discharge. • Limit dredging and material disposal to designated areas to prevent sediment accumulation in critical habitats. • Restore degraded riparian zones to enhance biodiversity and ecological balance. • Regularly test dredged materials for harmful substances before disposal. • Conduct regular wildlife surveys to monitor populations and habitat conditions, particularly for migratory birds. • Establish conservation measures to protect sensitive species and their habitats. • Enforce strict access controls to protected areas to prevent illegal logging and poaching. • Promote community awareness and involvement in conservation efforts to mitigate human-wildlife conflict.	MOT	Ministry of Wildlife Conservation and Tourism, MOEF

1.6.2 Management Plan for Decommissioning Phase

Table-6 Management Plan for the Decommissioning Phase

Issues/Components	Potential impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
Management Plan for Aquatic Ecosystem and Biodiversity				
Aquatic Flora and Fauna	• Removal of structures and equipment may increase turbidity and smother aquatic habitats. • Improper storage or handling of fuels and chemicals could lead to leaks and spills. • Dismantling of structures may result in the loss of habitats developed around piers or underwater structures. • Underwater noise from vehicle movement and demolition activities could disrupt aquatic species. • Dust deposition on plant leaves could hamper photosynthesis. • Improper treatment and disposal of waste could further pollute water bodies. • Movement of equipment and vessels may introduce or spread invasive species. • Dismantling port structures could alter water flow patterns, leading to erosion, sedimentation, or changes in water quality.	• Implement spill prevention plans, provide secondary containment for fuel storage, and ensure rapid-response teams are available for spill clean-up. • Use silt curtains and schedule activities during low-current periods to minimize sediment suspension. • Regularly spray water to suppress the generated dust. • Assess existing habitats around structures before dismantling and consider habitat relocation or restoration plans. • Use low-noise machinery, limit demolition activities to times when aquatic species are less active and employ acoustic deterrents if needed. • Clean and inspect all equipment and vessels before entry and exit to prevent the spread of invasive species.	Decommissioning Contractor	MOT
Management Plan for Terrestrial Ecosystem and Biodiversity				
Terrestrial Flora and Fauna	• Removal of infrastructure leads to vegetation clearance and destruction of critical habitats.	• Restrict vehicle movement to predefined paths and minimize the footprint of dismantling activities.	Decommissioning Contractor	MOT

Issues/Components	Potential impacts	Proposed mitigation/ enhancement measures	Responsibility	
			Implementation	Supervision
	• Fuels, chemicals, and waste at port facilities can contaminate the soil. • Runoff from the decommissioning site can pollute nearby water bodies. • Dismantling activities and equipment movement can introduce invasive species. • Decommissioning process can stress wildlife and disrupt their natural behaviors. • Dust generated could be deposited on plant leaves, potentially hampering photosynthesis.	• Store fuels and chemicals in designated, secure areas to prevent spills and contamination. • Regularly spray water to suppress the generated dust. • Ensure all waste, including hazardous materials, is treated and disposed of in compliance with environmental regulations. • Restore disturbed sites by replanting native species and rehabilitating habitats after decommissioning. • Conduct regular monitoring of the site for invasive species and implement measures to prevent their spread. • Involve local communities in the planning and implementation of the decommissioning process to ensure their concerns are addressed and they benefit from the project.		

1.7 Biodiversity Monitoring Plan

The effectiveness of various mitigation measures is described and will be monitored through a well-defined biodiversity monitoring program. A biodiversity monitoring program is important as it provides useful information on the following aspects:

a) It helps to verify the predictions on ecological impacts presented in this study.
b) It helps to identify the need for improvements in the management plans.
c) It helps to verify compliance with statutory and community obligations.
d) It helps to indicate warnings of the development of any alarming ecological situations and thus, provides opportunities for adopting appropriate control measures.

The monitoring program for different biological components, outlined in the next few sections, has been based on the findings of the impact assessment studies described earlier.

The suggested monitoring plan for the construction, operation, and decommissioning phase of the proposed project is given in Table-7, Table-8, and Table-9 respectively.

Table-7: Biodiversity Monitoring Plan for Construction Phase

Aspects/env. Attributes/issues	Parameters/units	Monitoring locations	Means of monitoring	Frequency	Responsibility	
					Implementation	Supervision
Aquatic Flora	Monitoring of removal of aquatic flora	Clearing (dredging) and disposal sites and river port	Visual Inspection	Daily during clearing (dredging)	Contractor	PIU of MOT
Aquatic Wildlife	Monitoring of death/movement/ capture/killing/ disturbance/breeding/ migration of aquatic wildlife	Clearing (dredging) and disposal location and river port	Visual inspection and record keeping including photographs if available	Daily during clearing (dredging)	Contractor	PIU of MOT
Fisheries Resources	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of fish fauna	Clearing (dredging) and dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging)	Contractor	PIU of MOT
Terrestrial Flora	Monitoring of cut/removal of terrestrial flora	Riverport construction site	Visual inspection and record-keeping	Daily during site clearing	Contractor	PIU of MOT
Avifauna	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of avifauna	Clearing (dredging) and dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging) and site clearing	Contractor	PIU of MOT
Herpetofauna	Monitoring of death/movement/capture/ killing/disturbance	Dredged material disposal site and port construction site	Visual inspection and record keeping including	Daily during clearing (dredging) Daily during	Contractor	PIU of MOT

Aspects/env. Attributes/issues	Parameters/units	Monitoring locations	Means of monitoring	Frequency	Responsibility	
					Implementation	Supervision
Terrestrial Mammals	Monitoring of death/movement/capture/ killing/disturbance/ breeding/migration of terrestrial mammals	Dredged material disposal site and port construction site	Visual inspection and record keeping including photographs if applicable	Daily during clearing (dredging) Daily during clearing (dredging) and site clearing	Contractor	PIU of MOT
Protected Areas	Loss of protected area (hectares), Number of mature trees removed, Occurrence of different wildlife Species and their movement	Within a 1000m radius of each dredging location and dredged material disposal site Near Protected Areas.	Visual Inspection	Daily during clearing (dredging) Daily during clearing (dredging) and site clearing	Contractor	PIU of MOT

Table-8: Biodiversity Monitoring Plan for Operation Phase

Aspects/env. Attributes/issues	Parameters/units	Monitoring locations	Means of monitoring	Frequency	Responsibility	
					Implementation	Supervision
Aquatic flora and Fauna	Monitoring of cut/death/movement/ capture/killing/ disturbance/ breeding/migration of aquatic fauna	Upstream and downstream of the port construction site	Visual inspection and record keeping including photographs if applicable	Semi-annual	MOT	Ministry of Wildlife Conservation and Tourism, Ministry of Animal Resources and Fisheries
Terrestrial Flora and Fauna	Monitoring of cut/death/movement/ capture/killing/ disturbance/	Upstream and downstream of	Visual inspection and record keeping including	Semi-annual	MOT	Ministry of Wildlife Conservation

Aspects/env. Attributes/issues	Parameters/units	Monitoring locations	Means of monitoring	Frequency	Responsibility	
					Implementation	Supervision
	breeding/migration of aquatic fauna	the port construction site	photographs if applicable			and Tourism
Protected Areas	Occurrence of different wildlife Species and their movement	Within a 1000m radius of each maintenance dredging location and dredged material disposal site Near Protected Areas	Visual inspection and record keeping including photographs if applicable	Semi-annual	MOT	Ministry of Wildlife Conservation and Tourism

Table-9: Biodiversity Monitoring Plan for Decommissioning Phase

Aspects/env. Attributes/issues	Parameters/units	Monitoring locations	Means of monitoring	Frequency	Responsibility	
					Implementation	Supervision
Aquatic ecosystem and biodiversity	Death/disturbance capture of aquatic flora and fauna	Dismantling sites specifically the river near the port and adjacent area	Visual Inspection	Weekly	Decommissioning Contractor	MOT
Terrestrial Ecosystem and Biodiversity	Death/disturbance capture of aquatic flora and fauna	Dismantling sites	Visual Inspection	Weekly	Decommissioning Contractor	MOT

1.8 Biodiversity Conservation Measures

Clearing (dredging) activities in the White Nile River will have a potential negative impact on aquatic flora. These activities will disrupt the delicate ecological balance of the river, leading to habitat loss, water quality degradation, and the introduction of invasive species. However, the loss of vegetation will recover quickly, and consequently, the habitat will regain its previous state within a suitable time frame. Therefore, no net loss of biodiversity components is expected in the long run for aquatic ecosystems, and no biodiversity offset is needed.

In terrestrial ecosystems, some trees will be felled in the port construction area of Bor and access road preparation in Juba and Bor ports. The establishment of workers' facilities, laydown areas, and storage facilities could further contribute to small-scale vegetation clearance. During the project implementation phase, several biodiversity components will be severely affected. The length of the project will lead to a longer and continuous impact on the biodiversity values of the project area. Mitigation measures outlined in the Biodiversity Management Plan will be implemented to reduce the impacts on these components. However, there will be residual impacts on the terrestrial ecosystems in the port construction area in Bor, which could potentially cause a net loss of biodiversity in the larger area. Therefore, the offset measures detailed are proposed to enhance the habitats for biodiversity in the port construction and access road area and ensure the conservation of the existing biodiversity values of the project area. Conservation efforts need to compensate for the loss of biodiversity values due to project activities, which will be achieved through these offset measures.

1.8.1 Habitat Management Biodiversity Offset

The contractor in consultation with PIU will implement a Habitat Management Procedure (HMP) to offset impacts on terrestrial natural habitats caused by the Project components. The Project modifications consist of clearing vegetation within the Bor port construction area and the access road construction areas of Juba and Bor ports.

The objectives of the HMP are to i) provide enhancement measures for terrestrial biodiversity in the port and access road areas, and ii) establish the biodiversity offset required to achieve No Net Loss of Modified, Natural, and Critical Habitats, with input from local specialists and stakeholders as appropriate.

The activities to be undertaken include:

- Plant native tree species and native grasses with organic fertilizer in areas where trees have fallen to stabilize ground conditions on bare slopes, improve ecological resilience, and reduce rainwater runoff and erosion.
- Plant native tree species in areas surrounding the ports and other infrastructure to reduce erosion and improve landscape connectivity.
- Support local nurseries to grow more trees to be planted and used by the local community, as possible.
- Restore river courses by planting native trees and removing fallen trees and large rocks that may cause flooding and increased erosion.
- Create microhabitats and hibernacula for animals impacted by the loss of tree canopy cover.

The contractor and PIU will jointly identify degraded areas resulting from project implementation for restoration. This assessment will be based on reduced and fragmented habitat cover, bare exposed ground, amount of downed or damaged trees, and areas of debris buildup due to port and road construction. The contractor will restore the identified areas of land to compensate for the loss of vegetation and wildlife habitat and will adhere to the “like-for-like or better” principle.

1.9 Transfer of Knowledge (Training) Program

1.9.1 Component 1: Training

Implementation of the Biodiversity Management Plan will largely depend on the capacity of the implementing agency, PIU, and other relevant stakeholders. In this regard, a Transfer of Knowledge (Training) Program will be carried out by the supervising agency (Supervision Consultant) appointed by the Ministry of Transport. The following training programs will be arranged for concerned stakeholders:

- One training session on the implementation of the Biodiversity Conservation Plan.
- One training session on the Biodiversity Monitoring Plan and Habitat Management Procedure.
- One training session on Relevant environmental and social aspects of the Contract, including health and safety matters, Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH).

1.9.2 Training Module Preparation

The supervision consultant appointed by MOT will follow the following procedure for arranging the training season:

- Training will be arranged prior to the biodiversity implementation work
- Training Content development and sharing with PIU, MOT
- Finalizing the list of participants as per discussion with PIU
- Number of participants will be not more than 25 persons
- Draft Presentation module preparation
- Pre-knowledge test questionnaire and session plan
- Conducting the training
- Training Evaluation and Training report preparation

During conducting the training session, the following considerations will be considered –

- Venue, food, stationery, and all logistic support will be arranged by supervision consultant
- Participants will be informed of the rules and objectives of the training along with invitation letters.
- The training will encompass various participatory training delivery methods i.e. role play, learning games, simulation, etc. Which includes:
  - Methods include demonstrations, exercises, and active discussions.
  - Use of training aids such as charts; to add clarity to instructions, stimulate the participants, and enhance the trainee orientation of training.
  - Execute activities and ensure that the training sessions are interactive and participatory.
  - Conduct pre and post-training assessments of the participants.
  - Ensure that feedback is collected systematically, and evaluate the relevance and effectiveness of the training, partially based on evaluation templates.
  - Execute training online if unforeseen situations arise.

1.9.3 Mode of Training

The training sessions will be emphasized to be conducted physically. However, considering the unforeseen situation and government guidelines, the consultant team will discuss with the PIU team and arrange the sessions online as necessary.

Appendix D-5: Chance Finds Procedure

This chance find procedure has been developed in accordance with the mandate of the Director of Archives and Antiquities under the Ministry of Culture, Youth and Sports of South Sudan for protecting and preserving both the tangible and intangible cultural heritage records in the project area as well as the requirements of the World Bank Environmental and Social Standards (ESS8).

The objectives of the procedure are to:

- Define the steps that must be followed to manage the discovery of previously unknown cultural heritage, including the preservation and appropriate treatment of these finds, while also minimizing the potential disruption to the project schedule.
- Enable compliance with relevant national laws and regulations along with other requirements that relate to the discovery of heritage items.

If a chance find is discovered in the project area the following steps should be undertaken:

- Work should be stopped immediately in all construction/clearing (dredging) activities in the area of the chance find.
- Immediately informed the Project Implementation Unit (PIU) of the Ministry of Transport (MOT) about the chance find.
- The find(s) should be marked and protected via fencing/blocking off.
- Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remains, a security guard should be present until the Director of Archives and Antiquities (DOAA) under the Ministry of Culture, Youth and Sports takes over immediately (within 24 hours or less).
- Notify the Project Coordinator of the Ministry of Transport who in turn will notify the Director of Archives and Antiquities (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include aesthetic, historic, scientific or research, social, and economic values.
- Decisions on how to handle the findings shall be taken by the authority. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration, and salvage.
- Implementation of the authority decision concerning the management of the finding shall be communicated in writing by the DOAA.
- Construction work could resume only after permission is given by the DOAA concerning the safeguarding of the heritage.

The Contractor's E&S team will submit a chance find report to the MOT within one day of the find. This will record the following information but are not limited to:

- Date and time of the discovery.
- Location of the discovery (GPS coordinates and maps, as appropriate).
- Description/photograph of the cultural resources.
- Estimated weight and dimensions of the find.
- Temporary protection that has been implemented (if any).

The chance finds report will be submitted to any other concerned parties following national legislation. In case of delay incurred in direct relation to archaeological findings not stipulated in the contract agreement and affecting the overall work schedule, the contractor may apply for a time extension. However, the contractor will not be entitled to any kind of compensation other than what is directly related to the execution of the archaeological findings works and protections.

APPENDIX E

Appendix E: STUDY TEAM

The Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile in South Sudan was prepared by EQMS Consulting Limited, Bangladesh in association with the sub consultant Besmart Inter Technology Solution of Juba, South Sudan (hereafter referred to as the "Consultant") under contract to the Ministry of Transport (MOT) of the Republic of South Sudan. EQMS-Besmart was selected by the MOT following a competitive bidding process for undertaking the ESIA.

Project Name: *Environmental and Social Impact Assessment for the Rehabilitation and Construction of the Juba and Bor Ports, their Access Roads, and for Clearing (Dredging) Works Between the Juba-Bor Section of the River Nile*

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2.	Md. Zahidul Islam	Environmental Specialist	• Masters in Environmental Science and Management, Jahangirnagar University, 2021 • Master of Science in Disaster Management, University of Dhaka, 2014 • Master of Science in Geography and Environment, Jahangirnagar University, 2008 • Bachelor of Science in Geography and Environment, Jahangirnagar University, 2007	15
3.	Md. Mahfuzur Rahman	Social Development Specialist	• Master of Social Science (MSS), ShahJalal University of Science and Technology, Sylhet, 2011 • Bachelor of Social Science, ShahJalal University of Science and Technology, Sylhet, 2010	12
4.	Sk. Salahuddin Ahammad	Water Quality Specialist	• Masters in Environmental Science and Management, Jahangirnagar University, 2022 • M.Sc. in Chemical Engineering, Bangladesh University of Engineering and Technology, 2008	15

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5.	K. M. Mijanur Rahman, PhD	Ecologist	• Ph.D. in Biological Sciences (Specialization: Ecology), Kazan (Volga Region) Federal University, Kazan, Russian Federation, 2019 • M.Sc. in Zoology (Specialization: Wildlife Ecology, Management and Conservation Biology), Jahangirnagar University, Savar, Dhaka, 2008 • B.Sc. in Zoology, Jahangirnagar University, Savar, Dhaka, 2007	15



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