



## Environmental Impact Assessment (EIA)

### Simplified Environmental Study (SES) Report



## Preparatory Survey for the Project of Construction of Natete Bridge in the Republic of Mozambique

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#### **As Subcontractor by**

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## ACRONYMS AND ABBREVIATIONS

|          |                                                                    |
|----------|--------------------------------------------------------------------|
| AASHTO   | American Association of State Highway and Transportation Officials |
| AQUA     | Agência Nacional de Qualidade e Controle Ambiental                 |
| ANAC     | Administração Nacional de Áreas de Conservação                     |
| ANE      | National Roads Administration                                      |
| AfDB     | African Development Bank Group                                     |
| ARA      | Administração Regional de Águas                                    |
| ARAP     | Abbreviated Resettlement Action Plan                               |
| AQUA     | Agência Nacional para o Controlo da Qualidade Ambiental            |
| CCEP     | Communication and Community Engagement Plan                        |
| CBD      | Convention on Biological Diversity                                 |
| DIA      | Direct Influence Area                                              |
| DINAMC   | Direcção Nacional do Ambiente e Mudanças Climáticas                |
| DPOPH    | Direção Provincial de Obras Públicas e Habitação                   |
| DUAT     | Direito de Uso e Aproveitamento de Terra                           |
| EIA      | Environmental Impact Assessment                                    |
| EPT      | Environmental Management Team                                      |
| EN       | Estrada Nacional                                                   |
| EO       | Environmental Officer                                              |
| ERP      | Environmental Rehabilitation Plan                                  |
| ESO      | Environmental and Social Officer                                   |
| ESMP     | Environmental and Social Management Plan                           |
| GoM      | Government of Mozambique                                           |
| GRM      | Grievance Redress Mechanism                                        |
| HSE      | Health, Safety and Environment                                     |
| HIV/SIDA | Human Immune Deficiency/Virus/ acquired immunodeficiency syndrome  |
| IFC      | International Finance Corporation                                  |
| IIA      | Indirect Influence Area                                            |
| IIAM     | Instituto de Investigação Agronómica de Moçambique                 |
| INAM     | Instituto Nacional de Meteorologia                                 |
| INE      | Instituto Nacional de Estatística                                  |
| INGD     | Instituto Nacional de Gestão de Desastres                          |
| IUCN     | International Union for Conservation of Nature                     |
| JICA     | Japan International Cooperation Agency                             |
| KBA      | Key Biodiversity Area                                              |
| LC       | Local Community                                                    |
| LCC      | Local Coordination Committee                                       |
| MAAP     | Ministério de Agricultura, Ambiente e Pescas                       |
| MAE      | Ministério da Administração Estatal                                |
| MITESS   | Ministério do Trabalho, Emprego e Segurança Social                 |
| MISAU    | Ministério da Saúde                                                |
| PAI      | Project Area of Influence                                          |
| PCEP     | Communication and Community Engagement Plan                        |
| PMU      | Project Management Unit                                            |
| PPE      | Personal Protective Equipment                                      |
| PRA      | Environmental Rehabilitation Plan                                  |

|        |                                                                  |
|--------|------------------------------------------------------------------|
| PRM    | Polícia da República de Moçambique                               |
| RAP    | Resettlement Action Plan                                         |
| SDAE   | Serviços Distritais de Actividades Económicas                    |
| SDPI   | Serviços Distritais de Planeamento e Infra-estruturas            |
| SEP    | Stakeholder Engagement Plan                                      |
| SPA    | Serviço Provincial do Ambiente                                   |
| SES    | Simplified Environmental Study                                   |
| STACC  | Saskatchewan Apprenticeship and Trade Certification Commission   |
| SWS    | Small Water System                                               |
| ToR    | Terms of Reference                                               |
| TIPA   | Tropical Important Plant Area                                    |
| TVM    | Televisão de Moçambique, EP                                      |
| UNCCD  | United Nations Convention to Combat Desertification              |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNFCCC | United Nations Framework Convention on Climate Change            |
| WB     | World Bank                                                       |
| WMP    | Waste Management Plan                                            |
| WHO    | World Health Organization                                        |

## SYMBOL

|                   |                                                 |
|-------------------|-------------------------------------------------|
| °                 | Degrees                                         |
| °C                | Degrees Celsius                                 |
| m                 | Meters                                          |
| mm                | Millimeters                                     |
| kW                | Kilowatts                                       |
| MVA               | Megavolt-Ampers                                 |
| RE                | Reference Evapotranspiration (ET <sub>o</sub> ) |
| m <sup>3</sup>    | Cubic meter                                     |
| m/s               | Meter per second                                |
| Km/h              | Kilometer per hour                              |
| %                 | Percentage                                      |
| Km                | kilometer                                       |
| ppm               | Part per milion                                 |
| mg/m <sup>3</sup> | Milligram per cubic meter                       |
| O <sub>3</sub>    | Ozone                                           |
| SO <sub>2</sub>   | Sulphide dioxide                                |
| NO <sub>2</sub>   | Nitrogen dioxide                                |
| CO                | Carbon monoxide                                 |
| PM                | Particule Matter                                |
| TSP               | Total Solid Suspension                          |
| dB                | Decibes                                         |
| NTU               | National Turbidity Units                        |
| mg/L              | Milligram per litter                            |
| pH                | Hydrogen concentration                          |
| BOD               | Biochemical Oxygen Demand                       |
| SS                | Suspended Solids                                |
| FC                | Fecal Coliforms                                 |
| DO                | Dissolved oxigen                                |

## NON-TECHNICAL SUMMARY

### 1 Project Context and Justification

The bridge over the Natete River, located on National Road N13 in the Ribaué district, is a vital infrastructure linking the districts of Ribaué, Lalaua, Malema, and other areas in northern Nampula and southern Niassa. This bridge facilitates the transport of agricultural products, access to markets, schools, and health units, and is crucial for the socio-economic development of the region. However, the current structure is degraded and poses a risk to the safety of users, as well as hindering circulation, especially during the rainy season.

To address this challenge, the Government of Mozambique, through the National Roads Administration (ANE), with funding from the Government of Japan and technical assistance from the Japan International Cooperation Agency (JICA), plans to rebuild the bridge. The projected investment is approximately US\$5 million, aiming for a safe, durable, and resilient infrastructure to extreme weather events, while also integrating modern engineering standards, as well as environmental and social sustainability measures.

The reconstruction of the bridge is justified by the need to guarantee safe and permanent mobility, promote the efficient flow of agricultural production, and strengthen the climate resilience of the road network in the face of increased flooding and heavy rainfall.

### 2 Legal and Institutional Framework

The project is subject to environmental licensing by the Provincial Environmental Service (SPA) of Nampula and has been classified in Category B (moderate and localized impacts). The study followed the requirements of Decree nº 54/2015, which regulates the EIA process in Mozambique, as well as the JICA Environmental and Social Guidelines de 2022, which establish international sustainability standards.

### 3 Project Area Characterization

The project's intervention area is located in a tropical climate zone, characterized by a well-defined rainy season, which strongly influences the local hydrological regime. The Natete River, a central element of the landscape, is a periodic watercourse, whose flows vary significantly between seasons, with intense floods during the rainy season and a drastic reduction in flow, even drying up in some sections, during the dry season.

The region has generally fertile soils, which support a vegetation cover dominated by miombo and riparian gallery forests, with these resources mostly used for agriculture, the main economic activity.

From an ecological point of view, the area is of relevance, being located near Mount Ribaué, a unique formation internationally recognized as a Tropical Important Plant Area (TIPA) and simultaneously designated as a Key Biodiversity Area (KBA). This regional status is because it harbors unique ecosystems and remarkable biodiversity, including endemic and threatened species of fauna and flora, which imposes special protection requirements and a cautious approach on the part of the project.

From a socioeconomic point of view, the Ribaué district is home to a population of approximately 311,522 inhabitants, mostly rural and with an economy heavily based on subsistence agriculture. This population faces significant development challenges, including multidimensional poverty, limited access to basic health and education services, and marked gender disparities in access to economic opportunities, with women facing structural barriers in resource control and the formal labor market. In this context, natural resources, and particularly the Natete River, play a vital role in the survival and well-being of local communities, which depend directly on it for water supply, subsistence fishing and irrigation of their fields, highlighting the deep interconnection between the biophysical environment and the local socioeconomic system.

#### **4 Project Location and Technical Characteristics**

The project is in the Ribaué District, about 7 km from the district's main town, crossing the Natete River on the N13. The new bridge will be 40 m long and 11 m wide, built in precast reinforced concrete, with deep foundations of the drilled pile type, ensuring durability and resistance to flooding.

The structure will include access ramps, sidewalks for pedestrians, drainage and containment devices, horizontal and vertical signage, as well as erosion protection measures on the banks. Infrastructure will be installed, such as a construction site, access roads and storage areas, which will be duly renovated after the completion of the works.

The Direct Influence Area (DIA) of the project comprises the riverbed and banks, access roads and construction site, while the Indirect Influence Area (IIA) covers riverside communities and nearby areas, extending beyond the boundaries of the Ribaué district and into the region.

#### **5 Main Environmental and Social Impacts Identified and Proposed Mitigation and/or Enhancement Measures**

The study identified a set of positive and negative environmental and social impacts, distributed among the pre-construction, construction, and post-construction phases of the new bridge over the Natete River. These impacts were evaluated in terms of their magnitude, duration, reversibility, probability of occurrence, and

sensitivity of the affected environment, allowing for the classification of their overall significance.

In general, the project reveals a dual nature of impacts. On the one hand, during the construction phase, negative environmental impacts are recorded, such as soil and riverbank disturbance, risks of erosion and siltation, temporary alteration of water and air quality, noise, generation of waste and effluents, as well as potential interference with local vegetation and fauna. These impacts are, however, temporary, localized, and mitigable, not presenting a permanent or irreversible character. On the other hand, the positive impacts are significant and long-term, reflecting in the substantial improvement of mobility, road safety, the flow of agricultural production, and regional economic integration, with multiplier effects on local development.

The assessment of the significance of the impacts allowed them to be ranked according to their magnitude and relevance. The risks of water contamination, soil erosion, and road accidents were classified as highly significant, requiring rigorous mitigation measures, such as sediment control, efficient drainage, revegetation of riverbanks, and adequate signage during construction. The positive social impacts were classified as very highly significant, as they promote employment opportunities, local income, as well as improved living conditions for the communities.

Among the less significant negative impacts of the proposed project are the temporary alteration of the landscape, the emission of dust and noise, the production of solid waste, and the localized disturbance of vegetation. All these effects can be controlled through the application of the measures contained in the study, as well as the environmental and social management plans, namely, the Waste Management Plan (WMP), the Health, Safety and Environment (HSE) Plan, the Workforce Management Plan, the Environmental Rehabilitation Plan (ERP), Communication and Community Engagement Plan (PCEP) and Emergency Response Plan (ERP).

The results obtained during the public consultations show strong community support for the project, with the population underlining the importance of the new bridge for local development and for easier access to markets, schools and health units. The main concerns raised – related to pedestrian safety, dust control, noise and priority in hiring local labor – were duly considered and incorporated into the measures of the ESMP.

The study recommends the full implementation of the Grievance Redress Mechanism (GRM), ensuring that any community concerns are recorded and resolved quickly and transparently. An Environmental and Social Officer (ESO) be permanently present throughout the construction phase, responsible for overseeing

compliance with environmental and social measures, preparing monthly reports, and liaising with local and provincial authorities.

## 6 Public Consultations

During the EIA process of the proposed project, two public consultations were held, with the main objective of ensuring the effective participation of local communities, district authorities, environmental authorities, community leaders and other stakeholders. The consultations allowed for the collection of opinions, concerns, suggestions and expectations regarding the project, ensuring that its design and implementation are aligned with the real needs of the affected and beneficiary populations.

The consultation meetings were held in the Ribaué district, with the participation of representatives from the Nampula Provincial Environment Service (SPA), the District Planning and Infrastructure Service (SDPI), the District Economic Activities Service (SDAE), community leaders from the areas crossed by the EN13, members of riverside communities and representatives of vulnerable groups, in accordance with the legal and methodological requirements defined by Decree nº 54/2015, the Environmental Directive for the Road Sector (ANE, 2002) and JICA Guidelines (2022).

The communities expressed widespread support for the project, recognizing its direct benefits in terms of improved mobility, enhanced road safety, creation of temporary jobs, and increased economic opportunities. However, some concerns were raised, mainly related to the safety of workers and pedestrians during the execution of the work; the control of dust and noise from heavy machinery; the compensation of those affected with farmland located near the riverbanks; the proper management of solid waste and effluents; the priority of hiring local labor and providing goods and services to small local businesses; and respect for local communities.

The mitigation and management measures presented in the ESMP, namely through the Communication and Community Engagement Plans, the Workforce Management Plan, the Waste Management Plan, and the Health, Safety and Environment (HSE) Plan and the Grievance Redress Mechanism will ensure that any concerns, complaints, or conflicts arising from the execution of the project are addressed.

This ongoing process of public participation will be maintained throughout the entire construction phase, ensuring two-way communication between the contractor, ANE and local communities, strengthening trust, transparency and the social legitimacy of the project.

## 7 Costs of Implementing the ESMP

The implementation of the ESMP is estimated to cost around USD130,000,00 covering mitigation, monitoring, and capacity-building activities. These costs are duly integrated into the overall project budget, under the responsibility of the Contractor, with supervision from the Environmental and Social Inspection and the Owner. Therefore, the Contractor must include all mitigation and monitoring costs in its budget and execution schedule, ensuring adequate human, material, and financial resources. The Environmental Works Inspector is responsible for validating the implementation and periodically reporting progress and compliance to the Environmental Authority and JICA.

## 8 Conclusions and Recommendations

The SES concludes that the negative environmental impacts associated with the project are controllable and compensable, while the positive impacts are substantial, lasting, and strategic for regional development and the SPA in particular. The project will strengthen road connectivity, reduce the isolation of communities, boost local and regional trade, and promote the climate resilience of public infrastructure.

In view of the above, the SES recommends the issuance of the Environmental License for the project, conditional upon full compliance with the management and mitigation measures established in the ESMP and the execution of periodic environmental audits.

It is also recommended that ANE ensure the integration of environmental and social monitoring into the overall work schedule and guarantee the continuous training of the technical team and local workers in good environmental practices, safety, and social coexistence. The project is aligned with national environmental legislation and the JICA Guidelines, reinforcing the GoM commitment to environmental sustainability and inclusive development.

## 1 INTRODUCTION

### 1.1 Background

The bridge over the Natete River, located along National Highway N13, is a road section of high strategic importance, linking the districts of Ribaué, Lalaua, Malema, and other areas in the northern part of Nampula province, as well as the southern part of Niassa province. This infrastructure plays a vital role in boosting the local economy, allowing for the flow of agricultural production, the mobility of rural and urban communities, and access to markets, health units, and educational institutions. However, the precarious state of the bridge has imposed significant constraints on the socio-economic development and territorial cohesion of the region, aggravated by increasing climate vulnerability, with projections of increased frequency and intensity of extreme phenomena such as floods and torrential rains.

To respond to these challenges, the Government of Mozambique (GoM), through the National Roads Administration (ANE), with financial support from the Government of Japan and technical assistance from the Japan International Cooperation Agency (JICA), intends to rebuild the infrastructure under consideration, in an investment of approximately USD5.000.000,00 (five million US dollars). The reconstruction will be designed according to climate resilience criteria, ensuring greater durability and responsiveness to future environmental risks.

In accordance with the environmental legislation in force in the country, as well as the JICA Environmental and Social Guidelines, the project is subject to environmental licensing. To this end, the activity was classified in Category “B” by the Provincial Environmental Service (SPA) of Nampula and is therefore subject to a Simplified Environmental Study (SES), as stipulated by Decree n°. 54/2015, of December 31, which approves the Environmental Impact Assessment (EIA) Process in the country. Prior to the SES, Terms of Reference (ToR) were submitted and approved by note n° 1359/SPA/RLA/220, dated October 10, 2025 (Annex A).

### 1.2 Brief Description

The project consists of the reconstruction of the bridge over the Natete River, Ribaué District at the bridge current location, with a new infrastructure 40 meters long, 11 meters wide, and with a 40-meter span. The selected technical solution is a mixed structure of precast concrete and concrete beams, with foundations using drilled shaft piles, guaranteeing a safe and permanent crossing throughout the year.

The structural design complies with international engineering standards and JICA specifications, prioritizing durability, safety, and landscape integration. The project also includes complementary works, such as access ramps at both ends, sidewalks for pedestrian traffic, drainage and containment systems, erosion protection devices, horizontal and vertical signage, as well as the implementation of environmental rehabilitation measures on the riverbanks.

The temporary support areas, such as the construction site and provisional access roads, will be properly restored after the completion of the work, in accordance with good environmental and social practices.

### 1.3 Project Justification

The reconstruction of the new bridge is justified by technical, economic, social, and environmental reasons. The existing structure is at the end of its useful life and poses safety risks associated with its degraded state, endangering users and hindering road traffic during the rainy season. The project will provide safe and permanent mobility conditions, ensuring connectivity between localities and administrative centers, facilitating the transport of agricultural products and access to schools, markets, and health facilities.

From an economic standpoint, the new bridge will contribute to the dynamism of local productive activities, reducing transportation costs and travel times. At the social level, it will promote community inclusion and integration, reinforcing equitable access to opportunities and services. In turn, JICA's technical cooperation introduces high-quality construction and environmental management standards, aligned with the principles of sustainable development and climate resilience.

The project is also aligned with national development and connectivity policies, directly contributing to the reduction of rural poverty, territorial integration, and increased resilience to extreme weather events.

### 1.4 Scope of the Study

This Simplified Environmental Study (SES) was prepared to comply with the requirements of Decree n° 54/2015, of December 31, which regulates the Environmental Impact Assessment (EIA) Process in Mozambique, after the project was classified in Category B by the Provincial Environmental Service (SPA) of Nampula.

The scope of the study covers the identification, assessment, and proposal of mitigation measures for the environmental and social impacts associated with all phases of the project in the project's area of influence.

The study includes a detailed characterization of the biophysical and socioeconomic components of the project's direct and indirect area of influence, the identification of the main environmental and social pressure factors, the analysis of the magnitude and significance of the impacts, and the formulation of an Environmental and Social Management Plan (ESMP) that ensures legal compliance and the sustainability of the intervention. The Project's Area of Influence (AIP) includes a Direct Area of Influence (AID), which comprises the bridge construction site, immediate riverbanks, yard, and access roads; and an Indirect Area of Influence (AII), which encompasses riverside communities, ecosystems associated with the Natete River, and the surrounding mainland territory, with socioeconomic impacts on a regional scale.

## 1.5 Methodology

The methodology adopted in the preparation of the study was based on the technical principles of multidisciplinary and participatory environmental impact assessment, as established by Decree n° 54/2015, of December 31, which regulates the EIA process in Mozambique. The methodological approach also followed the JICA Environmental and Social Guidelines, incorporating analyses of alternatives, social equity, climate risk, and a participatory process, including Public Consultation.

Documentary and legal reviews, field surveys, direct observations, interviews with communities and local authorities, and representative public consultations were carried out.

The methodology adopted for the identification and assessment of environmental and social impacts was based on a combination of methods, including the application of Checklists and an adapted Leopold Interaction Matrix. Each identified impact was assessed based on criteria of Nature, Magnitude, Extent, Duration, Reversibility, Probability of Occurrence, and Sensitivity of the receiving environment. The significance of the impacts was determined by calculating the Impact Significance Index (ISI), which combines these criteria.

## 1.6 Limitations

The study faced some limitations, namely the absence of long-term historical environmental monitoring data in the project area, which made it difficult to analyze trends in some parameters. There was also a scarcity of detailed historical information on specific environmental parameters, such as water quality and ecological characteristics of the river.

The availability of detailed information on the engineering project in its early stages also constituted a limitation, and the present SES was based on the available conceptual design. Despite these limitations, the data collected and the analyses performed are considered technically robust and adequate to support the environmental decision on the environmental and social viability of the project.

## 1.7 Project Proponent

The Natete Bridge construction project is proposed by the ANE, with funding from the Japanese Government through JICA. ANE offices are located at Avenida de Moçambique nº 1225, CP 403, Bairro Luís Cabral, Maputo City. Contact: +258-21476163. E-mail: [geral@ane.gov.mz](mailto:geral@ane.gov.mz)

## 1.8 Project Environmental Consultant

The study was prepared by the consulting firm Enviestudos, Lda., contracted by Katahira International Group, from Japan, which in turn was contracted by ANE. Enviestudos, Lda. is a legally registered environmental consulting company in the country, with NUIT 400298505, accredited by the Ministry of Agriculture, Environment and Fisheries (MAAP) as an Environmental Consultant since 2011, providing environmental solutions for different public and private projects. Enviestudos' facilities are in the KaMfumu neighborhood, Rua Viana da Mota no. 72, Phones: +258-82/84-3289330. Email: [enviestudosconsultores@gmail.com](mailto:enviestudosconsultores@gmail.com), Maputo City.

The team mobilized by the consultant is presented in table 1.1 below, indicating the relevant qualifications and the responsibilities performed in the study. The team is composed of experts in the areas of environmental impacts, sociology, air quality, noise, water resources, and ecology. The team was supervised by ANE and JICA, and the work was carried out in close collaboration with local and district environmental authorities.

Table 1-1 - Composition of the study's technical team

| No. | Name                    | Role                                                                                                                                                                                                                                                        | Main Qualifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Arcangelo Passela       | Study Coordinator and Environmental Representative of the Client to the environmental authority; Internal review and approval of specialist reports; and Preparation of progress reports and the final version of the ESIA, including public consultations. | Certified by MAAP as an environmental consultant and auditor, with over 20 years of experience. Knowledge and application of environmental and social safeguards required by international funders such as the World Bank, IFC, AfDB, and JICA. Technical writing skills and production of complex reports, including environmental audit reports, socio-environmental assessments, and technical opinions.                                                                             |
| 2   | Amad Hassam Abdul Gani  | Social-Environmental Specialist. Socioeconomic studies, including the public consultation process and specialized studies on air, noise, and water quality.                                                                                                 | Environmental Consultant, Geology Consultant, Environmental Auditing.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3   | Felda Francisco Langa   | Ecologist. Flora and Fauna Surveys and preparation of the thematic report.                                                                                                                                                                                  | Study of identification and mapping of ecosystem goods and services in conservation areas; Key informant interviews for the value chain component and production of a field report on the value chain for ANAC; Plant Ecologist and facilitator in the second edition of the Integrative Medicine Mini-Course for the "First Integrative Medicine" project; Study of household profiling in the Karingani hunting areas; communities neighboring the reserve in the Massingir District. |
| 4   | Inácio Alfredo Massango | Responsible for topographic and GIS studies, acquisition of geographic data, and production of thematic maps.                                                                                                                                               | Experience in various related projects, especially in GIS and cartographic production.                                                                                                                                                                                                                                                                                                                                                                                                  |
| 5   | Support Team            | Logistical and administrative support, technical assistance, compliance assurance, and supervision support.                                                                                                                                                 | Secondary or technical education (minimum completed high school), preferably in environment, geography, sociology, agronomy, or related fields.                                                                                                                                                                                                                                                                                                                                         |

## 1.9 References

This study was developed based on the legal and regulatory framework of Mozambique, namely the Constitution of the Republic, the Environmental Law (Law No. 20/97), the Decree on the Environmental Impact Assessment Process (Decree No. 54/2015), and applicable sectoral regulations. The JICA Guidelines (2022) and international technical references, such as the World Health Organization (WHO) standards for air quality, noise, and water, were also considered. The specific bibliography and reference documents consulted are listed in Chapter 12.

## **2 LEGAL FRAMEWORK, REGULATIONS AND POLICIES APPLICABLE TO THE PROJECT**

### **2.1 Introduction**

The legislative, regulatory, and political framework forms the guiding basis of the EIA process in Mozambique. This chapter presents the policies, laws, regulations, and institutional instruments applicable to the Project, as well as the correspondence between the national system and the environmental and social policies of JICA, the technical partner entity in the financing and assistance of the project.

### **2.2 Policy and Legal Framework**

The legal framework of the proposed project is based on a set of national and international legal instruments that establish the norms and procedures applicable to the environmental, social, and technical management of the activity. The following table lists national and international legal instruments, highlighting their relevance to the project.

Table 2-1 - Applicable Legal and Policy Framework and Relevance to the Project

| Legal Instrument / Guideline                                                                          | Description / Main Objective                                                                                                          | Responsible Institution                                   | Relevance to the Project                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Constitution of the Republic of Mozambique (2004, revised by Law No. 1/2018 of 12 June)</b>        | Recognizes the right to life and the right to an ecologically balanced environment, requiring the State to protect natural resources. | Ministry of Agriculture, Environment and Fisheries (MAAP) | Guides biodiversity preservation, proper waste management, and mitigation of environmental impacts. Ensure community participation and access to environmental information. |
| <b>Resolution No. 5/95 of 3 August – National Environmental Policy (PNA)</b>                          | Promotes the sustainable use of natural resources, balancing economic growth and environmental protection.                            | MAAP                                                      | Supports environmental mitigation, protection of riverbanks, and community participation in decision-making.                                                                |
| <b>Law No. 20/97 of 1 October – Environmental Law</b>                                                 | Establishes the legal basis for environmental management and sustainable development.                                                 | MAAP                                                      | Provides the legal foundation for conducting Environmental Impact Assessments (EIA) and implementing mitigation and monitoring measures.                                    |
| <b>Decree No. 54/2015 of 31 December – EIA Regulation</b>                                             | Regulates the EIA process, defining project categories and procedural requirements.                                                   | MAAP / Provincial Environmental Service (SPA)             | Classifies the project as Category B and defines the requirements for SES approval.                                                                                         |
| <b>Decree No. 130/2006 of 19 July – General Directive for Public Participation in the EIA Process</b> | Requires public consultation with affected and interested stakeholders, ensuring transparency and inclusiveness in decision-making.   | MAAP / SPA                                                | Ensures effective public participation and transparency, aligning with JICA's social safeguard requirements.                                                                |
| <b>Decree No. 11/2006 of 15 June – Solid Waste Management Regulation</b>                              | Establish rules for the handling, transport, and disposal of solid waste.                                                             | MAAP                                                      | Relevant to the management of construction and demolition waste during bridge reconstruction.                                                                               |
| <b>Decree No. 83/2014 of 31 December – Hazardous Waste Management Regulation</b>                      | Establishes norms for safe management, transport, and disposal of hazardous waste.                                                    | MAAP                                                      | Requires safe handling and disposal of hazardous materials, ensuring environmental protection and public health.                                                            |
| <b>Law No. 16/91 of 3 August –</b>                                                                    | Regulates the use and protection of                                                                                                   | Regional Water                                            | Ensure proper water management and                                                                                                                                          |

|                                                                                                                             |                                                                                                                                                                                                                    |                                                             |                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Water Law</b>                                                                                                            | water resources.                                                                                                                                                                                                   | Administration (ARA-North)                                  | pollution prevention in the Natete River during construction.                                                                                                                                                                |
| <b>Land Law No. 19/97 of 1 October and Decree No. 66/98 of 8 December – Land Law Regulation</b>                             | Governs the use and allocation of land rights (DUAT).                                                                                                                                                              | MAAP / District Geography and Cadastre Services             | Ensure lawful land use and compensation for affected populations, where applicable.                                                                                                                                          |
| <b>Decree No. 18/2004 of 2 June (amended by Decree No. 67/2010) – Environmental Quality and Effluent Emission Standards</b> | Establishes environmental quality standards and limits for effluent discharge.                                                                                                                                     | MAAP                                                        | Ensures effluents do not contaminate soil, air, or water, supporting compliance with national pollution control standards.                                                                                                   |
| <b>Decree No. 18/2004 of 2 June – Regulation on Pollution Prevention and Protection of the Aquatic Environment</b>          | Defines measures to prevent pollution of watercourses and aquatic ecosystems.                                                                                                                                      | MAAP / ARA-Norte                                            | Guides sediment, effluent, and accidental spill control in the Natete River.                                                                                                                                                 |
| <b>Law No. 10/99 of 7 July – Forest and Wildlife Law</b>                                                                    | Establishes the legal framework for the protection, conservation, sustainable use, and management of forest and wildlife resources, including regulation of activities affecting natural habitats and biodiversity | MAAP / National Directorate of Forests and Wildlife (DNFFB) | Ensures protection of riparian vegetation and terrestrial habitats, controls vegetation clearing, and prevents adverse impacts on biodiversity, in line with national conservation objectives and JICA safeguard principles. |
| <b>Law No. 13/2023 of 25 August – Labor Law</b>                                                                             | Regulates labor relations, occupational safety, and health.                                                                                                                                                        | Ministry of Labor, Employment and Social Security (MITESS)  | Requires adoption of occupational health and safety measures during construction and operation.                                                                                                                              |
| <b>Decree No. 25/2008 – Hazardous Substances Management Regulation</b>                                                      | Defines rules for handling, transport, and storage of hazardous chemicals.                                                                                                                                         | MAAP / National Institute of Mines (INAMI)                  | Applicable to the use of fuels, lubricants, and solvents at the construction site.                                                                                                                                           |
| <b>Law No. 10/2023 – Land Use and Urban Planning Law</b>                                                                    | Establishes principles for the rational and sustainable use of land.                                                                                                                                               | MAAP                                                        | Ensures territorial compatibility of the project with local spatial planning instruments.                                                                                                                                    |
| <b>Law No. 10/2020 of 24 August</b>                                                                                         | Defines legal measures for prevention,                                                                                                                                                                             | National Institute for                                      | Ensures project resilience and safety during                                                                                                                                                                                 |

|                                                                 |                                                                                                                                           |                                                |                                                                                                                                  |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>– Disaster Risk Management Law</b>                           | preparedness, response, and recovery from disasters.                                                                                      | Disaster Management (INGD)                     | floods or other natural disasters.                                                                                               |
| <b>UN Framework Convention on Climate Change (UNFCCC, 1994)</b> | Establishes global commitments for reducing greenhouse gas emissions and adapting to climate change.                                      | MAAP / National Directorate for Climate Change | Encourages climate-resilient infrastructure and sustainable water resource management.                                           |
| <b>ANE Environmental and Social Directive (2002)</b>            | Sets environmental management principles for road projects.                                                                               | National Roads Administration (ANE)            | Directly applicable to the bridge project, providing operational guidelines for environmental compliance in road infrastructure. |
| <b>JICA Environmental and Social Guidelines (2022)</b>          | Establish policies for assessment, mitigation, and monitoring of environmental and social impacts in JICA-supported projects.             | JICA                                           | Provides the overarching framework for integrating environmental and social sustainability principles into all project phases.   |
| <b>JICA Environmental and Social Safeguard Policy</b>           | Ensures JICA-funded projects comply with international environmental and social protection standards, including involuntary resettlement. | JICA                                           | Requires the ESIA to meet international standards compatible with Mozambican legislation.                                        |
| <b>JICA Gender and Social Inclusion Policy</b>                  | Promotes gender equality and equitable participation in development projects.                                                             | JICA                                           | Encourages gender integration in public consultations and local employment opportunities.                                        |

## 2.3 Administrative Framework on Environmental Issues in the Context of the Natete Bridge Construction Project

This subchapter details the administrative structure and procedural flow governing environmental licensing in the country, in accordance with the SPA's decision to classify it in Category B. This classification defines a more agile and decentralized administrative path.

### 2.3.1 Hierarchy and Competencies of Environmental Authorities

With the classification in category B, the administrative hierarchy is concentrated at the provincial level, with central supervision.

Provincial Level (Nampula SPA) - Main Licensing Authority

- **Role in the Project:** As the primary authority for Category B projects, the Nampula SPA is responsible for:
- **Screening and classification:** validating the project's classification as Category B, based on its potential for localized and moderate impact.
- **Approval of the Terms of Reference:** approving the Terms of Reference for the SES, which is the required EIA instrument for this category.

Technical Analysis and Decision: analyzing the SES Report and issuing the Environmental License for the project.

- **Monitoring:** the body responsible for monitoring compliance with the license conditions during the construction and operation of the bridge.

Central Level (National Directorate for the Environment and Climate Change (DINAMC) - National Supervisory Authority).

Role in the Project: DINAMC does not issue the license, but acts in a supervisory and support role:

- **Appeals Review:** Can be activated if there is an appeal against the SPA decision or if complex technical issues arise.
- **Capacity Building and Guidance:** Provides general guidelines to the provinces to ensure uniformity in the application of the law.
- **Supplementary Inspection:** May, in exceptional cases, verify compliance with licenses issued by the provinces.

District Level (Ribaué District Administration) - Local Liaison Authority

Role in the Project: Its involvement remains vital to the social legitimacy of the project:

- **Facilitation of Public Consultations:** Support in logistics and mobilization for public consultation sessions in the district.
- **Information Validation:** Help contextualize the socioeconomic baseline of the affected communities.
- **Conflict Mediation:** Act as primary point of contact for issues raised by local communities.

### 2.3.2 Administrative Process Flow of the EIA Process for Category B Projects

The process for Category B is less complex than that of an EIA for Category A, focusing on the SES. The flow is illustrated below:

#### Detailed Description of the Flowchart Steps

**Screening and Classification:** Based on the project description, the Nampula SPA classified the activity in Category B. This indicates that the impacts are considered moderate, localized, and amenable to mitigation through standard management measures. This was a crucial administrative decision that defined the entire subsequent process.

**Preparation of the SES:** Instead of a complex Environmental Impact Assessment (EIA), the developer prepares an SES. This report is more concise and focuses on a simplified environmental and social baseline analysis; identification and preliminary assessment of the most significant impacts; and proposal of an Environmental Management Plan (EMP) with specific mitigation, monitoring, and management measures.

Although the SES is less exhaustive than an EIA, to comply with JICA, the study must be robust enough to function as an Environmental and Social Management Plan (ESMP), incorporating social aspects (e.g., complaint mechanism, livelihood plan).

**Public Consultation Process:** Remains mandatory. It must be conducted in the Ribaué District, ensuring that local communities are informed about the project and the SES, and that they could express their concerns.

**Submission and Technical Analysis by the SPA of Nampula:** The final SES report is submitted to the SPA of Nampula. The analysis is conducted by the provincial technical team, which assesses the adequacy of the SES, including the EMP.

**Decision and Licensing by the SPA:** As a competent authority, the SPA issues the Environmental License for the project. This license will have conditions adapted to the local context of the province.

**Post-License Monitoring and Inspection:** Monitoring of compliance with the license conditions will be carried out by the SPA of Nampula, which has greater proximity to the project site.

**Implication of Classification as Category B:** The SES, including the EMP, was developed with a level of detail and comprehensiveness that satisfies not only the SPA of Nampula, but also the highest JICA standards, particularly in social aspects.

## 2.4 International Treaties

Mozambique is a signatory to several international agreements and conventions that reinforce the country's commitment to environmental protection and sustainable development. Among the most relevant instruments for this project are listed in Table 2.2.

Table 2.2 - International Treaties and Conventions Relevant to the Project

| International Treaty                                                                  | Year of Ratification | Main Provisions                                                                     | Corresponding National Instruments                                                              | Relevance to the Project                                                                                                          |
|---------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Ramsar Convention on Wetlands</b>                                                  | 2003                 | Promotes the conservation and wise use of wetlands and aquatic ecosystems.          | Environmental Law (Law No. 20/97) and Decree No. 45/2004 – Environmental Management Regulation. | Ensures protection of riverbanks and riparian ecosystems of the Natete River, preventing hydrological and ecological degradation. |
| <b>Convention on Biological Diversity (CBD)</b>                                       | 1995                 | Conservation of biodiversity and sustainable use of natural resources.              | National Biodiversity Strategy and Action Plan (EPANB II, 2015–2035).                           | Requires mitigation of impacts on local fauna, flora, and habitats, ensuring ecological sustainability of the project.            |
| <b>United Nations Convention to Combat Desertification (UNCCD)</b>                    | 1996                 | Prevention of land degradation and control of soil erosion.                         | National Land Policy (1995) and Land Management Regulation (Decree No. 66/98).                  | Relevant for erosion control on riverbanks and bridge foundations, minimizing soil loss and sedimentation into the river.         |
| <b>United Nations Framework Convention on Climate Change (UNFCCC)</b>                 | 1994                 | Reduction of greenhouse gas emissions and promotion of climate adaptation measures. | National Strategy for Adaptation and Mitigation of Climate Change (2013–2025).                  | Encourages the integration of climate resilience and proper drainage measures to withstand floods and extreme weather.            |
| <b>UNESCO World Heritage Convention</b>                                               | 1982                 | Protection of cultural and natural heritage of outstanding universal value.         | Cultural Heritage Protection Law (Law No. 10/88).                                               | Ensures that the project does not affect cultural, historical, or archaeological sites within the area of influence.              |
| <b>Basel Convention on the Control of Transboundary Movements of Hazardous Wastes</b> | 2006                 | Establish safe management, transport, and disposal of hazardous waste.              | Solid Waste Management Regulation (Decree No. 94/2014).                                         | Guides the safe handling and disposal of construction and maintenance waste, preventing environmental contamination.              |
| <b>ILO Convention No. 155 on Occupational Safety and Health</b>                       | 2003                 | Promotes safety and health at work and improvement of working conditions.           | Labor Law (Law No. 23/2007) and Occupational Health and Safety Regulation (Decree No. 61/2009). | Ensures adequate safety and hygiene conditions at the construction site, minimizing occupational hazards and accidents.           |

## 2.5 Environmental Institutional Framework

The Environmental Institutional Framework operates in an interconnected manner across national, provincial, and district levels, ensuring that the EIA process for Category B projects is technically sound, socially inclusive, and environmentally sustainable. Collaboration between ANE, AQUA, SPA, and JICA is essential to ensure simultaneous compliance with national standards and donor requirements.

Table 2.3 presents the institutional framework for environmental management and complementary mandates.

Table 2-3 - Environmental Institutional Framework in the Context of the Project

| Institution / Entity                                                                         | Level of Action       | Main Institutional Functions                                                                                        | Specific Responsibility / Relevance to the Project                                                                                                                          |
|----------------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ministry of Agriculture, Environment and Fisheries (MAAP)</b>                             | National              | Coordinates and formulates national environmental policies and sustainable natural resource management strategies.  | Provides legal and policy guidance for the project within the framework of national environmental management. Oversees compliance with environmental norms and regulations. |
| <b>National Agency for Environmental Quality Control (AQUA)</b>                              | National              | Responsible for technical evaluation, environmental licensing, and compliance monitoring.                           | Supervises the review and approval of the Simplified Environmental Impact Assessment Report (Category B) in coordination with the Provincial Directorate of Environment.    |
| <b>Provincial Environment Service (SPA) – Nampula</b>                                        | Provincial            | Implements environmental policies and regulations at the provincial level; issues licenses and conduct inspections. | Serves as the direct licensing authority for the project and oversees local environmental and social monitoring during implementation.                                      |
| <b>National Roads Administration (ANE)</b>                                                   | National              | Manages and maintains the national road network, including the construction and rehabilitation of bridges.          | Acts as the project proponent and executing agency, ensuring integration of environmental and social best practices throughout the project lifecycle.                       |
| <b>Regional Water Administration – North (ARA-Norte)</b>                                     | Regional              | Manages and protect water resources and aquatic ecosystems within the river basin.                                  | Ensures that the construction works do not disrupt the Natete River's hydraulic regime, overseeing discharges and water abstraction.                                        |
| <b>Provincial Directorate of Public Works and Housing (DPOPH)</b>                            | Provincial            | Provides technical supervision of public works and ensures compliance with engineering and safety standards.        | Collaborates with ANE in technical oversight and verification of structural and environmental safety conditions of the bridge.                                              |
| <b>National Institute for Disaster Risk Management and Reduction (INGD)</b>                  | National / Provincial | Plans and implements disaster mitigation and response measures.                                                     | Supports the integration of flood and disaster resilience measures into infrastructure design.                                                                              |
| <b>Ribáué District Administration / District Planning and Infrastructure Services (SDPI)</b> | District              | Coordinates planning, infrastructure, and environmental management activities at district level.                    | Facilitates local coordination, community engagement, and liaison with local authorities.                                                                                   |
| <b>Community Councils and</b>                                                                | Community             | Represent local communities and                                                                                     | Promote public participation, environmental                                                                                                                                 |

|                                                      |               |                                                                                                             |                                                                                                                                                                        |
|------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Local Leaders</b>                                 |               | participate in consultation and decision-making processes.                                                  | awareness, and conflict resolution during project implementation.                                                                                                      |
| <b>Japan International Cooperation Agency (JICA)</b> | International | Provides technical assistance and ensures compliance with international environmental and social standards. | Ensures the project's alignment with JICA's Environmental and Social Safeguard Policies and international best practices in sustainability and stakeholder engagement. |

## 2.6 Policy of the Japan International Cooperation Agency (JICA)

JICA is the official cooperation agency of the Government of Japan responsible for implementing external technical assistance, governed by the Japan International Cooperation Law (2003).

JICA has an Environmental and Social Policy (2010, revised in 2022) that establishes rigorous principles and procedures to ensure that all projects supported by the agency are environmentally sustainable and socially responsible. This policy requires the completion of an Environmental and Social Impact Assessment (ESIA) before the approval of any project that may have significant impacts.

JICA's policy classifies projects according to their potential environmental impact (Categories A, B, C, and FI) and requires the development of management plans, effective public consultations, information dissemination, and accessible grievance mechanisms.

JICA also adopts the Environmental and Social Safeguards Guidelines, aligned with the international practices of the World Bank (WB) and the Asian Development Bank.

In the case of the proposed project to reconstruct the bridge over the Natete River in the Ribaué District, JICA acts as a technical partner and ensures that the environmental assessment process meets the requirements of both Mozambican legislation and international safeguard standards, guaranteeing transparency, fairness, and sustainability.

Table 2.4 presents the JICA Guidelines and their relevance to the Natete River Bridge Project.

Table 2-4-JICA Environmental and Social Policies and Their Relevance to the Project

| Policy / Guideline                                             | Description and Main Objective                                                                                                                                                         | Relevance and Application to the Project                                                                                                                                                                                                                     |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental and Social Guidelines</b>                     | Main framework for identifying, assessing, mitigating, and managing environmental and social impacts of supported projects, aligning them with international sustainability standards. | The project was subject to a detailed Simplified Environmental Study (SES), serving as the main instrument to comply with these guidelines. All project phases—planning, construction, and operation—were analyzed accordingly.                              |
| <b>Environmental and Social Impact Assessment (ESIA)</b>       | Requires systematic assessment of environmental and social impacts as an integral part of the project cycle to ensure informed decision-making.                                        | The SES, conducted and submitted under Mozambique's EIA Regulation (Decree No. 54/2015), meets this requirement. The study identified and evaluated impacts on both biophysical and socioeconomic components.                                                |
| <b>Biodiversity Protection and Natural Resource Management</b> | Calls for the protection of critical ecosystems, natural habitats, and biodiversity, avoiding adverse impacts on areas of high conservation value.                                     | The study identified proximity to sensitive zones (Ribáué Forest Reserve and Key Biodiversity Area – KBA). The project was designed to avoid direct impacts, and mitigation measures were proposed to reduce indirect disturbances to local flora and fauna. |
| <b>Pollution Prevention and Control</b>                        | Establishes the need to control air, water, and soil pollution and manage waste in an environmentally sound manner.                                                                    | The Environmental and Social Management Plan (ESMP) includes specific programs for solid and liquid waste management, dust suppression, and monitoring of water and air quality.                                                                             |
| <b>Involuntary Resettlement Safeguards</b>                     | Aims to protect and improve the living conditions of people physically or economically affected by the project, ensuring fair and adequate compensation.                               | An Abbreviated Resettlement Action Plan (ARAP) was prepared to address any loss of land or livelihood, ensuring compensation consistent with JICA and national standards.                                                                                    |
| <b>Stakeholder Engagement and Information Disclosure</b>       | Emphasizes transparency, access to information, and meaningful consultation with affected communities and stakeholders throughout all project phases.                                  | The process included two Public Consultations (the second held on 17 October 2025) to present SES findings and collect feedback. The report and related documentation are publicly accessible.                                                               |
| <b>Grievance Redress Mechanism (GRM)</b>                       | Requires the establishment of an accessible and effective system for communities to submit project-related complaints or grievances.                                                   | The ESMP includes a GRM with multiple access channels to ensure timely and transparent resolution of all registered concerns.                                                                                                                                |
| <b>Occupational and Community Health and Safety</b>            | Focuses on protecting the health and safety of workers and nearby communities.                                                                                                         | The ESMP integrates a Health and Safety Management Plan including training, provision of Personal Protective Equipment (PPE), and emergency response protocols. Community protection measures (e.g., signage, safe detours) are also included.               |

|                                                   |                                                                                                                    |                                                                                                                                                                                                    |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Climate Change Resilience and Disaster Prevention | Promotes consideration of current and future climate risks in the design and operation of infrastructure projects. | The new bridge was designed with climate-resilient criteria, accounting for increased frequency and intensity of floods, ensuring structural safety and durability against extreme weather events. |
| Code of Conduct and Integrity                     | Promotes ethical behavior, anti-corruption, and responsible conduct among all project participants.                | A project-specific Code of Conduct aligned with JICA's standards will be implemented and signed by all workers and contractors, fostering respect for the environment and local communities.       |

## 2.7 Analysis of the Gaps between Mozambique's EIA System and JICA Policy

Although Mozambique's EIA system and JICA's policy share similar principles such as impact prevention, public participation, and sustainability, there are some methodological gaps and differences between the two. This analysis is critical to the success of project licensing and implementation.

Firstly, Mozambican legislation focuses primarily on legal compliance and impact mitigation during the licensing phase, while JICA adopts a more comprehensive approach, incorporating social, cultural, and human rights criteria at all stages of the project cycle.

Secondly, the Mozambican system requires formal public consultations and publication of announcements, but JICA emphasizes the need for continuous participatory processes, including complaint and feedback mechanisms throughout implementation.

Another significant difference lies in the classification of impact categories. Decree n° 54/2015 categorizes projects into four levels (A+, A, B, and C), the same as JICA in 4 categories (A, B, C, and FI) but incorporates social risk and type of financing.

Furthermore, JICA policy emphasizes the international public disclosure of environmental and social reports prior to project approval, which exceeds national requirements.

Despite these differences, the national legal framework is compatible with JICA principles and allows for harmonization between both systems. For the specific case of the Natete River Bridge, the EIA process was designed to simultaneously meet local demands and JICA guidelines, ensuring that the project meets the highest standards of environmental and social sustainability.

The table below presents some other policy gaps between the JICA Guidelines and Mozambique's EIA system. However, some items from the JICA Guidelines are found in national legal documents. Nevertheless, some detailed conditions may be gaps and can be filled with practical measures.

Table 2-5 - Gap Analysis and Harmonization between the Mozambique EIA System and JICA Environmental and Social Policies

| Analysis Criterion                              | Mozambique EIA System                                                                                                                                             | JICA Policy (Applied)                                                                                                                                                           | Gaps and Recommendations for Harmonization in the Bridge Project                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Approach to Resettlement and Livelihoods</b> | The national EIA system requires identification and mitigation of social impacts; however, the depth of analysis and resettlement planning is often insufficient. | Requires an <b>Abbreviated Resettlement Action Plan (ARAP)</b> with a clear budget, implementation schedule, and compensation mechanisms, in line with international standards. | <b>Gap:</b> The national ESMP may not be sufficiently detailed to serve as a Resettlement Action Plan.<br><b>Recommendation:</b> Develop a <b>hybrid ESMP</b> that includes an ARAP fully compliant with JICA's standards. This ARAP should be developed through close consultation with the affected communities of Ribáuè.                                 |
| <b>Consultation with Local Communities</b>      | Decree No. 54/2015 requires public participation, but this is often limited to information disclosure and public hearings.                                        | Requires a <b>Free, Prior and Informed Consultation (FPIC)</b> process — continuous, participatory, and culturally appropriate.                                                 | <b>Gap:</b> The standard consultation process may not be deep enough to fully capture community concerns and consent. <b>Recommendation:</b> Implement a <b>Stakeholder Engagement Plan (SEP)</b> that goes beyond public hearings, including sectoral meetings, community leader dialogues, and communication tools adapted to the local context of Ribáuè. |
| <b>Grievance Redress Mechanism (GRM)</b>        | The national system does not explicitly require an operational, project-managed grievance mechanism.                                                              | Requires an <b>accessible, transparent, and effective Grievance Redress Mechanism</b> for communities throughout the entire project cycle.                                      | <b>Gap:</b> Lack of a formal mechanism for affected communities to submit complaints during construction.<br><b>Recommendation:</b> Establish and widely disseminate a <b>project-level GRM</b> , with contact points both at the construction site and district level, ensuring anonymity, accessibility, and feedback on complaints.                       |
| <b>Monitoring and Compliance</b>                | Environmental licensing requires monitoring, but SPA's supervision capacity may be limited.                                                                       | Requires a <b>robust system of monitoring, independent verification, and periodic reporting</b> on environmental and social compliance.                                         | <b>Gap:</b> Risk of weak continuous monitoring and limited reporting of commitments under the ESMP/ARAP.<br><b>Recommendation:</b> Allocate project budget for a <b>dedicated Environmental and Social Management Team</b> and, if possible, an <b>independent verifier</b> to audit compliance and report to both JICA and the SPA.                         |

### 3 PROJECT DESCRIPTION

#### 3.1 Introduction

This chapter provides a detailed description of the Natete River Bridge Construction Project in the Ribaué District, Nampula Province. This description is fundamental to establishing a clear baseline against which potential environmental and social impacts will be identified and assessed in subsequent chapters.

The project is part of the Government of Mozambique's efforts, with financial support from the Government of Japan and technical assistance from JICA, to improve transport infrastructure and reduce vulnerability to extreme weather events. The project aims to overcome a critical physical obstacle, improving mobility, safety, and the socioeconomic conditions of local populations and the region.

#### 3.2 Location and Access to the Project Area

The bridge over the Natete River is located 7km from the Ribaué district village, Nampula province, along the N13 road. Figure 3.1 shows the location of the bridge.

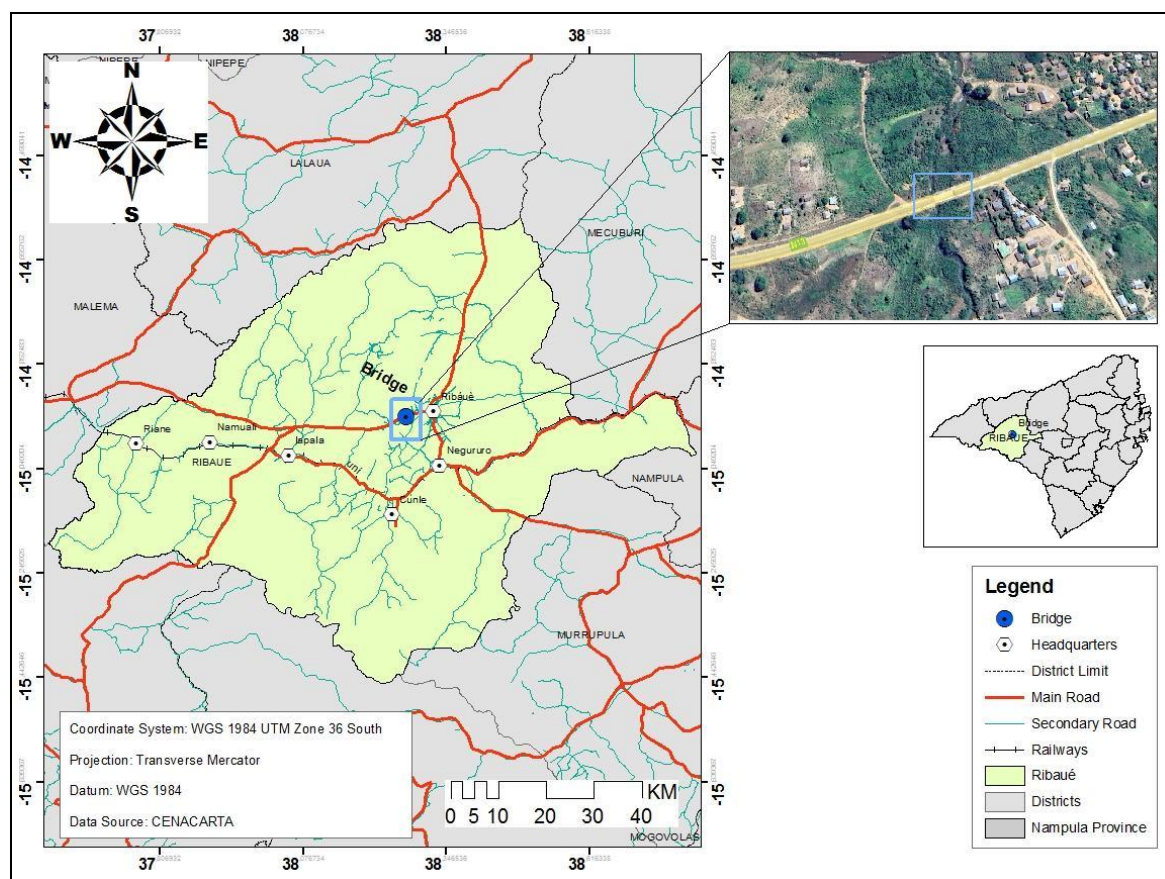


Fig. 3-1 - Project area location

### 3.3 Project Objectives

The main objective of the project is to rebuild and modernize the bridge over the Natete river, to ensure a permanent and safe connection between the north and south banks of the district, improving connectivity between communities, the flow of agricultural products, access to markets and basic social services.

Specifically, the project aims to strengthen the resilience of the infrastructure in the face of flooding and river erosion; ensure adequate road safety standards; promote local socio-economic benefits, including temporary employment and boosting trade; and reduce seasonal isolation and improve district mobility.

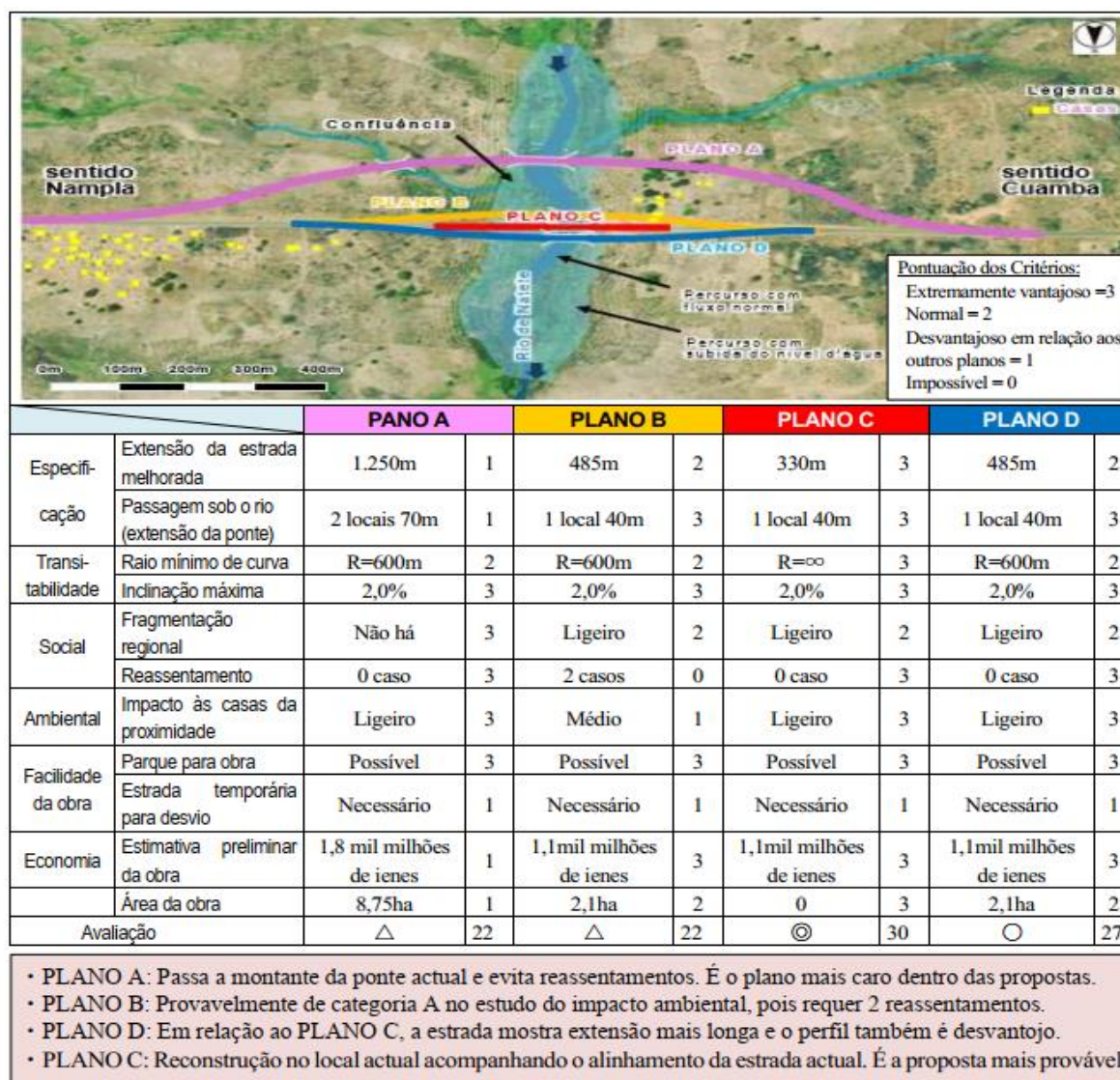
### 3.4 Project Alternatives

Three main options were analyzed to solve the problem of crossing the Natete bridge, namely location, technology, and the "no project" option based on technical, economic, environmental, and social criteria, as described below.

#### 3.4.1 Location Alternatives

Regarding location alternatives, four different options were analyzed (A, B, C, and D), with Alternative C being selected, which involves reconstruction at the current site. This option proved to have the least overall environmental and social impact, as it utilizes an existing and heavily anthropized corridor, thus avoiding the opening of new routes in sensitive areas and minimizing the need for resettlement and the loss of productive agricultural land.

Table 3-1- Comparison of location alternatives



### 3.4.2 Technological Alternatives

In terms of technological alternatives, five main technological options were analyzed using criteria such as safety and structural capacity; execution time; durability and ease of maintenance; climate resilience and flood risk; cost-effectiveness; logistics and accessibility to the site; and compliance with JICA requirements.

The following table presents the technological solutions analyzed for the construction of the Natete bridge.

Table 3-2 - Comparison of the technological alternatives analyzed.

| Alternative                              | Description                             | Advantages                                                             | Limitations                                                                   |
|------------------------------------------|-----------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Cast-in-place reinforced concrete</b> | Concrete molded on site using formwork. | High durability and structural strength; adaptable to site conditions. | Long construction period; greater need for skilled labor and quality control. |
| <b>Precast</b>                           | Prefabricated                           | Faster installation;                                                   | Requires cranes and                                                           |

|                                                     |                                                                                   |                                                                                                    |                                                                                                         |
|-----------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>reinforced concrete</b>                          | structural elements manufactured off-site and transported for assembly.           | higher quality control during production; reduced on-site work.                                    | specialized transport; higher initial cost and logistical complexity.                                   |
| <b>Modular steel bridge (e.g., Bailey type)</b>     | Modular metallic structure assembled on-site from prefabricated steel components. | Very fast installation; can be reused; suitable for temporary or emergency crossings.              | Lower durability in humid tropical climates requires frequent maintenance and anti-corrosion treatment. |
| <b>Composite structure (steel + concrete)</b>       | Combination of steel beams and reinforced concrete deck slab.                     | Optimized balance between weight and strength; suitable for medium spans; reduced foundation load. | Execution complexity; requires specialized engineering supervision and equipment.                       |
| <b>Traditional techniques using local materials</b> | Use of materials such as wood, stone, or plain concrete.                          | Low cost; promotes local labor participation and traditional knowledge.                            | Low durability; limited load capacity; inadequate for heavy traffic and flood-prone areas.              |

After comparative analysis, the solution based on a mixed structure of precast concrete and concrete beams was selected. This option represents the most balanced solution in terms of structural performance, speed of execution, climate resilience (lower susceptibility to damage from erosion or flooding), durability, and economic viability, ensuring the safe and sustainable rehabilitation of the road link over the Natete river.

### 3.4.3 Alternative for not implementing the bridge

The alternative of not implementing the project consists of maintaining the current situation, that is, not rebuilding the bridge in question. This implies not carrying out engineering interventions, leaving the crossing limited to improvised solutions (e.g., detours, forces, temporary bridges).

Not executing the proposed project will reduce the potential of the districts directly affected by the project and may represent the flight of investments to other regions and a loss of time in the transport of goods and people.

Although the alternative avoids direct environmental impacts of construction, the solution entails significantly negative social and economic consequences, especially in the context of dependence on regional mobility, fragility of local infrastructure, and high climate vulnerability. The solution of not implementing the project is therefore not viable from the point of view of sustainable local development, nor is it aligned with the government's commitments regarding territorial inclusion, combating rural poverty, and resilience to climate change.

### 3.4.4 Alternative with the Project

The option based on reconstructing the infrastructure at the current bridge site, following the existing road alignment using a mixed structure of precast concrete and concrete beams, with foundations based on drilled shaft piles, represents the only technical, environmentally, and socially acceptable solution, as it offers durability, low maintenance, and permanent safety. Its implementation guarantees the reinforcement of strategic local and regional infrastructure, compliance with national development and connectivity policies, and a direct contribution to reducing climate and social vulnerability.

### 3.4.5 Interventions under Selected Option

The selected option comprises a set of physical and social interventions. The main intervention will consist of the construction of the bridge infrastructure, including foundations, pillars, deck, access roads, and protective works (riprap and retaining walls).

Complementary interventions include the construction/rehabilitation of road access to the bridge, stormwater drainage, and vertical and horizontal signage, in addition to the implementation of a Community Management Plan (CMP) throughout all phases of project implementation, including community communication programs, complaint management, and monitoring.

## 3.5 Project Activities

The project execution comprises several phases and specific activities as described below.

### 3.5.1 Planning and Project Phase

The planning and design phase comprises a set of essential technical activities that precede the construction phase. In this phase, topographic, hydrological, and geotechnical studies are completed, providing the technical basis for structural design. Detailed design is developed at this stage, including technical drawings, structural calculations, specifications, descriptive reports, and budget.

Construction alternatives are also evaluated, ensuring technical, economic, and environmental viability. The final design integrates environmental and social mitigation measures, guaranteeing a safe, sustainable design in accordance with current regulations.

### 3.5.2 Pre-construction Phase

The pre-construction phase corresponds to the stage where the construction site, access roads, traffic diversions, and provisional water and energy supply systems are defined.

In the legal and administrative context, this phase is dedicated to obtaining all necessary licenses and authorizations. The central activity is the submission of the SES Report to the Nampula Spatial Planning Authority (SPA) and the consequent obtaining of the Environmental Installation License, an indispensable requirement to begin construction. At the same time, there is the regularization of the Land Use Rights (DUATs) for the areas affected by the project and the acquisition of other sectoral authorizations, such as those from the Regional Water Administration (ARA-Norte) for water abstraction and from the provincial energy department for the operation of generators.

The phase culminates with the logistical mobilization of the contractor, the recruitment of local labor, the transport of equipment and materials, and the preparation of the land with cleaning, controlled deforestation, and installation of the construction site and safety signage.

### 3.5.3 Construction Phase

The new bridge will be 40m long, sufficient to accommodate the maximum flow of the plan (180 m<sup>3</sup>/s) and 11m wide. The span length will be equal to or greater than that of the current bridge (40m).

The construction phase of the project corresponds to the period of physical execution of the works, involving the materialization of all structural components, as well as complementary ones foreseen in the executive project. It begins with earthworks, as well as the preparation of access roads, ensuring the conformation of the terrain and adequate conditions for the movement of equipment and materials. This is followed by excavations for the bridge foundations, carried out according to geotechnical specifications, and the construction of riprap and bank protection works, intended to stabilize the riverbed and prevent erosion processes.

Subsequently, the concreting operations of the foundations, pillars and deck are carried out, central stages in the structure of the bridge, guaranteeing resistance and durability. In parallel, drainage and paving works are being carried out on the access roads, to guarantee the adequate flow of rainwater and the functional integration of the bridge into the existing road network. The phase is completed with the installation of vertical and horizontal signage and metal safety barriers, essential elements for the operability and road safety of the infrastructure.

The construction method will be drilled shaft piling. The method, also known as bored piles or cast-in-place piles, is a technique widely used in the construction of deep foundations, especially in bridges, viaducts and heavy structures. The method has advantages including high load capacity, low noise and vibration, and diameter flexibility depending on the type of soil and load required.

The tubes are buried in the ground, either by pressure at the top, or by oscillation or rotation with impulse, or by vibration. The material contained inside the tube is

removed mechanically, although rotary excavation can also be used in some geological formations.

The proposed bridge reconstruction method is illustrated in Figure 3.2, and Figure 3.4 shows the cross-section of the bridge.

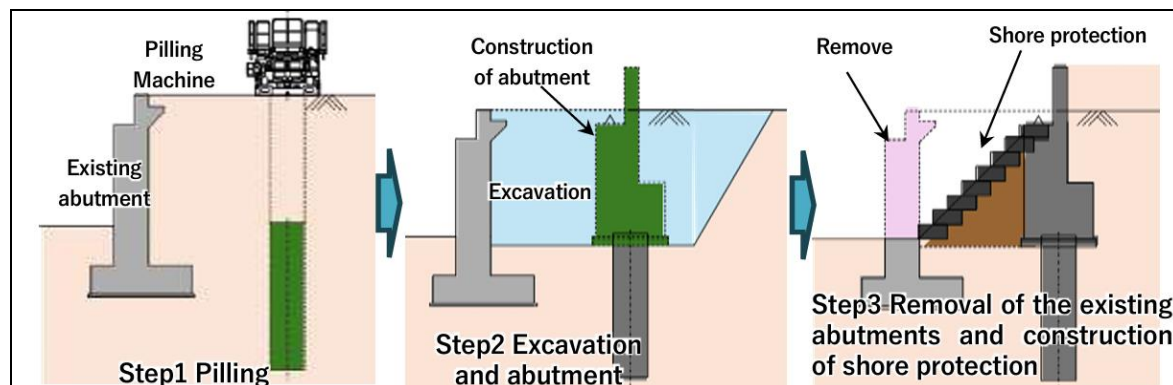


Fig. 3-2 - Method of constructing the bridge over the Natete River

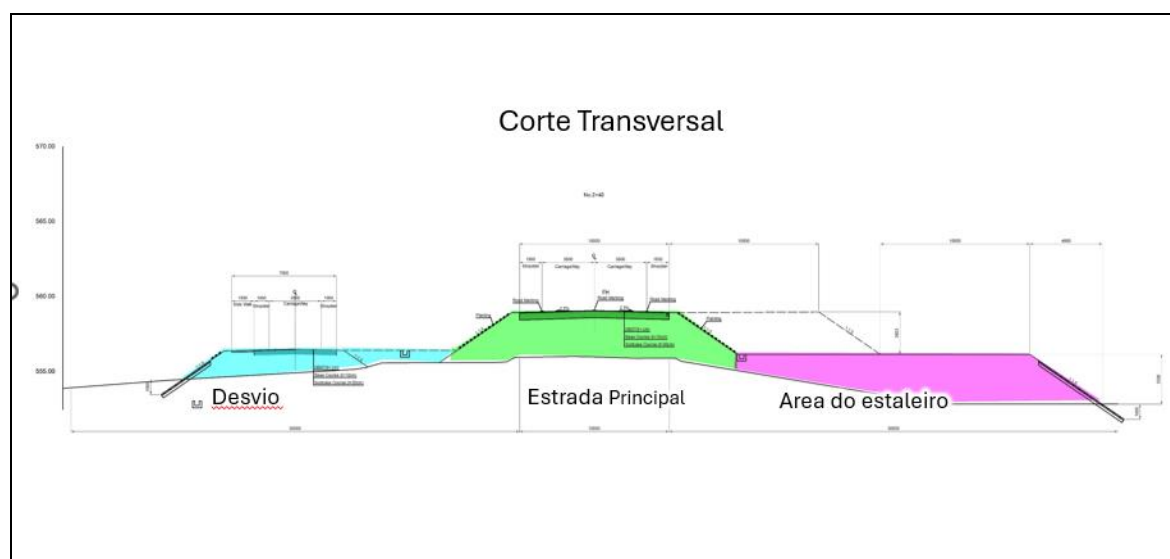


Fig. 3-3 - Illustration of a cross-section of the bridge.

Cofferdams will be constructed to provide a dry working area (i.e., by temporarily retaining water) for the installation of the piles and construction of their capping blocks. The cofferdam will be supported and protected by alternating layers of sand fill, geotextile materials, and rock. The cofferdam and surrounding materials will emerge approximately 1.0 m above the maximum water level.

After reaching the load limit or the foundation layer, steel reinforcement is introduced, and the shaft is fixed with high-strength concrete. The material removed from the formwork can be transported by barges for safe disposal or dumped into the river, provided it meets quality standards.

When using cofferdams, after the installation of the piles, the pile capping block will be cast in situ (alternatively, precast concrete forms can be transported afloat to the

site, then lowered to the required position over the pillars, and the cement poured inside them). In this way, the pile cap mass will be ready to receive the bridge pier.

In shallow water areas, near riverbanks and floodplains, temporary embankments may be constructed to protect the installation of the piles and massive abutment structures of the erected infrastructure.

This methodology involves the application of a semi-rigid pavement consisting of a double surface coating layer; a layer of cement-stabilized soils (soil-cement); and a layer of cement-stabilized soils (soil-cement). The percentages of cement allowed will be 5% (base) and 3% (sub-base).

When installing a new pier behind an existing pier, large-scale excavations will be necessary, as well as temporary waterproofing. To avoid this situation, it is proposed to partially utilize the abutment of the current bridge in a temporary manner for the installation of the new abutment. Using the existing bridge as a temporary structure will reduce costs, as well as minimize the volume of excavated material and, naturally, environmental pressure.

The abutment structure will be determined by the results of the geological survey. Some pillar foundations may be built directly on the shallow rock. However, it must still be found on driven piles to support the superstructure in case of excavation events near the pillar.

To reduce the costs of infrastructure reconstruction, the practice of integral structure or support structure will be evaluated. Regarding the number of spans, a 1-span or 2-span structure is proposed, of which, at this moment, the dominant proposal is for a 1-span structure.

The design of the proposed infrastructure was determined considering the criteria of AASHTO and Japan, meeting the SATCC Standards and ANE Standards. The project speed is 60 km/h (considering the existence of settlements in the surrounding area).

#### **3.5.4 Post Construction Phase**

The post-construction phase of the bridge begins after the completion of construction and handover of the project to the Government. This phase involves the use, management, and maintenance of the bridge under normal operating conditions, such as the regular circulation of vehicles and people on the bridge, implementation of vertical and horizontal signage to ensure road safety, and monitoring of heavy loads to prevent structural overload.

The bridge's operating activities also include regular inspections through routine visual and technical inspections (monthly, quarterly, annually) and verification of expansion joints, pillars, deck, and drainage, as well as preventive maintenance,

including periodic cleaning of the deck, drains, and sidewalks, and repair of surface cracks, anti-corrosion painting, and replacement of signage.

During the operation of the new infrastructure, punctual interventions will also be carried out in case of damage caused by accidents, floods or natural wear and tear, as well as the replacement of damaged components (e.g., guardrails, signage) and also monitoring of erosion on the riverbanks and control of vegetation around the structure and ensuring the safety of users through appropriate inspections and signage and structural monitoring.

In parallel, environmental and social aspects are monitored, as defined in the ESMP, including monitoring water quality, bank stability, erosion control and the impact on local communities. This phase aims to ensure the functional and environmental sustainability of the bridge, as well as the safety and well-being of users and neighboring populations.

### 3.5.5 Project Deactivation and Works Decommissioning Phase

The decommissioning of the bridge is an uncertain process and is not yet planned. However, activities associated with the decommissioning and deactivation of the Project works will take place.

The decommissioning and/or deactivation phase of the bridge works comprises a set of activities aimed at the orderly removal of temporary structures, the replacement of occupied areas, and the mitigation of environmental and social impacts generated during the execution of the works. This phase begins after the completion of the permanent infrastructure and its entry into operation, aiming to ensure safety, environmental sustainability, and the reintegration of the affected spaces.

The main activities include the removal of construction sites, equipment, and construction materials used, ensuring that all waste, including scrap metal, rubble, and hazardous materials, is properly segregated, packaged, and sent to licensed destinations. Temporary access roads and borrow areas or temporary material storage areas must be recovered and leveled, reducing the risks of erosion and terrain instability.

Additionally, degraded areas are revegetated by planting native species, contributing to the restoration of vegetation cover and soil protection. Infrastructure that cannot be reused, such as temporary accommodations, fuel tanks, containers etc. will be dismantled and removed in accordance with safety and environmental management standards.

In the social and safety field, measures are implemented to protect the occupational health of workers involved in this phase, ensuring adequate hygiene conditions, safe transportation, and personal protective equipment. Similarly,

communication is carried out with local communities, informing them about the decommissioning activities, the expected deadlines, and any temporary disturbances (noise, dust, vehicle traffic) that may occur.

### 3.6 Project Timeline

The preliminary project schedule is estimated at 24 months, distributed as follows:

- Months 1-3: Mobilization, site setup, and land preparation.
- Months 4-18: Construction of foundations, pillars, deck, and protective works (period subject to hydrological variations).
- Months 19-21: Paving, final drainage, and signage.
- Months 22-23: Final testing, demobilization, and handover of the project.
- Month 24 onwards: Start of the operational and monitoring phase.

Given local climatic conditions, the work schedule foresees approximately 300 working days per year, organized in two daily shifts of 8 hours each.

#### 3.6.1 Public Services

The project may utilize local public services. However, it should not cause a significant overload on local public services such as energy, health, or security. Any additional needs arising from the project activities will be duly coordinated with the district administration, ensuring integrated management and continuity of essential services to the community.

#### 3.6.2 Auxiliary Infrastructure and Inputs

A construction yard (camp site) will serve as a support facility for the bridge reconstruction works. Main components will be defined by the contractor. The location of the construction yard is shown in Figure 3-4, ensuring compliance with the minimum safety distance from the Natete River and other environmentally sensitive areas.



Fig. 3-4-Layout of the Construction Yard

### 3.6.3 Access Roads

Access routes will be opened, including a bypass road, to maintain mobility and site access during construction. These roads will facilitate traffic detours and safe circulation of people, equipment, and materials.

Planned works include:

- Opening a temporary bypass around the damaged bridge (220–270 m long);
- Compaction and leveling using local stone materials;
- Installation of temporary road signage;
- Construction of small culverts where drainage lines cross;
- Slope and margin reinforcement in erosion-prone zones.

The final alignment will be refined through detailed topographic surveys, avoiding cultivated areas and minimizing native vegetation removal and interference with sensitive habitats.

Upon completion of the works, all installations and/or areas affected by the project that cannot be reused or adapted to possible future use must be rehabilitated in accordance with the Environmental Restoration Plan. In the event of future use of the installations and/or related areas, it must be supported by technical and environmental feasibility studies.

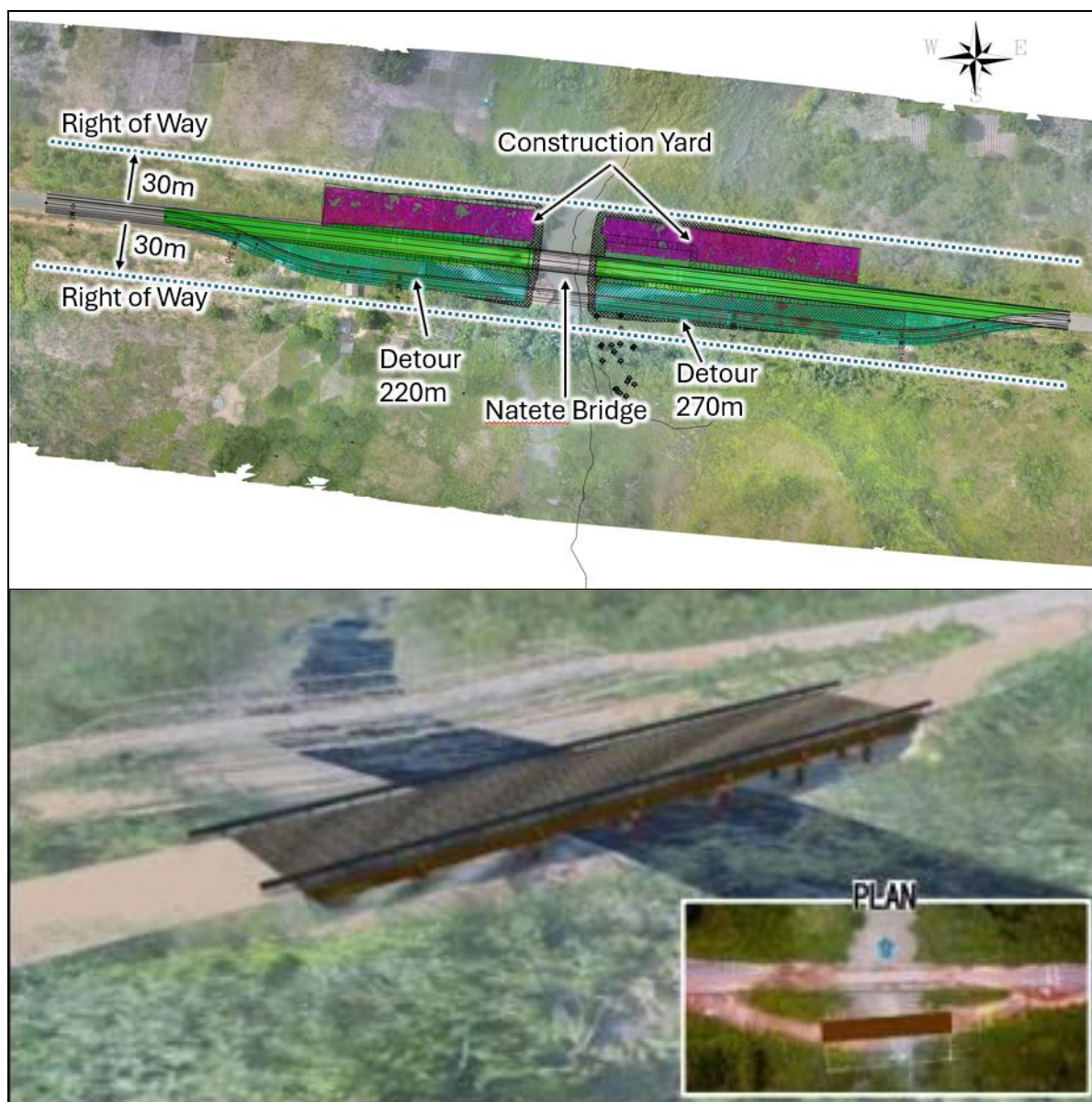


Fig. 3-5-Layout of Bypass Roads and Construction Yard

### 3.6.4 Water Supply

Water will be supplied from boreholes tapping groundwater, lined with PVC casing. The projected daily abstraction capacity is approximately 100 m<sup>3</sup>, operated on a rotational schedule to preserve aquifers. Water will feed a system of elevated storage tanks with a total capacity of 30 m<sup>3</sup>.

A formal request for water abstraction will be submitted to the Northern Regional Water Administration (ARA-Norte). Water will be conveyed to an underground reservoir with a capacity of 52 m<sup>3</sup> (5.2 m × 5.0 m × 2.0 m).

### 3.6.5 Energy and Fuel Supply

Two diesel generators (10–1,000 kVA, 110/220V, 220/380V, or 230/400V, 50–60 Hz) will be installed to supply electrical energy for construction operations.

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Authorization for generator use will be obtained from the Provincial Infrastructure Services' Energy Department (Nampula).

Semi-hazardous materials such as oils, lubricants, diesel, and gasoline will be used for vehicles and heavy machinery; thus, safe and compliant storage facilities will be established in designated locations.

### 3.6.6 Construction Materials and Equipment Needs

The bridge construction will require large quantities of materials — crushed stone, sand, and borrow soil — necessitating the opening of a quarry and borrow pits for suitable filling material.



Fig. 3-6 - Shows the proposed aggregate extraction site and nearby infrastructure

The site selection considered material availability, environmental sensitivity, and accessibility, to minimize extraction and transport impacts.

Portland cement will be used, and sand, stone, and water must meet the Bridge and Culvert Construction Technical Specifications. Other materials — such as timber, cement, iron, and steel — will be produced from the local market.

### 3.6.7 Labor Requirements

The number of workers to be employed will be determined by the contractor; however, most laborers will be recruited locally from neighboring communities and technical-vocational schools, prioritizing those with construction experience. Gender equity will be observed during recruitment.

All services related to security and surveillance, as well as the provision of meals, will be the responsibility of service providers who will also employ more people.

Security, catering, and cleaning services will be provided by external service providers, who will also employ additional local workers.

Regarding foreign workers, they will be hired in accordance with the principles established by subparagraph b, article 5, Decree No. 63/2011 of December 7, which governs the principles of hiring foreign labor in the country established by the Labor Law.

### 3.7 Delineation of the Project Area of Influence (PAI)

To define the limits of the AIP, the characteristics of the project activities were considered, as well as the delimitation of the environmental components that will be affected by the project. The definition of the AIP aims to allow the systematic evaluation of the direct, indirect, cumulative and synergistic impacts resulting from the construction, operation and, eventually, decommissioning phases of the bridge.

In its delimitation, the locations of the works, the potential economic effects resulting from the activity, the areas of impact generation and the respective propagation vectors were considered. Thus, two main categories of PAI were established.

#### 3.7.1 Area of Direct Influence (ADI)

The ADI corresponds to the immediate intervention zone where the reconstruction activities and, subsequently, the deactivation/decommissioning of the bridge cause direct and more intense impacts. For this project, the AID is defined as the polygon that encompasses the bridge site, immediate riverbanks, construction site, access roads, and material storage/sorting areas.

Typical impacts in the ADI include changes in land use; risks of soil and water contamination by contaminants (oils, cement, sediments); noise, dust, vibrations; disruption of traffic and road safety; and potential physical displacement or temporary loss of assets/activities (e.g., informal farms or stalls on the roadside).

#### 3.7.2 Indirect Area of Influence (IAI)

The IAI corresponds to the geographical zone where the secondary and far-reaching effects of the project are manifested, that is, impacts that do not occur directly during the construction, but result from the propagation of vectors such as traffic, socio-economic changes, downstream hydrodynamics, diffuse emissions, and cumulative pressures.

This area encompasses riverside communities and populations located near the bridge, which may be influenced by changes in accessibility and the flow of people and goods; it also includes riparian ecosystems and habitats associated with the Natete River, subject to changes in flow, sediment transport, and ecological dynamics. In addition, the AII integrates infrastructure near the project area such as schools, health units, and markets that may experience both benefits and

additional pressures due to the new infrastructure.

More broadly, the All extends to the surrounding continental territory, reflecting socio-economic impacts on a regional scale, mainly related to improved connectivity and mobility. It includes connections to secondary and tertiary roads in the district and surrounding areas, as well as regional trade and transport flows between population centers such as Ribaué, Lalaua, and Malema. It also encompasses the administrative intervention area of the district governance bodies, which will now deal with new opportunities and challenges arising from territorial revitalization.

Typical impacts on the All include improved mobility and local commerce; possible changes in land use and occupation patterns; increased traffic and, consequently, an increased risk of road accidents; attraction of migrants and increased pressure on local basic services; greater territorial integration and reduction of seasonal isolation; revitalization of local value chains; and, finally, structural changes in territorial planning and public investment priorities.

### 3.8 Current Land Use Patterns in the AIP

The main land use is subsistence and commercial agriculture, with over 70% of the usable area used by family farming. The main crops are cassava, corn, beans, peanuts, sweet potatoes, vegetables (tomatoes, cabbage), and cotton and tobacco in specific areas (commercial). Agriculture is practiced on hillside fields (cleared miombo) and fertile plains using rudimentary irrigation techniques.

The forests and natural vegetation (miombo and mountain forest) located in the higher areas, Mount Ribaué and Mount M'paluwe, have natural vegetation and endemic species, whose uses include the collection of firewood, medicinal plants, wild fruits, and as a source of wood for construction and charcoal production.

The land is used equally for natural pasture and livestock farming, including extensive raising of goats, cattle, pigs, and poultry. Pastures are in savanna and post-harvest agricultural areas.

The district has conservation areas and high biodiversity value. Mount Ribaué is recognized as a Tropical Important Plant Area (TIPA) and a Key Biodiversity Area (KBA) with the function of conserving biodiversity, rare habitats, and endangered species.

The land is occupied by human settlements and infrastructure with linear expansion along roads and in rural areas, and for schools, health units, markets, and churches.

Regarding water resources, water is used for irrigation and human consumption (boreholes, wells, springs, and for raising animals) and fishing. Forest resources

are used to obtain firewood (the main source of domestic energy) and timber for building houses, barns, charcoal, as well as non-timber products such as honey, mushrooms, wild fruits, medicinal herbs, etc.

Wild animals are hunted for subsistence (unlicensed) purposes, which persist in some forested areas where birds, small mammals, and reptiles are the main hunted groups.

### 3.9 Waste Production and Management (Solid and Liquid)

The project activities are associated with the production of liquid and solid waste, hazardous and non-hazardous, recyclable and non-recyclable, with an emphasis on the construction phase.

Solid waste management will involve source segregation between recyclable, hazardous, and inert waste in appropriate containers; temporary storage in a waterproofed and covered location, with adequate signage; and transport by a licensed operator with cargo and destination records.

Regarding final disposal, aggregates will be deposited and treated and/or reused in construction landfills, while recyclable waste will be sent to local recycling centers and hazardous waste delivered to licensed operators for co-processing or incineration. The suggested location for the non-hazardous waste deposit is located 500m from the tip (see figure 3.7).



Fig. 3-7 - Proposed location for landfill of construction and site waste.

For liquid waste, oily water will be sent to oil-water separators, while oily waste will be collected by a licensed operator for proper final disposal. Sanitary wastewater generated will be treated using chemical toilets with regular maintenance and collection by a licensed company, while concrete pouring water will be channeled to retention basins and pH neutralization before disposal.

Preventive measures such as spill containment kits, preventive maintenance of machinery and fuel tanks will be applied to contain any incidents.

Hospital waste will be segregated, separating contaminated waste from common waste (paper, food scraps, etc.) which will be deposited in the landfill. Contaminated waste, including sharps, will be disposed of by a specialized company.

## 4 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL REFERENCE SITUATION IN THE PROJECT AREA

### 4.1 Biophysics Characterization

#### 4.1.1 Climate and weather conditions

The meteorological characterization of the project area is fundamental to understanding the climatic conditions that influence the hydrological behavior of the Natete River, the planning of construction activities, and the durability of the infrastructure. The data presented are based on information from meteorological stations in the Nampula region and surrounding areas, representing the annual averages and seasonal variations typical of the local climate.

According to the Köppen classification, the climate is tropical dry or semi-arid (Aw) with two climatic seasons. The rainy season occurs from November to March, with annual precipitation varying between 800 and 1,200 mm (approximately 800-1,000 mm in semi-arid areas, up to >1,200 mm in wetter zones), while the dry season extends from May to October, resulting in prolonged periods of water scarcity.

#### 4.1.2 Temperature, precipitation and evaporation

The region has a humid tropical climate, with average annual temperatures ranging from 22°C to 28°C. The hottest months generally occur between October and March, with highs that can exceed 32°C, while the coolest months are between June and August, with lows around 18°C to 20°C. Daily temperature variations are moderate, which favors good conditions for outdoor construction activities for most of the year.

The weather is influenced by the district's geographical location, as it is situated in an intermediate region between the plateau areas of Lichinga and the flat coastal area of Nampula, registering an average annual temperature of 20°C and a relative humidity of around 65%. The mountainous regions of Ribaué and Iapala have the lowest temperatures in the district, during the months of May to August.

Precipitation has a well-defined seasonal distribution, mainly concentrated between November and April, corresponding to the rainy season. The average annual total rainfall is between 900 and 1,200 mm, with the possibility of intense and localized events. During the dry season (May to September), rainfall is scarce. This rainfall pattern is crucial for planning the work, especially regarding erosion and drainage control.

Average evaporation rates are moderate to high, ranging from 1,600 to 2,000 mm/year, with greater intensity during the dry and hot months. High evaporation influences surface water availability and soil moisture, important aspects for controlling compaction and stability of the bridge foundations.

The following figure shows the temperature and precipitation data in the Ribaué district.

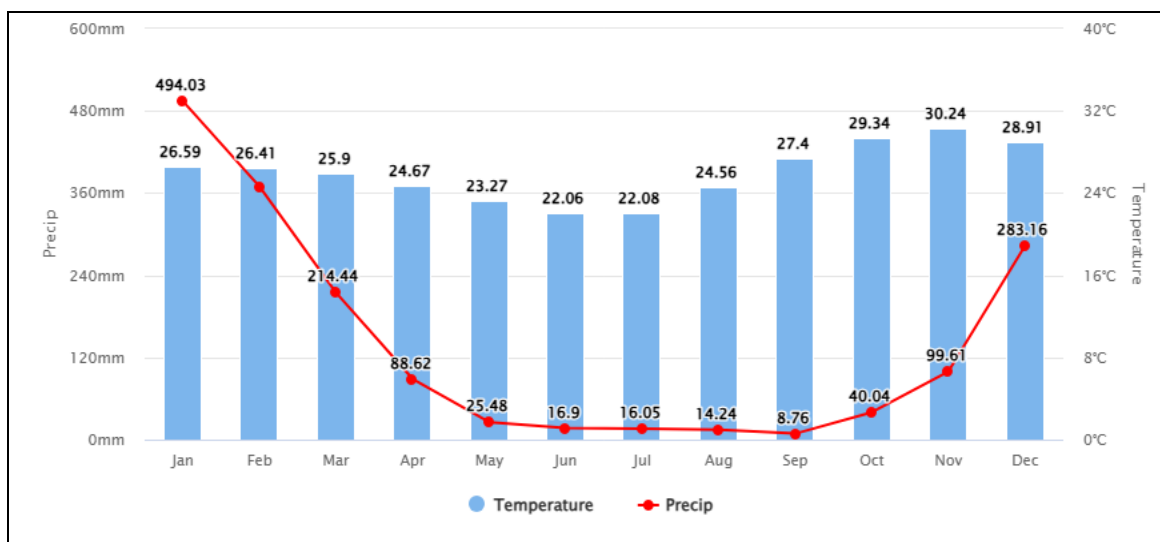


Fig. 4.1 - Variation in temperature and precipitation in the Ribaué district (source: Time & date, 2025).

### 4.1.3 Humidity

Relative air humidity generally remains high throughout the year, varying between 65% and 85%, with peak values during the rainy season (December to March). These humidity levels in the region influence thermal comfort, as well as the concrete curing process during construction, requiring adequate monitoring to ensure the quality of the materials used.

### 4.1.4 Wind speed

There is no specific wind measurements published for the Ribáué district, Nampula province. To characterize the wind in the AIP (Area of Intertropical Provincial Intervention), the nearest meteorological data (Nampula city Meteorological Station) and meteorological models were used to infer the wind behavior in the district.

The wind characterization in the Ribáuè district reveals a moderate wind regime, influenced both by the district's geographical position in the interior of the province and by its average altitude of approximately 535 meters above sea level. The predominant climate in the region is of the tropical Cerrado type (Aw), with a rainy season between November and March and a dry season from April to October, which significantly conditions the behavior of the wind throughout the year.

In terms of intensity, the average annual wind speeds in Ribáuè are between 6 and 10 km/h (equivalent to about 1.6 to 2.8 m/s), with marked monthly variations.

The windiest months correspond to the end of the dry season, between August and October, when average speeds of around 9 to 10 km/h are recorded, peaking

in October. The calmest period occurs during the rainy season, especially in February, when average speeds drop to around 6 km/h. These variations are associated with thermal and atmospheric pressure differences between the coast and the interior, as well as the lower surface roughness during the dry season, when vegetation is lower and soils are more exposed.

The directional wind regime shows clear seasonal rotation. During the months of December to February, the wind blows predominantly from the north, coinciding with the beginning of the hot and humid season. Between February and August, there is a gradual reversal of direction, with the south wind becoming predominant, associated with the influence of subtropical high-pressure systems in the southern hemisphere.

From August to December, the winds in the Ribaué district tend to blow from the east and northeast, following the movement of monsoon systems and the approach of the rainy season. This directional alternation is consistent with the patterns recorded in the city of Nampula, which serves as a regional meteorological reference and presents significant seasonal percentages: approximately 46% northerly winds in January, 80% southerly winds in June, and 49% easterly winds in October.

Under operational conditions, measurements from Nampula Airport (the nearest meteorological station with regular observations) confirm the predominance of easterly, northeasterly, and southeasterly winds, with hourly speeds generally varying between 10 and 20 km/h. These observations are useful as a practical reference, since the wind regime in Ribáuè tends to follow the same regional pattern, with small local variations due to topography and vegetation cover.

From a technical and planning point of view, the wind in Ribáuè does not present extreme characteristics, but it exerts a relevant influence on environmental comfort, the dispersion of dust and atmospheric emissions, as well as on the dimensioning of exposed infrastructure and works, such as bridges and metal structures. For design purposes, it is recommended to adopt a reference average wind speed of around 6 m/s, considering occasional gusts that can reach values between 15 and 25 m/s, especially during the transition between the dry and rainy seasons. The following figure shows the wind behavior in the Ribaué district.

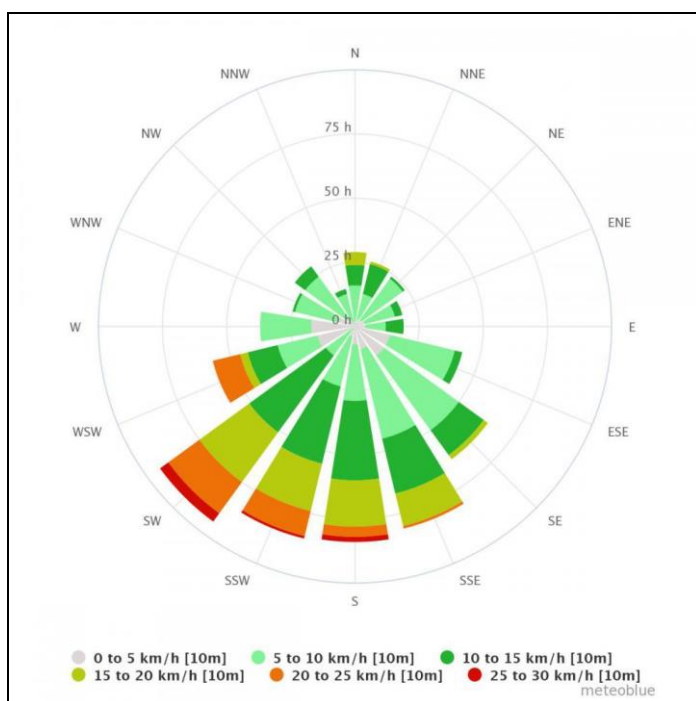


Fig. 4.2 - Compass rose (font: <https://weatherandclimate.com/mozambique/nampula>)

In summary, the wind regime in the Ribáuè district is moderate, with predictable seasonal variations and a dominant direction that alternates between north, south, and east throughout the year.

These conditions, although stable, should be duly considered in environmental and structural studies, and it is still recommended to install an anemometer or local weather station to collect continuous data for at least 12 months in order to confirm the patterns described here and allow for a more precise calibration of the specific wind conditions of the location.

#### 4.1.5 Hours of Sun

The region benefits from high levels of sunshine, with an annual average of 2,600 to 2,900 hours of sun. The sunniest months coincide with the dry season, between May and September, providing favorable conditions for fieldwork and material drying. The good solar availability also represents potential for the use of photovoltaic energy systems at the shipyard.

#### 4.1.6 Topography

Ribaué is part of the Mozambican Plateau, with plateau areas between 200-600m (medium plateaus) belonging to the Chire-Namuli mountain range and some areas above 600m (high plateaus).

Granite inselbergs stand out, including Mount Ribaué, which reaches approximately 1,777m, formed by gneiss and granite. Residual hills, ridges, and undulating relief predominate, with "V"-shaped valleys due to vertical erosion.



Fig. 4.3 - Morphological aspect of the project's area of influence.

Physiographically, the project area consists of a low plateau zone that gradually transitions to a more dissected relief with steeper intermediate slopes, from the sub-plateau transition zone to the coastal zone. Figure 4.2 illustrates the morphological map framing the project area.

Fig. 4.4 - Topographic map outlining the project area.

The physiography is dominated by alternating interfluvies and river valleys which, due to their width, depth and position (in relation to the rivers), may alternate with dambos.

#### 4.1.7 Soil

The Ribaué district is part of Agro-Ecological Zone 7 (interior of Nampula) where the predominant soils are mainly Ferralsols, Lixisols and Luvisols, with moderate to good fertility (IIAM (1994), cited by MINAGSEA (2014)). In the interior of the district, deep red clay soils predominate, with good permeability and drainage, suitable for agriculture. Residual soils derived from Precambrian rocks (gneiss and granite) also occur in the district, with variable texture, generally well-drained, in addition to alluvial soils in valleys.

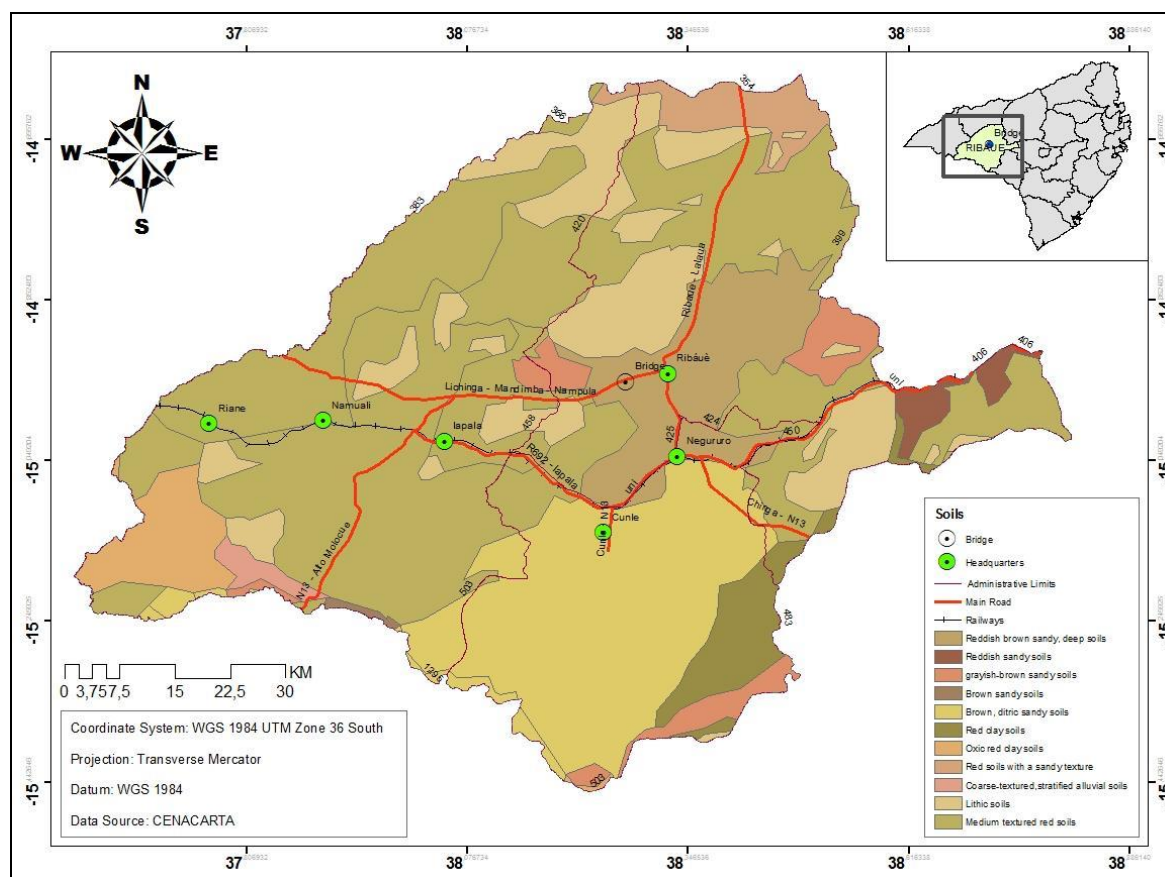


Fig. 4.5 - Map of soil occurrences in the district, framing the project area.

The river valleys are dominated by alluvial soils (Fluvisols), which are dark, deep, heavy to medium texture, moderately to poorly drained, and subject to regular flooding. According to MAE (2024), hydromorphic soils of varying texture are found in the dambos, ranging from gray sandy soils, sandy soils over clay to dark-colored stratified clayey soils (*Mollic, Gleyic and Dystric Gleysols, and Haplic and Luvic Phaeozems*).

Most soil in the proposed project area have medium to heavy textures, are deep, and are well to moderately well drained. On the intermediate slopes of the interfluvies, the soils vary in color, from brownish gray to yellowish-brown soils, are moderately well-drained, and have a clayey texture.

#### 4.1.8 Hydrography and water resources

The project's area of influence is integrated into the Ligonha River Basin, one of the most significant river systems in northern Mozambique. The hydrographic characterization reveals a well-defined drainage network, with watercourses that predominantly run west-east, following the natural slope of the Mozambican Plateau towards the Indian Ocean.

The Natete River, where the proposed project is located, presents typical characteristics of rivers with a periodic regime, with strong seasonality in its flows.

This variation is marked by a period of intense flooding during the rainy season (November to March) and a drastic reduction in water flow during the dry season (May to October), even drying up in some sections.

The fluvial dynamics of the Natete River show significant erosive processes, evidenced by the current depth of the riverbed, which is about four meters lower than at the time of the construction of the original bridge. This morphological alteration constitutes a critical factor for the proper dimensioning of the foundations of the new infrastructure, and it must be ensured that the structure is sufficiently resilient to withstand the hydraulic force during extreme flood events.

The hydrographic network is complemented by other relevant watercourses, such as the Musse, Lalaua, Mecuasse, and Mepuipui rivers, in addition to several ephemeral streams that only carry water during the rainy season. Figure 4.4 illustrates the hydrological scenario in the district.

The region's water resources play fundamental ecological and socioeconomic roles for local communities. As mentioned above, they are used for domestic supply through wells, boreholes, and springs; for agricultural irrigation; for livestock watering; and for subsistence fishing. The management of these resources within the context of the project falls under the legal scope of the Water Law (Law No. 16/91) and the regulations of the Northern Regional Water Administration (ARA-Norte), requiring the rigorous implementation of measures to prevent water pollution, as established in Decree nº 18/2004, to guarantee the protection of aquatic ecosystems and the traditional uses of the Natete River.



of the wells as a measure to preserve the aquifers, complemented by storage systems in reservoirs with a total capacity of 30 m<sup>3</sup>.

From an environmental point of view, potential risks are identified associated with the risk of contamination from infiltration of fuels, lubricants or effluents generated during construction.

#### 4.1.10 Ecological resources

The project's area of influence is situated within a unique ecological context of significant importance for biodiversity conservation in Mozambique. The bioecological zone is characterized as a transition region between the ecosystems of the Zambezia Forest Corridor and the coastal formations of northern Mozambique, dominated by a mosaic of landscapes that includes dry Miombo on the mid-slopes, patches of mountain forest on the higher altitude plateaus, and narrow strips of riparian forest along watercourses.

This ecosystem complex is particularly relevant in Monte Ribaué, recognized as Mozambique's first Tropical Important Plant Area (TIPA) and simultaneously designated as a Key Biodiversity Area (KBA), functioning as a true "island in the sky" that harbors unique microclimatic conditions, as well as endemic species. The forest reserves (Monte Ribaué and Mupalué) are 5 kilometers from the project site to the northeast and northwest. Figure 4.5 illustrates the location of these areas.

The flora of the region presents remarkable diversity, with a predominance of species characteristic of Miombo, such as *Brachystegia spiciformis*, *Julbernardia globiflora*, and *Pterocarpus angolensis* (Umbila), complemented by economically valuable timber species such as Chanfuta (*Afzelia quanzensis*) and African Mahogany (*Khaya anthotheca*) in gallery forests. The area also stands out for the presence of threatened species and those under commercial pressure, such as Pau-preto (*Dalbergia melanoxylon*) and *Millettia stuhlmannii*.

These ecosystems provide essential ecosystem services for the well-being of local communities and for maintaining regional environmental balance. Provisioning services include the availability of non-timber forest products (medicinal plants, wild fruits, honey), firewood, timber for construction, and water resources. Regulating services manifest themselves through soil protection against erosion, flood control, carbon sequestration, and microclimatic regulation.

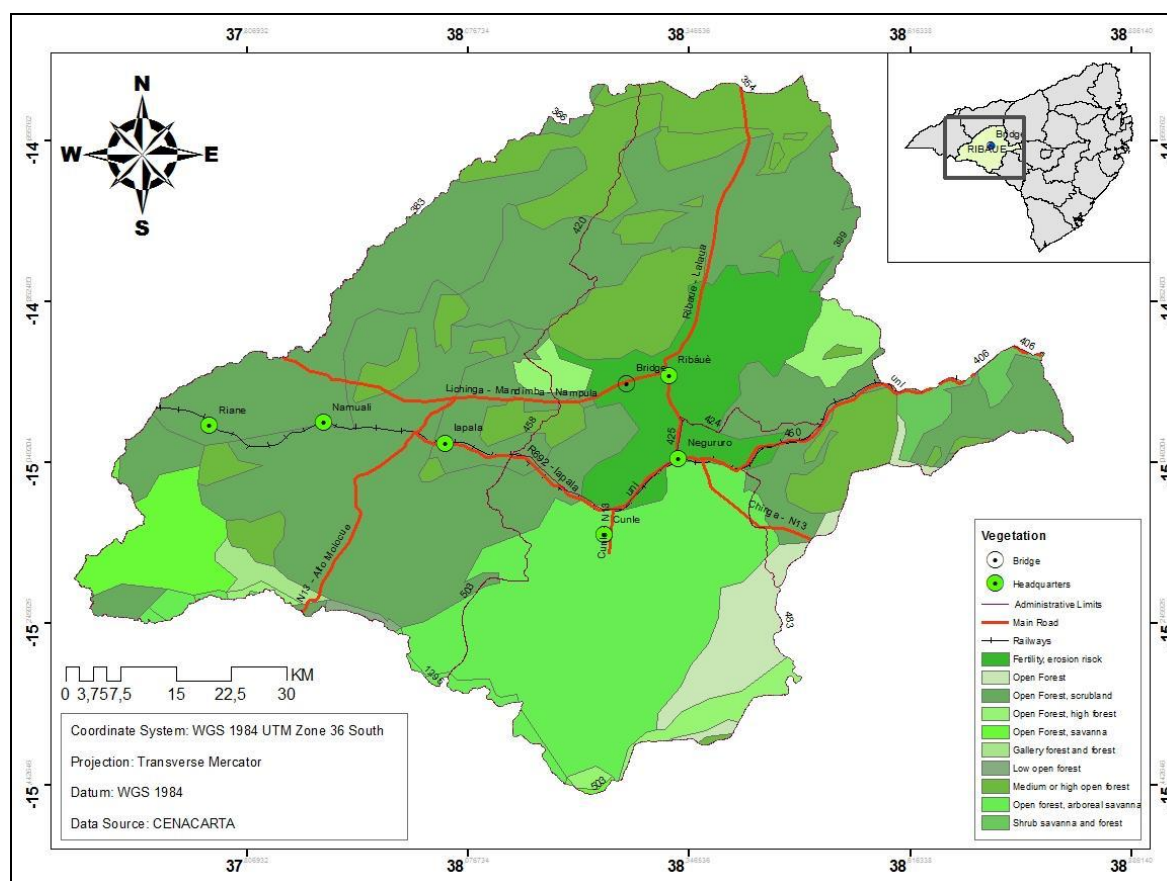


Fig. 4.7 - Vegetation map of the district, framing the project area.

Support services are based on maintaining habitats for biodiversity and nutrient cycling, while cultural services encompass aesthetic and spiritual values, as well as opportunities for education and scientific research. The preservation of these ecological resources and the functions they perform is therefore crucial for the environmental and socioeconomic sustainability of the region, requiring the implementation of rigorous protection and monitoring measures within the framework of the bridge reconstruction project.

The fauna is equally diverse, including mammals such as kudus, antelopes, and primates, a varied avifauna, and a herpetofauna of exceptional conservation relevance, with endemic and critically endangered species such as the *chameleons Nadzikambia Ribaué* and *Rhampholeon tilburyi*, and the amphibians of the *genera Nothophryne broadleyi* and *Nothophryne ribauensis*, both categorized as endangered.

Hunting practiced by the natives constitutes an alternative to the families' diet. The constant hunting of these animals jeopardizes their existence, some of which are already at risk of extinction.

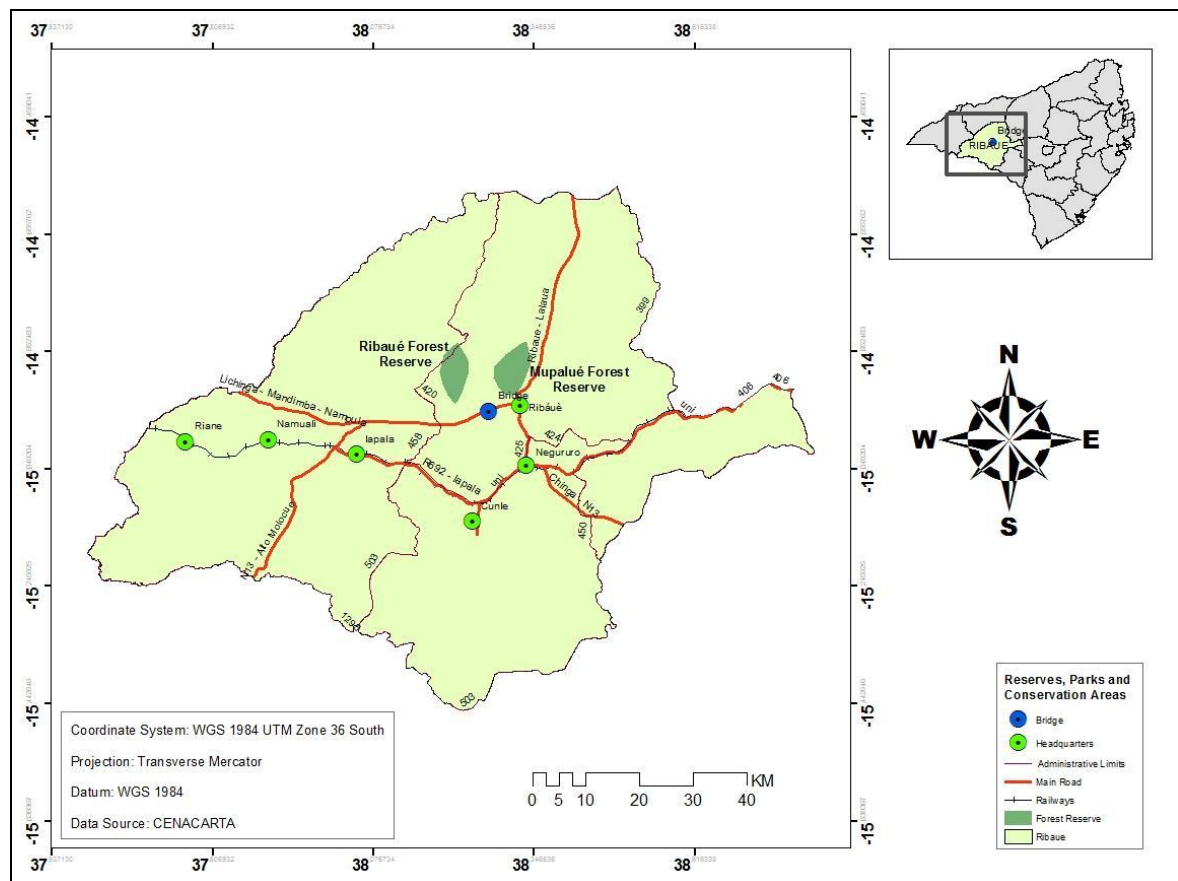


Fig. 4.8 - Location of the forest reserve and the Natete bridge.

## 4.2 Socioeconomic Characterization

The socio-economic characterization of AIP reveals a context marked by significant development challenges, which must be considered in the planning and implementation of social management measures, as established in the ESMP and ARAP.

### 4.2.1 Administrative context

The Ribaué district is in the western part of Nampula Province, bordering Lalaua district to the north, Alto Molocué district (in Zambézia Province) and Murrupula district to the south, Malema district to the west, and Mecubúri district to the east.

### 4.2.2 Demographics and Social Structure

The Ribaué District has a population of 311,522 inhabitants (INE, 2024), characterized by a young age structure – 47% of the population is under 15 years old.

The gender distribution reveals a slight female predominance (163,990 inhabitants) and a masculinity index of 96%. The urbanization rate is only 23%, indicating a predominantly rural population, concentrated in small population

clusters and dispersed in agricultural areas. The predominant ethnic group is the Emakhuwa.

The percentage of salaried workers is 6% of the active population, dominated by men (salaried women represent 1% of the female active population and 10% in the case of men).

This socioeconomic characterization underlines the existence of a rural, young population that is mostly dependent on vulnerable subsistence agriculture, with limited access to basic services. These factors should guide the implementation of all social interventions of the project, with emphasis on gender equity, prioritization of local labor, strengthening of the local economy, and mitigation of impacts that may worsen the living conditions of this population, in strict accordance with the provisions of ARAP and ESMP.

#### 4.2.3 Types of Housing and Habits of the Population

The pattern of land occupation and lifestyles in the AIP reflects a deep adaptation to the rural context and a direct dependence on natural resources.

The predominant dwellings are built with local materials, featuring wattle and daub or thatched walls and thatched roofs, although a gradual transition to zinc sheets is observed in areas with greater access to income.



Fig. 4.9 - Typical housing in the AIP

Most homes lack basic infrastructure, with dirt floors, no electricity, and dependence on communal water sources. Population clusters are distributed linearly along the main roads, with rural dwellings scattered near the fields.



Fig. 4.10 - Population clusters along the N13 near the bridge.



Fig. 4.11 - Fishermen near the bridge.

The population's way of life is structured around the subsistence agricultural cycle, where families dedicate their daily lives to cultivating the land, processing food, and obtaining essential resources. The diet of the populations in the project region is based on xima (a type of porridge) made from corn or cassava, supplemented with beans, vegetables, and occasionally animal protein from river fishing, domestic livestock farming, or subsistence hunting. Gender roles are well defined, with women responsible for most subsistence agricultural activities, food

processing, fetching water and firewood, and caring for the family, while men are more involved in cultivating commercial crops, livestock farming, and salaried work.

Social and cultural life is organized around community structures, traditional ceremonies, and reciprocal relationships, such as the "majoja" community work system. This characterization highlights a population whose housing and daily habits are closely linked to local ecosystems, simultaneously facing significant challenges in access to infrastructure, food security, and pressure on natural resources-aspects that must be fully considered in the design and implementation of the project.

#### 4.2.4 Economic and Occupational Activities

The economy is dominated by subsistence agriculture, an activity that involves about 92% of families. This practice takes place on small family farms, based on crops intercropping such as cassava, corn, cowpeas, cowpeas, and peanuts, with cotton being the main cash crop.

However, some families employ traditional methods of soil fertilization such as fallowing, incorporating plant stubble, manure, or ashes into the soil. In addition to climatic issues, the main constraints to production are pests, drought, lack or insufficiency of seeds and pesticides.

Extensive livestock farming (cattle, goats, pigs, and poultry) in the district appears as a complementary activity. The occupational structure reflects this reality: 91% of the economically active population consists of self-employed farmers, with a notable predominance of women in this activity. The salaried sector is small (6% of the active population), showing a strong gender disparity, with men being significantly more represented (10%) than women (1%).

#### 4.2.5 Development and Vulnerability Indicators

According to available data, the poverty rate in the district worsened from 54% in 1997 to 58% in 2007, a value significantly higher than the national average. This upward trajectory of poverty reflects a combination of multiple factors, including low agricultural productivity, limited economic diversification, inadequate access to basic services, and high exposure to climatic shocks such as droughts and floods. Poverty in the region manifests itself mainly in the form of multidimensional poverty, characterized not only by insufficient monetary income but also by deprivation in access to education, health, decent housing, drinking water, and sanitation.

Chronic malnutrition affects a significant portion of the population, especially children, reflecting food insecurity and persistent nutritional deficiencies. The situation is aggravated by gender disparities in access to resources and economic

opportunities. Women, although constituting the main workforce in subsistence agriculture, have more limited access to land, credit, and technical assistance, and are significantly underrepresented in the formal salaried sector (only 1% of the female active population).

#### 4.2.6 Gender and Woman

The analysis of gender dynamics in the AIP reveals a context of profound asymmetries that structure the social and economic organization of the population of the Ribaué District.

The demographic composition, with a slight female predominance (163,990 women) and a masculinity index of 96%, configures a scenario in which women bear a disproportionate burden of productive, reproductive, and community responsibilities.

The sexual division of labor is markedly asymmetrical, with women performing almost all subsistence farming tasks – assuming about 91% of family food production – in addition to food processing, obtaining water and firewood, childcare, and domestic management. This triple workload constitutes a severe constraint on their mobility, social participation, and access to income opportunities outside the family sphere.

Women face structural barriers in accessing and controlling fundamental productive resources, including land (DUAT), credit, agricultural inputs, and markets for the sale of their surpluses. These limitations are starkly reflected in the formal labor market, where only 1% of economically active women have access to salaried work, compared to 10% of men.

In the context of the bridge reconstruction project, women are particularly exposed to differentiated impacts. Potential disruptions in access to water sources, cultivation areas, or firewood harvesting areas during the construction phase will tend to substantially increase their daily workload and commuting time. Simultaneously, they are more vulnerable to health risks arising from the possible contamination of natural resources and to safety issues associated with the influx of temporary workers.

Given this context, it is imperative that a gender perspective be integrated across all phases of the project, in strict accordance with JICA guidelines. This integration must materialize through concrete measures, such as the creation of community consultation mechanisms that guarantee the safe and equitable participation of women, the establishment of quotas for their hiring in activities suited to their skills and availability, the implementation of strict codes of conduct against sexual harassment, and the prioritization of their access to opportunities for the provision of goods and services.

Continuous monitoring, with indicators disaggregated by sex, will be fundamental to evaluating the effectiveness of these measures. In this way, the bridge project could not only prevent the exacerbation of existing inequalities but also act as a catalyst for greater gender equality, ensuring that its benefits are shared fairly by all members of the community.

#### 4.2.7 Conflict of Interests and Law and Order Situation

The implementation of a large-scale project such as the reconstruction of the bridge over the Natete River takes place in a complex social context, with the potential to generate conflicts of interest and challenges to law and order, requiring proactive and systematic management.

Conflicts of interest tend to emerge mainly from competition for resources and opportunities, namely through the perception of unfair distribution of benefits such as employment and supply contracts, the use of land for temporary infrastructure that interferes with farmland or other traditional uses, and the change in local socio-economic dynamics resulting from improved accessibility.

The management of these potential conflicts is based on fundamental pillars, which include conducting a continuous and transparent community consultation process, establishing and widely disseminating objective and equitable criteria for local contracting, rigorously implementing the ARAP (Agreement on Local Provisions and Actions), and operationalizing an accessible and effective Complaints Management Mechanism.

Regarding the law-and-order situation, the Ribaué District is generally considered a stable area, without serious conflicts or widespread organized crime. However, the implementation of the project introduces specific risk factors that require mitigation. These include the potential increase in opportunistic crime, such as theft of materials and equipment, the emergence of social tensions that may escalate into confrontations, and risky behaviors on the part of workers, including public disturbance or, in a more serious scenario, cases of sexual exploitation, as well as gender-based violence.

To address these risks, it is imperative to develop and implement a Safety Plan for the construction site, encompassing asset surveillance, access control, and close coordination with law enforcement authorities. The adoption and rigorous enforcement of a Code of Conduct for all workers and subcontractors, complemented by awareness sessions on local culture and standards of conduct, constitutes a crucial preventive measure.

Maintaining an ongoing dialogue with community leaders and security authorities will allow for a rapid response to any tensions, ensuring a safe and stable environment for project execution, protecting neighboring communities, and preserving its social license to operate.

## 4.2.8 Infrastructure and public services

### **Communication Routes**

The area is served by the Malawi-Nampula-Nacala railway and a road network of 368 km, comprising 48 roads, of which 36 are local roads connecting villages to towns; 7 roads connecting towns to the headquarters of the Administrative Posts; 2 connecting the headquarters of the posts to the District Headquarters; 2 state highways; and 2 regional roads, including the N13, whose bridge in question constitutes a critical bottleneck.

Ribaué has two airfields located in the town center and in the Administrative Post of lapala. The first is 2 km long and 100 m wide, the second is 1.5 km long and 100 m wide. Although both are operational, they have not been used regularly. Two post offices in Ribaué and lapala and one post office in the Administrative Post of Cunle operate in the district.

### **Water Supply**

The main sources of drinking water supply in the district include Small Water Supply Systems (SWSS), mechanical wells, and improved wells (boreholes). There are 12 mechanized boreholes, 3 manual wells, and 23 small dams. This infrastructure is still precarious in rural areas, with projects underway to improve coverage.

Regarding SWSS, by the end of 2023, the district had 3 water supply systems: 1 in Vila – Sede, 1 in Namiconha, and 1 in Riane, the latter inoperative since 2018 due to the high operational costs of the rotating generator used to supply energy, with a cumulative 1,384 household connections and 29 public fountains, of which 8 were broken (Ribaué Government (2025): District Development Strategy, Ribáué 2025 – 2034). The following table summarizes the operational status of each water supply source.

Table 4-1- Summary of operational status by water supply source

| Type of Water Source                     | Location / Number of Infrastructures     | Operational Status                          |
|------------------------------------------|------------------------------------------|---------------------------------------------|
| <b>Small Water Supply Systems (PSAA)</b> | Ribaué Village                           | Operational                                 |
|                                          | lapala Village                           | Out of operation / Non-operational          |
| <b>Mechanized Boreholes</b>              | 12 units distributed across the district | Variable operation (majority operational) * |
| <b>Hand-Dug Wells</b>                    | 3 units                                  | Variable operation                          |
| <b>Small Dams</b>                        | 23 units                                 | Mainly used for multiple purposes **        |

\*\* Used for multiple purposes such as community water supply, livestock watering, and small-scale irrigation

Regarding water boreholes, by the end of 2023, the district had 557 boreholes, of which 527 were operational and 30 were broken. Up to the period under analysis, the population served was approximately 174,270 inhabitants with a coverage rate of 57.3%. The following table shows the water supply situation.

Table 4-2- Evolution of Water Supply Indicators (2019–2023)

| Designation              | 2019    | 2020    | 2021    | 2022    | 2023    |
|--------------------------|---------|---------|---------|---------|---------|
| <b>Water Boreholes</b>   | 408     | 417     | 478     | 539     | 557     |
| <b>Population Served</b> | 122,400 | 125,100 | 143,400 | 161,700 | 174,270 |
| <b>Coverage Rate (%)</b> | 55.3    | 55.9    | 56.6    | 57.3    | 57.3    |

### **Electricity**

The district benefits from electricity produced by the Cabora Bassa Hydroelectric Plant. The electricity supply from the national grid does not yet cover the entire district, which would only happen with the expansion of the electricity grid. Currently, the localities of Matharya and Riane have been using generator sets to obtain energy. In the district headquarters, electricity reaches approximately 500 consumers.

Firewood is the main source of energy for cooking in more than 90% of households, exerting significant pressure on forest cover.

### **Education System**

The education system in the AIP reflects the structural challenges common to many rural areas of Mozambique, characterized by significant efforts to expand access to education that coexist with critical limitations in quality and infrastructure.

The district has a network of 92 schools distributed throughout its territory, covering different levels of education, from primary to secondary education. This expansion of the school network represents remarkable progress towards universal access to education, particularly at the early levels of schooling. However, schools face problems of overcrowded classrooms, a lack of adequate teaching materials, and degraded or insufficient physical infrastructure. The training and distribution of teachers constitutes another significant challenge, with deficiencies particularly pronounced in more remote rural areas and for specific high school subjects.

These factors combine to result in educational indicators that reflect the difficulties of the education system, including still high rates of grade repetition and school dropout, especially in the transition years between educational cycles and among female students. Education in the region still presents significant disparities related to gender and geographic location. Girls face additional barriers to their education,

including domestic responsibilities and care for younger siblings, considerable distances to school, and early marriages.

Communities located in areas further from urban centers generally have less access to educational establishments, particularly beyond the primary level.



Fig. 4.12 - Matharya EPC is approximately 1km from the bridge.



Fig. 4.13 - Escola Primaria de 8 km.

The bridge reconstruction project, by improving connectivity and accessibility, could have an indirect positive impact on the education sector in the region, facilitating the transportation of students and teachers, access to teaching materials, and potentially reducing the isolation of rural communities. However, it is essential that the project interventions consider these educational constraints so

as not to exacerbate existing vulnerabilities, ensuring that the construction period does not interrupt access to schools or create conditions that could contribute to increased school dropout rates.

### **Health Infrastructure**

The health system in the AIP has serious limitations in terms of coverage, responsiveness, and quality of services, reflecting the structural challenges of the health sector in rural areas of Mozambique. The Ribaué District has a health network composed of 9 health units, including health posts and centers and a rural hospital, which is clearly insufficient to meet the needs of a population exceeding 310,000 inhabitants.

These health units struggle with critical shortages that compromise the provision of adequate health care. The shortage of qualified health professionals, the lack of essential medical equipment, and the irregular supply of medicines and other medical supplies are frequent obstacles to the effective functioning of services. Infrastructure problems are equally evident, with many units needing repair work, improvements in sanitation conditions, and access to reliable sources of drinking water.

The region's epidemiological profile further burdens this already weakened system. The area registers a high incidence of malaria, diarrheal diseases, and respiratory infections, which are the main causes of morbidity and mortality, particularly among children under five years of age.

The prevalence of HIV represents another significant challenge for local health services, requiring diagnostic, monitoring, and treatment capacities that often exceed available resources. Maternal and child health deserves special attention, with maternal and infant mortality indicators reflecting limitations in access to prenatal care, assisted deliveries, and specialized neonatal care.

The bridge reconstruction project, by improving accessibility, may have an indirect positive impact on the health sector by facilitating patient transport, access to more complex health units in emergencies, as well as the regular supply of medicines and equipment.

However, during the construction phase, the influx of workers may put additional pressure on local health services, particularly with regard to the care of any work-related accidents and the increased demand for basic health care. The project's ESMP establishes specific measures to mitigate these impacts, including coordination with district health authorities, temporary capacity building in the nearest health units, and the implementation of a first aid post at the construction site.

## **Telecommunications Network**

The district receives the TVM signal and has a community radio and television station with a 70km radius, 3 communication radios, and 3 mobile phone networks (TmCel, Vodacom, and Movitel), covering all administrative posts and localities in terms of mobile communication, except for the localities of Lupí, Mecuasse, and Riane.

Regarding communications, all 11 localities are covered by mobile telephony (Movitel), with access also to mobile internet. The district has a station on the Nacala Railway Line.

## 5 SCOPE DEFINITION

### 5.1 Introduction

This chapter describes the Scoping process carried out within the SES for the Natete River Bridge Reconstruction Project, located along National Road N13, in the Ribáuè District, Nampula Province.

Scoping is a fundamental step in the EIA process, as established by Decree No. 54/2015, of December 31, which regulates the EIA process in Mozambique, and by the JICA Guidelines. This phase aims to define the scope, limits, and priorities of the assessment, identifying the most relevant environmental and social components that may be affected by the proposed project. Specifically, the scoping process allows:

- Identifying and characterizing sensitive areas of the biophysical and socioeconomic environment.
- Determining the main potential impacts, both negative and positive.
- Establishing priority issues to be analyzed in detail in the following phases of the study.
- To guide the development of mitigation and monitoring plans to be integrated into the ESMP.
- To promote the participation of stakeholders, thus ensuring that local concerns are considered in the decision-making process.

The scope was conducted through:

- Field surveys for preliminary characterization of environmental and socioeconomic components.
- Documentary review of existing technical reports, legislation, and environmental data.
- Spatial analyses (GIS) identify sensitive areas and critical intervention zones.
- Public consultations with representatives of local communities, district authorities, government agencies, namely the environmental agency, and other stakeholders.

Based on these analyses, priority environmental themes were defined, as well as the most relevant environmental assets, and critical areas of environmental attention (hot spots), which require greater control and monitoring during the pre-construction, construction, and post-construction phases. Based on these

elements, it will be possible to define the technical and thematic framework of the study, guiding subsequent analyses and the formulation of mitigation and environmental management measures to be included in the following chapters of the report.

## **5.2 Selection of Impact Assessment Items**

The environmental and social aspects of the project that were examined as part of the study's scoping are presented in Table 5.1, which were also incorporated into the study's Terms of Reference.

Table 5-1 - Evaluation items for Environmental and Social Considerations of the project (Source: EIA ToR)

| No. | Field / Category           | Evaluation Item                             | Description and Context of Application                                                                               |
|-----|----------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1   | <b>Pollution</b>           | Air Pollution                               | Evaluates the emission of dust and exhaust gases from construction machinery and material transportation.            |
| 2   |                            | Water Pollution                             | Assesses the potential contamination of the Natete River and nearby surface and groundwater resources.               |
| 3   |                            | Waste Management                            | Evaluates the generation, handling, storage, and disposal of solid and hazardous waste.                              |
| 4   |                            | Noise and Vibration                         | Measures noise and vibration emissions from construction equipment, vehicles, and activities.                        |
| 5   | <b>Natural Environment</b> | Protected Areas                             | Verifies the presence and proximity of protected areas, notably Mupalue–Ribáuê, to the project's area of influence.  |
| 6   |                            | Fauna and Flora / Biodiversity              | Identifies sensitive species, habitats, and ecosystems potentially affected by the construction works.               |
| 7   |                            | Hydrology and Hydraulics                    | Analyzes potential alterations in flow regimes, drainage patterns, and bank stability of the Natete River.           |
| 8   |                            | Topography and Geology                      | Examine geotechnical stability, soil characteristics, and risks of erosion or landslides.                            |
| 9   | <b>Social Environment</b>  | Involuntary Resettlement                    | Evaluates the need for physical displacement or loss of agricultural land.                                           |
| 10  |                            | Low-Income / Vulnerable Populations         | Considers impacts on vulnerable family's dependent on subsistence agriculture.                                       |
| 11  |                            | Ethnic Minorities and Local Communities     | Analyzes potential impacts on community cohesion and cultural integrity.                                             |
| 12  |                            | Local Economy and Livelihoods               | Assesses effects on employment, income generation, and productive local activities.                                  |
| 13  |                            | Water Usage and Water Rights                | Examines possible interference with community water use and customary rights.                                        |
| 14  |                            | Existing Social Infrastructure and Services | Evaluates potential impacts on nearby infrastructure such as roads, wells, schools, and health centers.              |
| 15  |                            | Local Social Institutions                   | Assesses the role and participation of local structures (leaders, councils, and associations) in project management. |
| 16  |                            | Distribution of Benefits and Damages        | Verifies fairness in the distribution of project benefits and impacts among different social groups.                 |
| 17  |                            | Local Conflicts of Interest                 | Analyzes potential disputes between affected communities, the contractor, and authorities.                           |

| No. | Field / Category | Evaluation Item                           | Description and Context of Application                                                                 |
|-----|------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 18  |                  | Gender                                    | Evaluates the participation of women and vulnerable groups and gender-differentiated impacts.          |
| 19  |                  | Infectious Diseases (HIV/AIDS and Others) | Assesses risks of disease transmission linked to worker presence and increased mobility.               |
| 20  |                  | Occupational Health and Safety            | Analyzes occupational hazards and safety conditions for workers during project execution.              |
| 21  |                  | Common Use of Water and Natural Resources | Reassesses community dependence on natural resources, including fishing and local material extraction. |
| 22  | Others           | Global Warming                            | Considers greenhouse gas emissions and the project's contribution to climate change mitigation.        |
| 23  |                  | Accidents                                 | Evaluates risks of traffic accidents, spills, or collapses during construction activities.             |

The 23 items above represent the main environmental and social sensitivity indicators considered relevant to the project, organized into 4 major evaluation categories:

1. **Pollution** (Items 1–4) – air quality, water, noise, and waste management.
2. **Natural Environment** (Items 5–8) – ecosystems, biodiversity, soils, and water resources.
3. **Social Environment** (Items 9–21) – socioeconomic, cultural, equity, and governance aspects.
4. **Other / Global** (Items 22–23) – climate change, accident risks, and common use of resources.

### 5.3 Results of the Scope Definition

The expected environmental and social impacts of the reconstruction of the bridge over the Natete River, Ribaué District, are presented in Table 5.2 by phase of the project cycle:

- **Pre-Construction** (PC) – planning, mobilization and preparation of the construction site.
- **Construction** (C) – execution of civil works; and
- **Post-Construction** (Post-C) – demobilization, rehabilitation and operation of the infrastructure.

Table 5-2 - Matrix of Scope of the Potential Environmental and Social Impacts of the Project

| No. | Field / Category           | Evaluation Item                  | Evaluation Phase  | Prediction and Evaluation                                                                                                                                                                                                                                                                                                                       |
|-----|----------------------------|----------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | <b>Pollution</b>           | Air Pollution                    | ● PC ● C ● Post-C | <b>Pre-construction:</b> Temporary generation of dust and exhaust gases.<br><b>Construction:</b> High dust and gas emissions from machinery and material handling.<br><b>Post-construction:</b> Temporary dust emissions from rehabilitation and traffic circulation.                                                                           |
| 2   |                            | Water Pollution                  | ● PC ● C – Post-C | <b>Pre-construction:</b> Diffuse contamination risks from fuels/lubricants and minor interference with surface runoff.<br><b>Construction:</b> High risk due to sediment release and accidental spills; risk decreases after stabilization.<br><b>Post-construction:</b> No interference expected; improved hydrological stability anticipated. |
| 3   |                            | Waste Management                 | ● PC ● C ● Post-C | <b>Pre-construction:</b> Potential soil and water contamination from scattered waste.<br><b>Construction:</b> Peak generation and handling of waste materials; high sensitivity.<br><b>Post-construction:</b> Residual waste generation during demobilization.                                                                                  |
| 4   |                            | Noise and Vibration              | ● PC ● C – Post-C | <b>Pre-construction:</b> Temporary noise and vibration from site clearing machinery.<br><b>Construction:</b> Significant but short-term noise from heavy equipment; limited to daytime.<br><b>Post-construction:</b> Minor noise from final cleanup and demobilization.                                                                         |
| 5   | <b>Natural Environment</b> | Protected Areas (Mupalue–Ribáuè) | ---               | <b>Pre-construction:</b> No expected impacts on protected areas.<br><b>Construction:</b> Located outside the Direct Influence Area; minor indirect risks from transport or drainage.<br><b>Post-construction:</b> No impacts anticipated.                                                                                                       |
| 6   |                            | Fauna and Flora / Biodiversity   | ● PC ● C – Post-C | <b>Pre-construction:</b> Partial vegetation clearance, temporary disturbance to fauna, limited habitat loss.<br><b>Construction:</b> Habitat disruption and deforestation; regeneration possible through revegetation.<br><b>Post-construction:</b> No further impact expected.                                                                 |

| No. | Field / Category   | Evaluation Item                     | Evaluation Phase  | Prediction and Evaluation                                                                                                                                                                                                                                                     |
|-----|--------------------|-------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   |                    | Hydrology and Hydraulics            | ● PC ● C – Post-C | <b>Pre-construction:</b> Localized flow alteration and compaction affecting infiltration.<br><b>Construction:</b> Temporary flow modification and bank erosion; controlled through drainage measures.<br><b>Post-construction:</b> No impacts expected.                       |
| 8   |                    | Topography and Geology              | ● PC ● C – Post-C | <b>Pre-construction:</b> Localized visual alteration from land clearing, equipment mobilization, and site setup.<br><b>Construction:</b> Temporary soil movement; erosion risk manageable.<br><b>Post-construction:</b> Terrain stabilizes naturally; no significant effects. |
| 9   | Social Environment | Involuntary Resettlement            | – ● C –           | <b>Pre-construction:</b> No physical displacement or restriction of land/resource use.<br><b>Construction:</b> Access restrictions for farmers.<br><b>Post-construction:</b> No resettlement activities foreseen.                                                             |
| 10  |                    | Vulnerable / Low-Income Population  | ● PC ● C –        | <b>Pre-construction:</b> Economic concerns due to temporary disruption of farming.<br><b>Construction:</b> Temporary reduction in productivity and income.<br><b>Post-construction:</b> No effects anticipated.                                                               |
| 11  |                    | Local Communities and Ethnic Groups | ● PC ● C ● Post-C | <b>Pre-construction:</b> Community concerns regarding land access and resource use. <b>Construction:</b> Temporary vulnerability due to restricted river use.<br><b>Post-construction:</b> Enhanced mobility and access to services; improved agricultural transport.         |
| 12  |                    | Local Economy and Livelihoods       | ● PC ● C ● Post-C | <b>Pre-construction:</b> Uncertainty about potential land or resource loss.<br><b>Construction:</b> Temporary disruption of trade and agriculture.<br><b>Post-construction:</b> Improved market access and productivity.                                                      |
| 13  |                    | Water Use and Rights                | – ● C ● Post-C    | <b>Pre-construction:</b> No interference expected.<br><b>Construction:</b> Temporary pressure on community water use.<br><b>Post-construction:</b> Improved River access and reduced contamination risk.                                                                      |
| 14  |                    | Infrastructure and Social Services  | – ● C ● Post-C    | <b>Pre-construction:</b> No interference expected.<br><b>Construction:</b> Temporary disturbance to local access roads and services.<br><b>Post-construction:</b> No interference expected.                                                                                   |
| 15  |                    | Local Social Institutions           | ● PC ● C ● Post-C | <b>All phases:</b> Continuous community engagement and coordination required throughout planning, construction, and operation.                                                                                                                                                |

| No. | Field / Category | Evaluation Item                           | Evaluation Phase  | Prediction and Evaluation                                                                                                                                                                                                                           |
|-----|------------------|-------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16  |                  | Distribution of Benefits and/or Damages   | – ● C ● Post-C    | <b>Pre-construction:</b> No effects expected.<br><b>Construction:</b> Monitor equitable distribution between affected and beneficiary groups.<br><b>Post-construction:</b> Broad sharing of socio-economic benefits.                                |
| 17  |                  | Local Conflicts of Interest               | ● PC ● C –        | <b>Pre-construction:</b> Potential disputes over employment or access.<br><b>Construction:</b> Same risks; manageable through community liaison.<br><b>Post-construction:</b> No risks expected.                                                    |
| 18  |                  | Gender                                    | ● PC ● C –        | <b>Pre-construction:</b> Minimal gender-related impacts.<br><b>Construction:</b> Temporary effects on women's mobility and access to resources.<br><b>Post-construction:</b> No impacts expected.                                                   |
| 19  |                  | Infectious Diseases (HIV/AIDS and Others) | ● PC ● C –        | <b>Pre-construction:</b> Low risk due to limited workforce mobilization.<br><b>Construction:</b> Increased exposure risk mitigated by awareness campaigns.<br><b>Post-construction:</b> No further risk expected.                                   |
| 20  |                  | Occupational Health and Safety            | ● PC ● C ● Post-C | <b>Pre-construction:</b> Low occupational risk.<br><b>Construction:</b> High risk during work; mitigable with safety plans and PPE.<br><b>Post-construction:</b> Limited risks during environmental restoration.                                    |
| 21  |                  | Common Use of Water and Natural Resources | – ● C ● Post-C    | <b>Pre-construction:</b> No impacts expected.<br><b>Construction:</b> Temporary restriction on fishing and sand extraction.<br><b>Post-construction:</b> Gradual recovery of community resource use.                                                |
| 22  | Others           | Climate Change / Global Warming           | ● PC ● C –        | <b>Pre-construction:</b> Limited CO <sub>2</sub> emissions from machinery and transport.<br><b>Construction:</b> Temporary greenhouse gas emissions from vehicles and equipment.<br><b>Post-construction:</b> No significant emissions expected.    |
| 23  |                  | Accidents and Road Safety Risks           | ● PC ● C ● Post-C | <b>Pre-construction:</b> Moderate accident risk during site setup.<br><b>Construction:</b> High risk of accidents involving workers and equipment.<br><b>Post-construction:</b> Reduced risk due to improved infrastructure and traffic conditions. |

The construction phase presents the highest concentration of impacts, reflecting the intensity of the project's physical and social activities. The most critical components throughout the project cycle are Water Resources (Natete River); Waste and Pollution Management; Biodiversity and Riparian Vegetation in the Area of Influence; Vulnerable Population and Livelihoods; and Occupational and Community Health and Safety.

The pre- and post-construction phases are less sensitive but require continuous monitoring to ensure long-term environmental and social stability.

## 6.1 Research Items and Methodology

To assess the environmental factors that will be affected by the proposed development and that cannot be determined in the scoping phase, it is necessary to conduct a series of surveys to collect existing data and identify the baseline. Specific survey items and methods will be described in the following table.

Table 5-3 - Environmental and Social Baseline Survey Plan

| Category            | Survey Item         | Parameters                                                                                                                                                                                                                    | Location                                                       | Frequency / Quantity                         | Survey Methodology                                                                                                                            |
|---------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Pollution           | Air Quality         | PM <sub>2.5</sub> , PM <sub>10</sub> , O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , CO, wind direction, wind speed                                                                                                    | Along the Nacala Corridor                                      | Once (1 site × 2 seasons – rainy and dry)    | On-site measurement using calibrated portable air quality monitoring equipment.                                                               |
|                     | Water Quality       | pH, Suspended Solids (SS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Fecal Coliforms (FC), Turbidity, Odor, Oils and Grease                                                                                     | Natete River (upstream, downstream, and near the project site) | Once (several sampling points along 1 river) | Water samples collected in sterile containers and transported to a certified laboratory for physical, chemical, and microbiological analysis. |
|                     | Noise and Vibration | A-weighted equivalent continuous sound level (LAeq), maximum sound level (Lmax)                                                                                                                                               | Along the Nacala Corridor                                      | Twice (2 points × 1 season – dry season)     | On-site measurement using a precision sound level meter and vibration analyzer following ISO and WHO guidelines.                              |
| Natural Environment | Flora and Fauna     | Identification of protected species classified as endangered or threatened under national law, national Red List, and IUCN Red List. Identification of flora and fauna species of livelihood importance to local communities. | Approximately within 250 m of radius from the project site     | Once                                         | Field survey combining direct observation, species inventory, and consultation with local communities and forestry officers.                  |

## 5.4 Results of the Environmental Survey

To evaluate current conditions related to air quality, noise and vibration, surface water quality, drainage water and groundwater, and flora and fauna, measurements and sampling were carried out. However, addressing some information gaps, in-depth socio-economic studies were conducted during the fieldwork, culminating in the development of an ARAP. The results of this research are presented below.

### 5.4.1 Air Quality

#### 5.4.1.1 Introduction

A baseline air quality study was conducted in the project area of influence (PAI) of the bridge reconstruction project over the Natete River, Ribaué District. The main objective of this study was to characterize the current state of air quality before the start of construction activities on the new structure, to establish a baseline for future impact assessment, as well as monitoring during the project execution phase.

Specifically, the study aims to: Identify the main sources of air pollution in the project area; Quantify the levels of inhalable particles (PM<sub>2.5</sub>, PM<sub>10</sub>, and TSP) and main gaseous pollutants (NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>); Assess the seasonal and spatial variability of air quality; and Establish reference parameters for future monitoring and impact assessment.

The characterization of air quality in the project region was conducted in accordance with the provisions of Decree nº 54/2015, of December 31, which regulates the EIA Process in Mozambique, as well as with national standards for Environmental Quality and Effluent Emissions, well as well with the World Health Organization (WHO, 2021) guidelines for inhalable particles and other air pollutants.

#### 5.4.1.2 Study area

The Ribaué district has a humid tropical climate, with a prolonged dry season between April and September and a rainy season between October and March. This seasonality directly influences the dispersion and deposition of atmospheric pollutants, with a higher risk of high dust concentrations during the dry season. Presence of unpaved roads, riverside communities and agricultural areas subject to seasonal fires.

The wind characterization in the Ribáuè district reveals a moderate wind regime, influenced both by the district's geographical position in the interior of the province and by its average altitude of approximately 535 meters above sea level. In terms of wind intensity, the average annual wind speeds in Ribáuè District are between 6

and 10 km/h (equivalent to approximately 1.6 to 2.8 m/s), with marked monthly variations.

#### 5.4.1.3 Methodology

The study area included both the area of direct influence, corresponding to a strip of approximately 1 km around the bridge and immediate access, and the area of indirect influence, covering up to 5 km, including riverside communities and adjacent agricultural areas.

The measurements were taken at 8:00 AM on September 12, 2025, using a portable meter with real-time measurements, at three points: at the planned construction site (before the bridge), on the bridge, and after the bridge as shown on the map below.

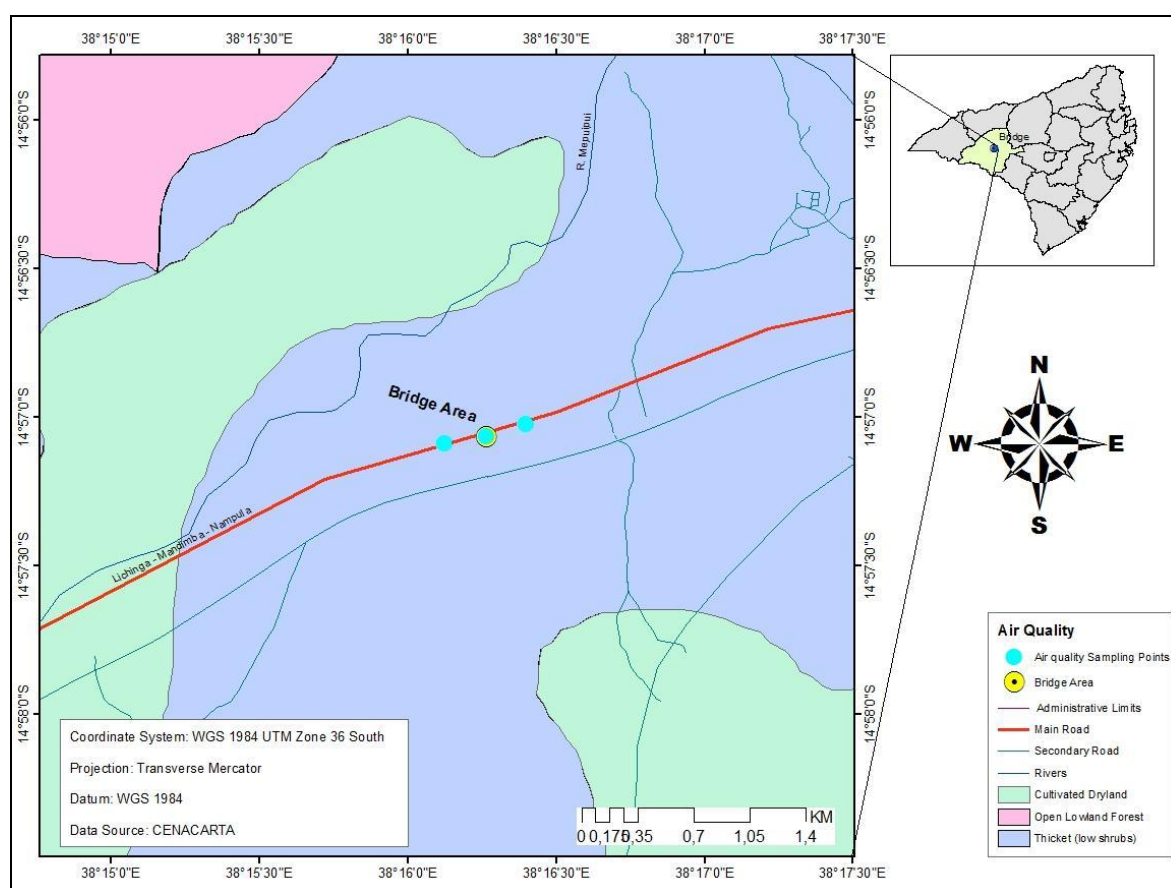


Fig. 5.1 – Air quality sampling map

The Particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub> and TSP parameters) were measured using gravimetric and continuous reading sensors, while the gases (NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>) through portable monitors.

Weather conditions, namely wind speed and direction, temperature, relative humidity and precipitation were also recorded.

#### 5.4.1.4 Baseline's results

##### **Weather Conditions**

Hourly wind speeds during the measurements ranged from 9 to 12 km/h, with the wind direction from N-NE, with small local variations due to topography and vegetation cover.

The average temperature recorded was 28 °C and relative humidity of 55–65%, indicating conditions favorable for moderate dispersion of pollutants, but with a high risk of dust during dry periods.

##### **Pollutant Concentrations**

Table 5.4 presents the results of pollutant measurements. The measurements were compared with national limits and WHO guideline values, with the aim of assessing the current situation and establishing a baseline for monitoring during construction.

Table 5.4 - Results of Pollutant Measurements

| Poluent                 | Monitoring Results at Sampling Locations |                      |                       | National & International Reference Limits                       |
|-------------------------|------------------------------------------|----------------------|-----------------------|-----------------------------------------------------------------|
|                         | Before the Bridge                        | At the Bridge        | After the Bridge      |                                                                 |
| <b>PM<sub>10</sub></b>  | 26 µg/m <sup>3</sup>                     | 44 µg/m <sup>3</sup> | 64 µg/m <sup>3</sup>  | Within Limits (WHO ≤50 µg/m <sup>3</sup> )                      |
| <b>PM<sub>2.5</sub></b> | 20 µg/m <sup>3</sup>                     | 44 µg/m <sup>3</sup> | 64 µg/m <sup>3</sup>  | Within Limits (WHO ≤25 µg/m <sup>3</sup> for 24-hour mean)      |
| <b>TSP</b>              | 16 µg/m <sup>3</sup>                     | 29 µg/m <sup>3</sup> | 44 µg/m <sup>3</sup>  | Within National Limits (200 µg/m <sup>3</sup> for 24-hour mean) |
| <b>NO<sub>2</sub></b>   | 0 ppm                                    | 0 ppm                | 0 ppm                 | Within Limits (WHO ≤25 µg/m <sup>3</sup> for 24-hour mean)      |
| <b>SO<sub>2</sub></b>   | 1.2 ppm                                  | 1.5 ppm              | 1.7 ppm               | Consistently Below Limits (WHO 125 µg/m <sup>3</sup> )          |
| <b>CO</b>               | 0 mg/m <sup>3</sup>                      | 0 mg/m <sup>3</sup>  | 0 mg/m <sup>3</sup>   | Within Limits (WHO ≤4 mg/m <sup>3</sup> for 24-hour mean)       |
| <b>CH<sub>4</sub></b>   | 4 ppm                                    | 4 ppm                | 4 ppm                 | Within Limits (WHO ≤1000 ppm for 8-hour mean)                   |
| <b>CO<sub>2</sub></b>   | 474 ppm                                  | 469 ppm              | 421 ppm               | Within Limits (WHO ≤ 5000 ppm for 8-hour mean)                  |
| <b>O<sub>3</sub></b>    | 0.1 mg/m <sup>3</sup>                    | 0 mg/m <sup>3</sup>  | 0.1 mg/m <sup>3</sup> | Within Limits (WHO ≤100 µg/m <sup>3</sup> for 8-hour mean)      |

#### 5.4.1.5 Analysis and Interpretation of Results

Overall, the results of the air quality monitoring indicate that all measured pollutants are within both national and international reference limits, demonstrating compliance with the established environmental standards. However, there is a clear increasing trend in particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>, and TSP) concentrations from the “Before the Bridge” to the “After the Bridge” sampling points, with the highest values recorded downstream.

This pattern suggests localized dust generation, and dispersion likely associated with vehicular activity and unpaved surfaces near the bridge area. Despite this increase, the concentrations remain below the national thresholds and WHO's earlier guideline limits.

With respect to gaseous pollutants, including Nitrogen Dioxide (NO<sub>2</sub>), Carbon Monoxide (CO), and Methane (CH<sub>4</sub>), all were virtually undetectable or recorded at very low concentrations, indicating negligible emission sources in the vicinity. Sulfur Dioxide (SO<sub>2</sub>) and Ozone (O<sub>3</sub>) levels were also well within acceptable safety limits, reflecting good ambient air quality conditions.

A noteworthy observation concerns the PM<sub>2.5</sub> concentration recorded at 64 µg/m<sup>3</sup>, which, while reported as compliant, exceeds the latest (WHO, 2021) guideline value of 15 µg/m<sup>3</sup> (24-hour mean). This implies that although air quality remains acceptable under national criteria, it may not fully align with current global health standards. Therefore, it is recommended to implement dust control and suppression measures such as regular watering of construction access roads, speed restrictions for heavy vehicles, and proper material storage to prevent exceedances during the construction phase.

#### 5.4.1.6 Conclusion and Recommendation

Air quality in the project area is considered good regarding inhaling particles (PM<sub>10</sub>, PM<sub>2.5</sub> and TSP), with values below the limits established by the WHO. Other atmospheric pollutants are also at acceptable levels. The results show that existing local sources (dust and wildfires) already represent an environmental pressure factor prior to the start of construction.

It is recommended that the baseline data be integrated into the ESMP, serving as a reference for comparison during the construction phase. Continuous monitoring of PM<sub>10</sub>, PM<sub>2.5</sub> and TSP should be ensured throughout construction, using the same sampling points established in the baseline. Immediate mitigation measures should include watering of access roads, stabilization of exposed soil areas, and community awareness initiatives to reduce the occurrence of seasonal fires. Additionally, continued monitoring is recommended in different seasons of the year, to capture seasonal variability and reinforce the representativeness of the baseline.

### 5.4.2 Noise quality

#### 5.4.2.1 Introduction

The baseline study conducted around the bridge project over the Natete River aimed to characterize the current state of the sound environment, thus establishing reference values that will allow for the evaluation, during the

construction phase and after the completion of the work, of any significant changes in noise levels.

#### 5.4.2.2 Study area

The District of Ribáuè, in Nampula Province, is predominantly rural, with small population clusters located along the main transport corridors, particularly the N13 road, which connects the district headquarters to other parts of the province. Local economic activities are mainly based on subsistence agriculture, small-scale commerce, and intermittent road transport, all of which influence the noisy environment in the area.

Overall, noise levels in the district range from low to moderate, consistent with rural and peri-urban settings. Field observations and previous assessments indicate that daytime equivalent noise levels (Leq) generally remain below the 55 dB(A) threshold recommended by the World Health Organization for residential zones, while nighttime levels decrease even further due to reduced human activity and low traffic volumes.

The main sources of noise in the district include intermittent traffic along the N13, community activities such as local markets and occasional motorcycle movement, as well as natural sounds generated by wind, insects, and other fauna, especially in areas farther from the main road.

No significant industrial or continuous noise-generating activities have been identified, which means that the overall acoustic quality in Ribáuè can be considered good, with noise levels compatible with community well-being and the preservation of local ecosystems. Temporary increases in noise may occur during infrastructure works, such as road or bridge construction, and should be managed through appropriate measures including controlled working hours, proper equipment maintenance, community awareness, and periodic monitoring of noise levels.

#### 5.4.2.3 Methodology

The measurements were carried out on September 12 and 13, 2025, covering at five strategic points: 500 meters before the bridge, on the bridge and 500 meters after the bridge, and October 18, 2025, one kilometer before the bridge (at the Matharya EPC) and at the school (EP1 km8) one kilometer after bridge. Measurements were taken during daytime (10:00 AM) and nighttime (6:00 PM) periods.

Calibrated sound level meters were used for this purpose, considering the parameters in decibels [dB(A)]. The map in Figure 5-2 shows the location of the noise measurements.

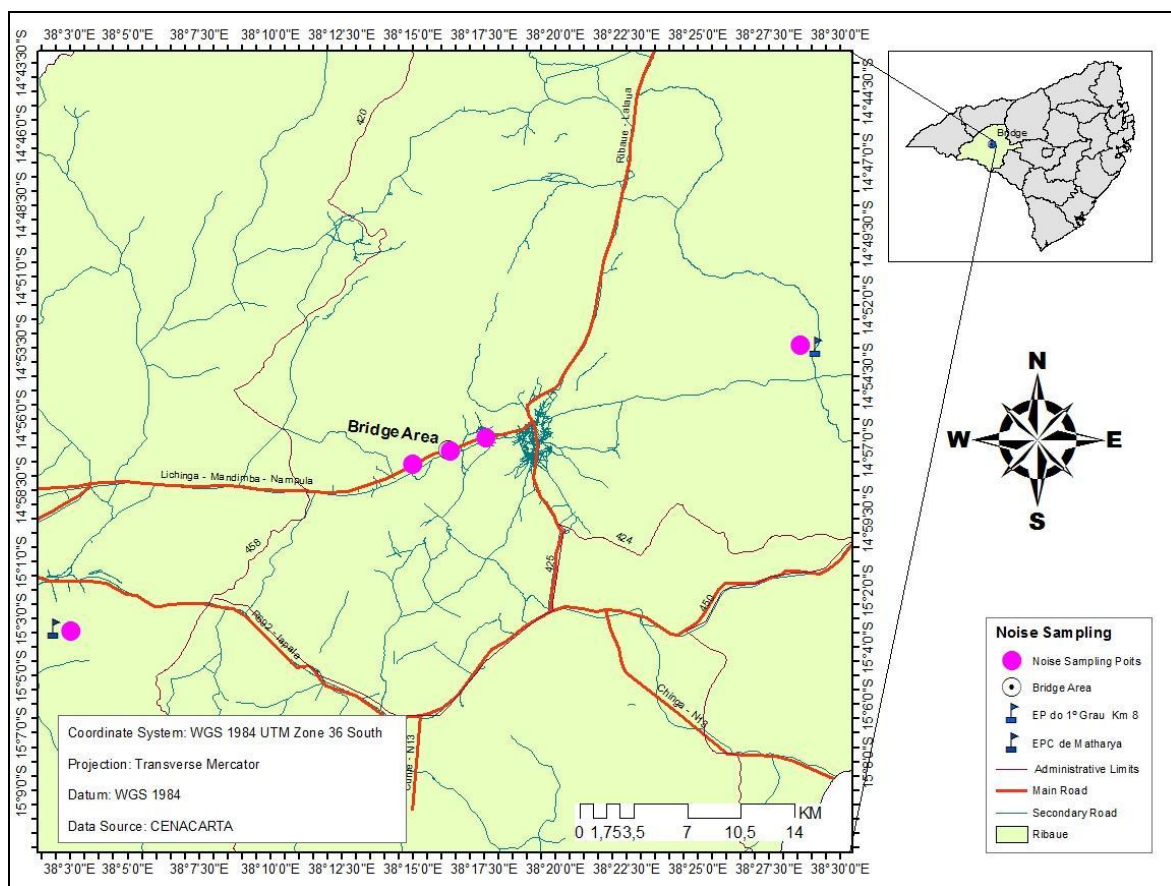


Fig. 5-2 - Noise sampling map

#### 5.4.2.4 Baseline Results

The results are presented in table 5.5. For the evaluation of sound quality, the results were compared with WHO standards, since the country does not have specific national standards for noise quality.

Table 5-5 - Results of Noise Measurements

| Parameters                                                                          | Monitoring Results at Sampling Locations |                   |               |              |         | Reference Limits                              |
|-------------------------------------------------------------------------------------|------------------------------------------|-------------------|---------------|--------------|---------|-----------------------------------------------|
|                                                                                     | 500m Before Bridge                       | 500m After Bridge | At the Bridge | EPC Matharya | EP1 km8 | Community Noise Guidelines (WHO, 1999)        |
| <b>A-weighted Sound Pressure Level (<math>L_{Aeq}</math>, <math>L_{max}</math>)</b> | 50 – 53 dB                               | 38 – 42 dB        | <b>65 dB</b>  | 45.4 dB      | 36.1 dB | 55 dB (Daytime) for Outdoor Residential Areas |

Table 5-6 - WHO Reference Limits for Environmental and Occupational Noise Levels

| Category                              | Indicator   | WHO Limit | Unit  | Application Context         |
|---------------------------------------|-------------|-----------|-------|-----------------------------|
| <b>Daytime environmental noise</b>    | $L_{eq}$    | 55        | dB(A) | Outdoor – residential areas |
| <b>Night-time environmental noise</b> | $L_{night}$ | 40        | dB(A) | Outdoor – sleep protection  |

|                                               |      |                       |       |                                                |
|-----------------------------------------------|------|-----------------------|-------|------------------------------------------------|
| <b>Indoor residential environments</b>        | Leq  | 30–35                 | dB(A) | Bedrooms and living rooms                      |
| <b>Hospital environments</b>                  | Leq  | 30                    | dB(A) | Inside hospital wards                          |
| <b>Schools and educational facilities</b>     | Leq  | 35                    | dB(A) | Classrooms                                     |
| <b>Mixed urban areas</b>                      | Leq  | 60 (day) / 50 (night) | dB(A) | Residential/commercial mixed-use zones         |
| <b>Industrial areas</b>                       | Leq  | 70                    | dB(A) | Industrial perimeters                          |
| <b>Occupational exposure (8-hour average)</b> | Leq  | 85                    | dB(A) | Workers' exposure limit over an 8-hour workday |
| <b>Peak occupational noise</b>                | Lmax | 140                   | dB(C) | Maximum instantaneous exposure level           |

#### 5.4.2.5 Analysis and Interpretation of Results

The noise monitoring results indicate that overall noise levels at all sampling locations, except for one, are within the WHO recommended daytime limit of 55 dB for outdoor residential environments. The only exceedance was recorded directly at the bridge, where the noise level reached 65 dB. This result is consistent with expectations, as the bridge forms part of the National Road N13 and is a point of concentrated vehicular movement, making it the primary source of traffic-related noise in the area.

At other monitoring points, including those located approximately 500 meters before and after the project new bridge, as well as at EPC Matharya and EP1 km8, noise levels remained well within the acceptable threshold. This indicates that the elevated noise impact is localized to the immediate vicinity of the bridge structure and does not extend significantly into surrounding residential or local community areas.

This baseline data provides an essential reference for comparison during the construction phase, when noise levels are anticipated to increase due to the use of heavy machinery and construction activities. Consequently, the project ESMP must incorporate robust mitigation measures, such as the installation of temporary noise barriers, scheduling of high-noise operations during daytime hours, maintenance of equipment to reduce mechanical noise, and regular monitoring to ensure compliance.

Additionally, as highlighted during public consultations, the design of the new bridge should consider long-term noise reduction features—such as smoother pavement surfaces and appropriate barriers—to minimize disturbance to nearby communities throughout the operational phase.

#### 5.4.2.6 Conclusion and Recommendation

The results of the ambient noise measurements at PAI indicate that noise levels in the project area are generally low to moderate, with no significant impacts anticipated during the bridge construction phase. The current noise conditions at

the future bridge site are typical of low-intensity rural environments, where human activity and traffic are limited.

Road traffic along the access route represents the main source of noise pollution in the area. Nearby communities are already exposed to noise levels that, at certain times, exceed recommended thresholds, which may increase the risk of discomfort and potential health effects if noise is not adequately controlled during construction.

To mitigate these risks, several measures are recommended. During construction, noisy activities should be limited to daytime hours, avoiding nighttime operations, and temporary acoustic barriers should be installed in locations close to sensitive receptors. Regular maintenance of construction equipment is essential to minimize avoidable noise emissions.

Traffic management strategies should also be applied, restricting the circulation of heavy vehicles during sensitive periods such as nighttime and early morning. Continuous monitoring of noise levels is necessary throughout the construction phase, with periodic measurements to ensure compliance with national and international standards.

### 5.4.3 Surface Water Quality

#### 5.4.3.1 Introduction

A baseline study was conducted to characterize the surface water quality of the Natete River, with the aim of establishing the necessary baseline for environmental monitoring during the construction and operation phases of the bridge.

The specific objectives of monitoring the surface water quality of the Natete River are to track temporal variations in water conditions throughout the different phases of the project and to detect early signs of contamination resulting from construction activities. The monitoring will focus on key physico-chemical and biological parameters, including turbidity, pH, conductivity, dissolved oxygen, organic matter, total suspended solids, coliforms, and other relevant indicators of aquatic ecosystem health. These data will ensure compliance with national and international water quality standards, help safeguard the ecological integrity of the river, and support timely environmental management decisions and corrective measures, while ensuring transparent reporting to authorities and local communities.

#### 5.4.3.2 Surface Water in Ribáué District

Ribáué District is characterized by a network of seasonal and perennial rivers, with the Natete River being one of the main watercourses in the area. In general,

surface water bodies in the district exhibit typical rural characteristics, with limited influence from industrial activities.

Water quality is influenced by natural factors such as soil sediment input, organic matter decomposition, and seasonal rainfall variations, as well as by occasional human activities, including agriculture, small-scale livestock farming, and domestic water use.

Available studies and field observations indicate that key physico-chemical and biological parameters—such as turbidity, pH, conductivity, dissolved oxygen, total suspended solids, organic matter, and coliforms—generally remain within acceptable limits for maintaining aquatic ecosystem health and for indirect domestic use. However, during the rainy season, increased soil erosion and runoff can temporarily elevate turbidity and suspended solids, affecting water transparency and dissolved oxygen availability.

Although the region has low population density and limited anthropogenic pressure, it is essential to maintain regular monitoring programs to detect changes in water quality, ensure compliance with national and international standards, and protect the multiple uses of the water resource, including supply, recreation, and aquatic biodiversity conservation.

#### 5.4.3.3 Methodology

The bridge is located at coordinates 15°48'S, 38°57'E, encompassing a direct influence area (DIA) composed of the riverbanks near the future shipyard and access roads, and an indirect influence area (IIA), encompassing stretches of the river up to 10 km upstream and downstream, including small riverside communities.

For the water quality characterization survey, a sample was collected downstream of the bridge near the construction site area (the map in Figure 5-3 shows the sample location), representing the possible influence of the works, where physicochemical parameters were evaluated, namely pH; Turbidity; Dissolved Oxygen (DO); Total Suspended Solids (TSS); biochemical oxygen demand (BOD<sub>5</sub>), odor, oils and greases, well as well microbiological parameters (fecal coliforms).

The collection was carried out in a sterilized and clean bottle, with conservation under refrigeration at 4°C, guaranteeing transport to a certified laboratory that follows ISO17025 standards.

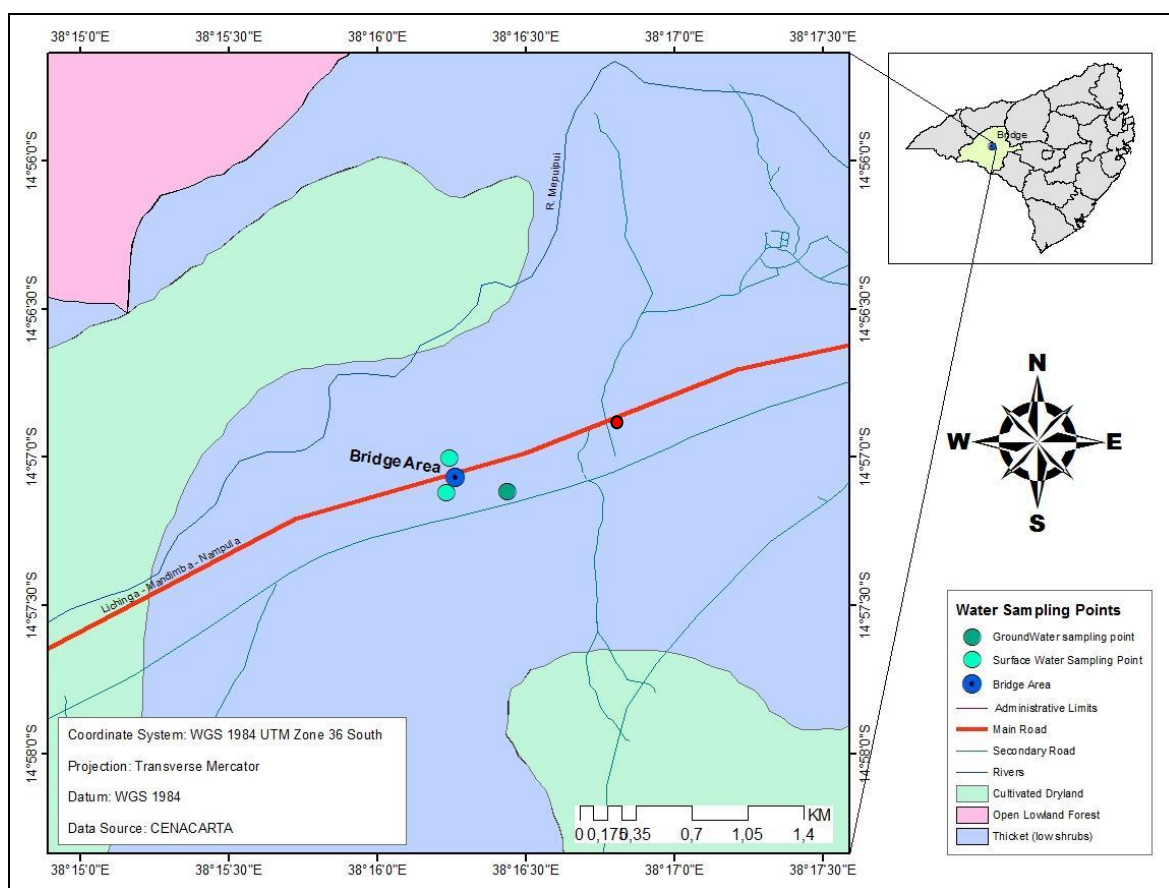


Fig. 5-3 – Surface water sampling point location map

#### 5.4.3.4 Results of Analyses

Table 5-2 presents the results obtained from the laboratory. Annex B presents the results of the laboratory analyses performed by SwissLab. The results of the analyses were compared with the WHO (2022) and national (Decree nº 18/2004) standards, considering the environmental and non-potable use of the resource, since it is surface water, focusing on environmental use (supply, irrigation, aquatic life and contamination levels).

Table 5-7 - Surface Water Quality Results (Natete River)

| Parameter                    | Result      |          | Unit | Mozambique Reference Standard                                             | WHO / UN Agency Reference                     |
|------------------------------|-------------|----------|------|---------------------------------------------------------------------------|-----------------------------------------------|
|                              | Downstream  | Upstream |      |                                                                           |                                               |
| pH                           | 6.21 (23°C) | 6,26     | —    | 6.5 – 8.5                                                                 | 6.5 – 8.5                                     |
| Turbidity                    | 17.4        | 170      | NTU  | ≤ 5 (drinking water)                                                      | < 1 (drinking water)                          |
| Dissolved Oxygen (DO)        | 4.9         | 1,7      | mg/L | > 5 mg/L (aquatic life)                                                   | ≥ 5 mg/L (aquatic life)                       |
| Total Suspended Solids (TSS) | 24.0        | 437      | mg/L | < 1000 mg/L general limit; ≤ 25 mg/L (clean water); ≤ 80 mg/L (moderately | ≤ 25 mg/L (clean water); ≤ 80 mg/L (moderate) |

|                                                    |            |            |            |                                               |                                                                |
|----------------------------------------------------|------------|------------|------------|-----------------------------------------------|----------------------------------------------------------------|
|                                                    |            |            |            | impacted rivers)                              |                                                                |
| <b>Biochemical Oxygen Demand (BOD<sub>5</sub>)</b> | 34.0       | 19         | mg/L       | < 5 (good) / < 30 (moderate)                  | ≤ 3 mg/L (excellent); 3–6 mg/L (moderate); > 6 mg/L (polluted) |
| <b>Odor</b>                                        | Present    | Present    | —          | Odorless (drinking water standard)            | Absent or non-offensive                                        |
| <b>Oils and Grease</b>                             | < 1.0 (LQ) | < 1.0 (LQ) | mg/L       | < 10 mg/L                                     | ≤ 10 mg/L (for surface waters)                                 |
| <b>Fecal Coliforms (E. coli)</b>                   | 890        | 58         | CFU/100 mL | 0 (drinking water) / < 200 (recreational use) | 0 CFU/100 mL (WHO, FAO, UNEP standards)                        |

#### 5.4.3.5 Analysis and Interpretation of Results

##### Downstream

The downstream surface water quality results from the Natete River show that most parameters are within or close to acceptable limits for natural surface waters, except for turbidity, BOD<sub>5</sub>, and fecal coliforms, which indicate moderate organic pollution and microbiological contamination.

The pH value of 6.21-6.26 is slightly below the ideal range but remains acceptable for aquatic life. Dissolved Oxygen (4.9-1,7 mg/L) is marginally lower than the recommended threshold (≥5 mg/L), suggesting moderate organic matter consumption and reduced oxygen availability for aquatic organisms.

Turbidity (17.4-170 NTU) is above both national and WHO limits for potable and clean surface waters, likely due to sediment load and soil erosion during runoff events. BOD<sub>5</sub> (34 mg/L) exceeds the threshold for moderately impacted waters, indicating the presence of biodegradable organic material, possibly from domestic effluents or agricultural runoff.

Fecal coliforms (E. coli: 890-58 CFU/100 mL) exceed both national and WHO standards for drinking and recreational waters, confirming microbial contamination, most likely from nearby human or livestock activity. Oil and grease levels (<1.0 mg/L) and odor remain within acceptable ranges, showing no evidence of hydrocarbon pollution.

The well water quality results from the Natete River show that most parameters are within or close to acceptable limits for well waters.

The pH value of 5,56 is slightly below the ideal range but remains acceptable for aquatic life. Dissolved Oxygen (3,7 mg/L) is lower than the recommended

threshold ( $\geq 5$  mg/L), suggesting lower organic matter consumption and reduced oxygen availability for aquatic organisms.

Turbidity (26,8 NTU) is above both national and WHO limits for potable and clean surface waters, likely due to sediment load and soil erosion during runoff events. BOD<sub>5</sub> (7 mg/L), indicating the low presence of biodegradable organic material, possibly from domestic effluents or agricultural runoff around there.

Fecal coliforms (E. coli: 23 CFU/100 mL) exceed both national and WHO standards for drinking and recreational waters, confirming microbial contamination, most likely from nearby human or livestock activity. Oil and grease levels ( $< 1.0$  mg/L) and odor remain within acceptable ranges, showing no evidence of hydrocarbon pollution.

Overall, downstream the water is classified as moderately impacted, requiring continuous monitoring, particularly of microbiological and organic parameters, and preventive measures to control runoff, waste disposal, and potential contamination sources during construction.

### **Upstream**

The analysis of the upstream water quality shows that several parameters present significant deviations when compared with the guidelines of the World Health Organization (WHO, 2022) and the environmental quality standards established by Mozambique's Decree No. 18/2004, as well as the national regulations applicable to drinking water.

The recorded pH value (6.26) is slightly below the typical acceptability range recommended by WHO and also below the range permitted by national legislation (6.5–8.5). Although this deviation is small, it indicates a slight tendency toward acidity which, under environmental conditions, can increase the solubility of metals and affect the ecological sensitivity of the aquatic system.

The levels of Total Suspended Solids (TSS) and turbidity show a very strong non-compliance with national and international standards. The TSS result (437 mg/L) is far above the limit established under Decree No. 18/2004 (60 mg/L), representing more than a seven-fold exceedance. Turbidity (170 NTU) also exceeds the WHO recommended level for water intended for consumption after disinfection, which should be below 5 NTU. These results indicate severe sediment loading in the river system, reflecting erosion processes, surface runoff carrying suspended particles, or land-use disturbances upstream.

Regarding Dissolved Oxygen (1.7 mg/L) and Biochemical Oxygen Demand (BOD<sub>5</sub> = 19 mg/L), although these parameters are not directly associated with numeric potability standards under WHO guidelines, they are important indicators of ecological quality. The low dissolved oxygen content and high BOD value demonstrate an aquatic environment subjected to significant organic loading,

characterized by decomposition processes and potential stress conditions for aquatic fauna.

The concentration of Fecal Coliforms (58 CFU/100 mL) does not comply with national standards for drinking water, which require total absence of this microbiological indicator in 100 mL.

Similarly, WHO states that the presence of fecal coliforms represents a direct health risk, especially when associated with high turbidity and organic matter content. This parameter suggests the existence of fecal contamination sources upstream, possibly associated with domestic effluents, livestock, or inadequate use of riverbanks.

The oils and greases parameter presented a value below the limit of quantification (<1 mg/L), indicating no hydrocarbon contamination upstream, which is a positive aspect in the overall environmental quality assessment.

Overall, the comparison with WHO (2022) guidelines and Decree No. 18/2004 shows that the upstream water already exhibits **moderate to poor quality**, with severe non-compliance in TSS, turbidity, and fecal coliforms, as well as slight non-compliance in pH.

These results indicate that the water body is under significant environmental pressure before any influence from the project, making it essential to ensure that subsequent activities do not worsen the current condition and that measures are implemented to maintain or improve downstream water quality.

#### 5.4.3.6 Conclusions and Recommendations

The baseline study of the Natete River established reference conditions for monitoring during the bridge construction and operation. Most water quality parameters—such as pH, dissolved oxygen, turbidity, total suspended solids, BOD<sub>5</sub>, and fecal coliforms—reflect a moderately impacted river, influenced by natural factors and local human activities. Key concerns include elevated turbidity, BOD<sub>5</sub>, and fecal coliform levels, indicating moderate organic and microbiological pollution.

It is recommended to implement continuous monitoring, focusing on microbiological and organic parameters, and to apply preventive measures to control runoff, waste disposal, and other potential contamination sources during construction. These actions will safeguard aquatic ecosystem health and ensure compliance with national and international water quality standards.

## 5.4.4 Fauna and Flora

### 5.4.4.1 Introduction

This report presents the results of the Specialized Study on Fauna and Flora carried out in the Area of Influence (AID) of the bridge reconstruction project over the Natete River. The study was conducted within the framework of the Environmental Assessment System (EAS) process, in accordance with the requirements of Mozambican environmental legislation and the JICA Guidelines, which require the assessment of biodiversity and the protection of threatened species or sensitive habitats.

The main objective of this survey was to characterize the biodiversity existing within a 250-meter radius of the intervention zone, identifying the fauna and flora species present, assessing whether the occurrence or not of species of priority conservation, and proposing recommendations to ensure environmental management and protection during the execution of the project. The study contributes to informed decision-making in project planning and implementation, ensuring compatibility between infrastructure development and the conservation of local ecosystems, in accordance with the guidelines of the Environmental Law (Law nº 20/97, of 1 October), Decree nº 12/2002, of June, 8 (Forest and Wildlife Regulations), and the IFC Performance Standards (PS6 – Biodiversity and Natural Resources).

### 5.4.4.2 Characterization of the Fauna and Flora of the Study Area

#### **Flora**

The study area is located within the Miombo Seco ecological region, characterized by tree and shrub vegetation adapted to poor soils and seasonal fires. Within a 250-meter radius, secondary vegetation and areas of natural regeneration predominate, interspersed with small agricultural plots and riparian forest areas along the Natete river.

The main tree and shrub species identified include ***Brachystegia spiciformis***, ***Julbernardia globiflora***, ***Khaya anthotheca***, ***Ficus sycomorus***, ***Annona senegalensis***, ***Syzygium guineense***, ***Albizia tanganyicensis***, and ***Bauhinia petersiana***. In open areas and clearings, herbaceous and grass species such as ***Andropogon eucomus*** and ***Alloteropsis paniculata*** were recorded.

Species of ecological and economic value were also observed, such as ***Millettia stuhlmannii*** (panga-panga) and *Dalbergia melanoxylon* (pau-preto), both included in the IUCN Red List, classified as Vulnerable. However, their occurrence was sporadic, without the formation of significant populations within the study perimeter.

The riparian vegetation remains relatively well preserved and plays an important ecological role, acting as a natural barrier against erosion and a breeding habitat, as well as a food source for various fauna species.

### **Fauna**

The terrestrial fauna observed in the survey area is essentially composed of small and medium-sized species, common in transitional ecosystems between forested and agricultural areas. Among the mammals, the green monkey (*Chlorocebus pygerythrus*), the kudu (*Tragelaphus strepsiceros*), the peccary (*Potamochoerus larvatus*), and small rodents stand out.

The birdlife presented considerable diversity, with emphasis on resident species and some migratory ones, such as *Corythornis vintsioides* (kingfisher), *Milvus migrans* (black kite), *Tauraco livingstonii* (turaco), and *Ploceus cucullatus* (weaver). The Natete River constitutes an important feeding and resting area for these birds.

The herpetofauna (reptiles and amphibians) observed was mainly composed of common species, such as small lizards and frogs, with no direct record of endemic or endangered species. Despite the ecological relevance of the Ribáuè district, where conservation species such as *Nadzikambia Ribaué* and *Nothophryne ribauensis* are found, these were not observed within the 250-meter radius analyzed, which is justified by their habitat restricted to mountainous areas and high-altitude forests.

In the aquatic environment, the presence of small and medium-sized fish species used in local artisanal fishing was observed. No endangered fish species were identified during the research.

#### **5.4.4.3 Study Methodology (Fauna and Flora)**

The ecological survey was conducted using standardized methods of direct observation and rapid sampling, in accordance with JICA guidelines for environmental biodiversity studies and IFC recommendations (2012).

For Flora, the stratified random sampling method was applied, combining direct observation and verification with satellite images and vegetation maps. Species were identified from morphological characteristics, with the support of regional field guides and taxonomic confirmation at the Herbarium of Eduardo Mondlane University (UEM).

For Fauna, the surveys followed different methodologies for each taxonomic group:

- Mammals: direct and indirect observation (footprints, feces, trails) in linear transects; no indirect signs of fauna were visualized or observed at any of the taxonomic levels (small, medium and large size)
- Birds: fixed-point counting method, with auditory and visual observations at dawn;
- Herpetofauna: visual inspection of transects, tree trunks, rocks, and wet banks;
- Fish: identification through direct observation and interviews with local fishermen.

The data were supplemented with consultations of IUCN lists, CITES, Flora of Mozambique, and previous JICA and ANE reports on regional biodiversity.

#### 5.4.4.4 Results Obtained

The survey showed moderate biodiversity, characteristic of **Miombo ecosystems** influenced by human activities.

Flora: typical Miombo species were recorded, well adapted to anthropogenic disturbances. Among the conservation species, *Millettia stuhlmannii* and *Dalbergia melanoxylon* were identified sporadically, without representative density. Herbaceous species of the general *Digitaria* sp and *Phragmites mauritianus* occur in the area.

No critically endangered or endemic species were found within a 250m radius. Within the area, the greatest predominance was of species of food importance, such as ***Phaseolus vulgaris*** (common bean), ***Zea mays*** (corn), ***Allium cepa*** (onion), ***Musa* sp** (bananas), ***Saccharum officinarum*** (sugar cane), ***Solanum lycopersicum*** (tomato) and ***Cucurbita* sp** (pumpkin).



Fig. 5-4 - Typical vegetation found within a 250m radius

**Fauna:** The observed fauna consists of common and widely distributed species. No species of priority conservation (Critically Endangered or Endangered) were identified within the direct area of influence of the project.

Herpetofauna and avifauna showed moderate local diversity, with bird's indicative of stable ecosystems, such as kingfishers and weavers. Five species of fish were identified through interviews and direct observation: Clarias, beardfish, frogfish, snakefish, and crocodilefish, in addition to small crustaceans (crabs).



Fig. 5-5 B & C: Clarias fish and cattfish caught using a hook by a local fisherman.

In general, the area covered by the 250 meters around the bridge does not constitute a critical habitat nor does it harbor significant populations of threatened species. The expected impact of the project on fauna and flora is low and

reversible, provided that the recommended environmental mitigation measures are applied throughout the study.

#### 5.4.4.5 Conclusion and Recommendations

The specialized study on fauna and flora carried out in the vicinity of the bridge reconstruction project concludes that the area presents ecological characteristics of low sensitivity, with a predominance of common species and an absence of critical habitats or populations of priority conservation within the 250-meter radius analyzed.

The existing vegetation, composed of Miombo mosaics and riparian forests, plays relevant ecological roles and should be preserved and rehabilitated after the works. The observed fauna does not present threatened species but requires attention regarding the temporary disturbance caused by the construction of the new bridge, especially noise, movement of personnel and alteration of the vegetation cover.

It is concluded that the project does not present significant risks to local biodiversity, provided that the recommended management and mitigation measures are properly implemented.

It is recommended that riparian vegetation be preserved during and after the works; hunting and collection of species by workers be prohibited; reforestation with native species in the affected areas; periodic environmental monitoring of fauna and flora; Integration of national and JICA environmental and social practices into the project management plan, ensuring compliance with international safeguards.

#### 5.4.5 Alternative Analysis

The analysis of alternatives for implementing the bridge reconstruction project considered three main dimensions: location, technology, and the "no project" option.

Regarding location alternatives, four different options were analyzed (A, B, C, and D), with Alternative C being selected, which involves reconstruction at the current site. This option proved to have the lowest overall environmental and social impact, as it utilizes an existing and heavily anthropized corridor, thus avoiding the opening of new routes in sensitive areas and minimizing the need for resettlement and the loss of productive agricultural land.

With respect to technological alternatives, five options were evaluated, with the mixed structure solution of precast concrete and concrete beams being selected, as it offers the best balance between durability, climate resilience, execution time, economic viability, and environmental compatibility, including lower noise and

vibration levels when compared to some metallic alternatives. Finally, the analysis of the "no project" alternative concluded that not rebuilding the bridge would perpetuate safety risks, worsen the socioeconomic isolation of the communities, and lead to economic stagnation in the region. Furthermore, the negative impacts of this alternative far outweigh the negative impacts identified for the project alternative, which are mostly temporary and mitigable.

## 6 IDENTIFICATION AND ASSESSMENT OF THE ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROJECT

### 6.2 Methodology for Identifying and Assessing Environmental Impacts

The identification and assessment of the environmental and social impacts of the proposed reconstruction project of the bridge over the Natete River, in the Ribaué district, were carried out based on a combination of internationally recognized methods, adapted to the national context of Mozambique and the JICA Guidelines (2022) in particular, which require a detailed analysis of environmental and social risks/impacts, paying attention to biodiversity, water resources, involuntary resettlement, cultural heritage, climate change and social equity.

The impact identification process began with a detailed analysis of the project's life cycle phases, including planning/preparation, construction, operation and decommissioning, to identify the activities with the greatest potential for interaction with the receiving environment. Subsequently, Impact Checklist techniques were used, complemented by the application of the adapted Leopold Interaction Matrix, allowing the relationship between the project activities to be established, as well as the potentially affected environmental and social components.

#### 6.2.1 Impacts Evaluations

Each identified impact was subsequently evaluated using the following criteria: Nature (positive/negative); Origin (direct, indirect, cumulative); Magnitude/Intensity (low, medium, high); Extent (local, district, regional); Duration (temporary, medium-term, permanent); Reversibility (reversible, irreversible); Probability of occurrence (low, medium, high); and Sensitivity of the receiving environment (low, moderate, high).

#### 6.2.2 Determining the Significance of Impacts

The significance of an impact is determined by the combination of several factors that assess the temporal and spatial scale, the magnitude of the change, the sensitivity of the affected environment, and the probability of occurrence. It is, therefore, an integrated analysis that allows estimating the relative importance of each impact in the environmental and social context of the project, considering both negative and positive effects.

For the present study, the significance of the impacts was determined using the Impact Significance Index (ISI), a method widely used in environmental assessments and adapted to the JICA Guidelines (2022) and Mozambican environmental legislation consolidated by Decree nº 54/2015 of December 31).

The **ISI** calculation combines five main criteria: magnitude, extent, duration, sensitivity, and probability – each with specific assessment scales. The result of

the index is obtained through the formula, where: **M** = Magnitude/Intensity; **E** = Extent; **D** = Duration; **S** = Sensitivity of the receiving environment; **P** = Probability of occurrence. These classification criteria are described in Table 6.1, and Table 6.2 presents the classification of the **ISI** Results.

Table 6.1 - Criteria and Classification of the Impact Significance Index (ISI)

| Criterion                                                                                             | Description                                                                              | Classification                                                   | Score |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------|-------|
| <b>A. Magnitude / Intensity – Degree of Severity of the Impact on the Receptor Environment</b>        | Measures the degree of alteration imposed by the activity on the environment or society. | Very Low – almost imperceptible, negligible impact               | 1     |
|                                                                                                       |                                                                                          | Low – slight impact, easily reversible                           | 2     |
|                                                                                                       |                                                                                          | Moderate – noticeable impact, but controllable/mitigable         | 3     |
|                                                                                                       |                                                                                          | High – severe impact, with potential for significant degradation | 4     |
|                                                                                                       |                                                                                          | Very High – extreme, irreversible, or large-scale impact         | 5     |
| <b>B. Extent – Geographical Area Affected by the Impact</b>                                           | Evaluates the spatial coverage of the impact's influence.                                | Point-specific – within the immediate project area               | 1     |
|                                                                                                       |                                                                                          | Local – restricted to the project intervention area              | 2     |
|                                                                                                       |                                                                                          | District – affects the area within the district boundaries       | 3     |
|                                                                                                       |                                                                                          | Provincial – extends beyond local and district limits            | 4     |
|                                                                                                       |                                                                                          | Regional/National – effects felt at regional or national scale   | 5     |
| <b>C. Duration – Timeframe of the Impact's Persistence</b>                                            | Measures the period during which the impact remains active.                              | Very Short – up to 1 month                                       | 1     |
|                                                                                                       |                                                                                          | Short – up to 1 year (construction phase)                        | 2     |
|                                                                                                       |                                                                                          | Medium – between 1 and 5 years                                   | 3     |
|                                                                                                       |                                                                                          | Long – more than 5 years, but reversible                         | 4     |
|                                                                                                       |                                                                                          | Permanent – irreversible or indefinite duration                  | 5     |
| <b>D. Sensitivity of the Receiving Environment – Environmental or Social Vulnerability/Importance</b> | Measures the ecological and social relevance of the affected area.                       | Low – already degraded environment, low ecological/social value  | 1     |
|                                                                                                       |                                                                                          | Moderate – medium relevance, some resilience                     | 2     |
|                                                                                                       |                                                                                          | High – environmentally/socially important area                   | 3     |
|                                                                                                       |                                                                                          | Very High – fragile area of high ecological/social relevance     | 4     |
|                                                                                                       |                                                                                          | Critical – extremely                                             | 5     |

|                                                                          |                                                                                                                |                                                                                         |   |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---|
|                                                                          |                                                                                                                | vulnerable environment (e.g., conservation areas, rare habitats, dependent communities) |   |
| <b>E. Probability of Occurrence – Likelihood of the Impact Happening</b> | Evaluates the likelihood that the impact will occur, considering the nature of the activity and local context. | Unlikely – <10%                                                                         | 1 |
|                                                                          |                                                                                                                | Low Probability – 10–30%                                                                | 2 |
|                                                                          |                                                                                                                | Medium – 30–60%                                                                         | 3 |
|                                                                          |                                                                                                                | Probable – 60–90%                                                                       | 4 |
|                                                                          |                                                                                                                | Highly Probable – >90%                                                                  | 5 |

Table 6.2 - Environmental and Social Impact Significance Matrix

| Impact Significance Index (ISI) | Significance Level         | Interpretation / Management Implication                                                                                                              | Color Code                                                                                      |
|---------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| ≤ 10                            | Insignificant (Negligible) | The impact is imperceptible or negligible, requiring no specific mitigation. Routine good practice is sufficient.                                    |  Green       |
| 11 – 25                         | Low Significance           | Minor impact, easily reversible and controllable through standard environmental management procedures.                                               |  Light Green |
| 26 – 60                         | Moderate Significance      | Noticeable but manageable impact. Requires targeted mitigation and monitoring to prevent escalation.                                                 |  Yellow      |
| 61 – 120                        | High Significance          | Substantial impact that may cause significant environmental or social alteration. Requires robust mitigation, management, and continuous monitoring. |  Orange    |
| > 120                           | Critical Significance      | Severe and potentially irreversible impact. May compromise project viability unless design alternatives or compensation measures are implemented.    |  Red       |

### 6.3 Impacts on Pollution

The impacts on pollution refer to changes in air, water, and soil quality resulting from activities associated with the project's development. In the case of the Natete River Bridge Project, these impacts mainly stem from equipment mobilization operations, site preparation, construction work, and subsequent demobilization of the construction site.

Potential sources of pollution include atmospheric emissions from machinery and transport, accidental spills of fuels and lubricants, dust and solid waste generation, as well as the possibility of water contamination due to the proximity of the various activities to the river course.

### 6.3.1 Impacts on Air Quality

#### 6.3.1.1 Pre-construction Phase

During the pre-construction phase of the project, it is expected that there will be point atmospheric emissions resulting from the operation of machinery, transport of materials, and cleaning of the implementation area, generating dust and exhaust gases (CO, NO<sub>x</sub>, and particles).

**Impact Assessment:** In general, these impacts are localized, reversible, and easily controllable through the adoption of preventive measures, of low significance, resulting in ISI 10-15.

#### 6.3.1.2 Construction Phase

During the construction phase, the impacts of air pollution become more pronounced due to increased construction activities, intensive machinery movement, and handling of various construction materials. At this stage, there is a significant emission of dust and exhaust gases (CO, NO<sub>x</sub>, SO<sub>2</sub>, and particulates) from vehicles, excavations, earthmoving, transportation, and unloading of materials such as crushed stone, sand, and cement. These emissions temporarily contribute to the degradation of air quality and can cause discomfort to neighboring communities, especially during periods of strong winds and low humidity.

**Impact Assessment:** The impacts are direct, of moderate to high magnitude, temporary duration, and high probability. In terms of significance, the impacts were classified as being of medium to high environmental importance (ISI 40–70).

#### 6.3.1.3 Post Construction Phase

During the post-construction phase, impacts related to air pollution are generally reduced, temporary, and short-lived, since the main work activities have already been completed. At this stage, the potential environmental effects mainly result from the removal of temporary equipment and structures, transportation of remaining materials, and final cleanup of the intervention area.

**Impact Assessment:** In general, these impacts are of low magnitude, localized, and easily reversible, ceasing after the complete cleanup and recovery of the affected area, resulting in a favorable final significance as an ISI ranging from 15-25.

## 6.3.2 Impacts on Water Quality

### 6.3.2.1 Pre- Construction Phase

The potential impacts on water resources are indirect and of small magnitude, resulting essentially from preparatory interventions and the movement of machinery. Among the main potential effects are the risk of diffuse contamination associated with the improper handling and storage of fuels and lubricants; minimal disturbance of surface runoff due to the installation of the construction site near the riverbank; and the temporary alteration of local infiltration and drainage conditions due to soil compaction.

**Impact Assessment:** These are localized, temporary, and reversible impacts, classified as low significance, corresponding to an ISI ranging from 10 to 15.

### 6.3.2.2 Construction Phase

During the construction phase, the risks to water resources become more pronounced, as activities are concentrated directly on the riverbed and banks. At this stage, there is an increase in water turbidity due to riverbed disturbance and bank erosion, as well as the risk of accidental pollution by hydrocarbons and cement in case of leaks, spills, or improper handling of materials. Additionally, temporary obstruction of hydraulic flow may occur during the installation of supports and foundations, as well as downstream siltation if there is no effective sediment control.

**Impact Assessment:** The impacts are direct, of moderate to high magnitude, temporary duration, and high probability. In terms of significance, the impacts were classified as being of medium to high environmental importance (ISI 40–70).

### 6.3.2.3 Post Construction Phase

After the bridge's completion, a general trend of improvement in local hydrological conditions is observed, provided that the hydraulic design of the openings and drainage systems has been correctly designed and executed.

The new structure contributes to the reduction of trampling and informal river crossings, thus decreasing turbidity and sediment runoff during flood periods. However, a residual risk of solid waste deposition persists, especially accumulated garbage under the deck and on the banks, if there is no regular management.

**Impact Assessment:** In general, the impacts at this stage are predominantly positive, of a local and permanent nature, with moderate magnitude and favorable final significance (ISI 15-25), if there are continuous waste management and periodic maintenance of the drainage system and the riverbed.

### 6.3.3 Impacts of Waste Generation

#### 6.3.3.1 Pre-Construction Phase

In the pre-construction phase, waste generation is sporadic and of small magnitude, resulting from the cleaning and deforestation of the area, preparation of the construction site, and mobilization of equipment. The main wastes include plant remains (trunks, roots, branches, and foliage), removed soil, non-hazardous materials, and small quantities of hazardous waste from machine maintenance.

**Impact Assessment:** In general, these are impacts of probable occurrence, low magnitude, and short duration, and low to moderate significance (ISI 15-25).

#### 6.3.3.2 Construction Phase

During the project construction phase, waste generation increases due to the higher volume of construction activities and workers, including concrete debris, wood, plastics, packaging, and household waste. Hazardous waste, such as oils, solvents, and contaminated packaging, is also produced during this phase, which, if poorly managed, can cause soil and water pollution and environmental degradation.

**Impact Assessment:** In general, the impacts in this phase are direct, of moderate to high magnitude, local to district extent, and temporary duration, with a high probability of occurrence. The overall significance is medium to high (ISI between 50 and 80).

#### 6.3.3.3 Post Construction Phase

In the post-construction phase, waste generation is generally reduced, limited to final cleanup activities, site demobilization, and removal of temporary structures. Mainly inert and non-hazardous waste is produced, such as plastics, scrap metal, leftover materials, and packaging. Small amounts of hazardous waste, such as used oils and filters, may also arise from the final maintenance of equipment. If not managed correctly, they can cause point source contamination of soil and water.

**Impact Assessment:** In general, the impacts related to waste generation in this phase are of low magnitude, temporary, and reversible, with an ISI of 20 to 25.

### 6.3.4 Impact on Noise and Vibration Quality

#### 6.3.4.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts on noise and vibration quality are considered localized, occurring mainly during equipment mobilization, site clearing and preparation, and construction site setup. Noise sources are limited to the transport of materials and initial operation of light

machinery, without continuous or high-intensity activities. Vibrations in this phase are minimal and result only from vehicle movement and surface leveling off the ground, without the potential to cause significant discomfort to the local population or structural damage.

**Impact Assessment:** In general, this is a low-magnitude, short-duration, temporary, localized, and easily mitigable impact with a low ISI of 15-25.

#### 6.3.4.2 Construction Phase

During the construction phase, noise and vibration impacts increase due to the intensive use of heavy machinery and activities such as excavation, drilling, and material handling. Noise can exceed WHO limits (55 dB(A) day, 45 dB(A) night), while vibrations from compactors and heavy vehicles can cause temporary discomfort in nearby areas, varying according to the distance from dwellings and soil characteristics.

**Impact Assessment:** In general, the impacts at this stage are direct, of moderate to high magnitude, local to district extent, and temporary duration, with a high probability of occurrence. The overall significance is medium to high (ISI between 50 and 80).

#### 6.3.4.3 Post Construction Phase

During the post-construction phase of the project, the impacts on noise and vibration quality are significantly reduced, since large-scale activities have already been completed. At this stage, noise is generated only by occasional demobilization and equipment transport operations and final area cleaning. Vibrations are practically non-existent, limited to the residual movement of vehicles during the removal of materials and equipment, and noise levels at this stage are expected to remain within the standards recommended by the WHO for residential areas ( $\leq 55$  dB(A) daytime and  $\leq 45$  dB(A) nighttime).

**Impact Assessment:** Residual impacts, of low magnitude and local extent, with temporary duration and reversible, corresponding to low significance (ISI 15–30).

### 6.4 Natural Environment

#### 6.4.1 Impacts on Protected Areas (Mupalue – Ribáuè)

No impacts are foreseen on the protected areas, namely Mupalue – Ribáuè, during the project's life cycle.

## 6.4.2 Impacts on Biodiversity (Fauna e Flora)

### 6.4.2.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts on biodiversity (fauna and flora) mainly result from the activities of clearing the area, deforestation, and preparing the land for the installation of the construction site and access roads. The partial removal of vegetation can cause localized loss of vegetation cover, temporary reduction of micro-habitants, and disturbance to local fauna, especially small species and birds that use the area for shelter and feeding. Noise and machinery movement can also cause temporary flight of wild animals and displacement of species less adapted to human presence.

**Impact Assessment:** In general, these are local, temporary, and reversible impacts of low to moderate magnitude and low probability of occurrence, resulting in a low overall significance corresponding to an ISI between 20 and 25.

### 6.4.2.2 Phase Construction

During the project construction phase, impacts on fauna and flora become more significant due to the intensification of construction activities, machinery movement, and occupation of riverbanks. The removal of vegetation and the deposition of materials cause localized habitat loss and fragmentation of riparian vegetation. Noise, vibrations, and human presence cause temporary fauna displacement and changes in the behavior of birds and small mammals, while turbidity can affect sensitive aquatic organisms such as fish and macroinvertebrates during construction work near the riverbed.

**Impact assessment:** In general, the impacts in this phase of the project are direct, of moderate magnitude, local extent, and temporary duration, with a probable probability of occurrence. The overall significance is medium to high (ISI between 40 and 50).

### 6.4.2.3 Post Construction Phase

During the post-construction phase, activities associated with the decommissioning of the works, cleaning, and rehabilitation of the affected areas will not have any effects on the local fauna and flora.

## 6.4.3 Impacts on Hydrology and Hydraulics

### 6.4.3.1 Pre-construction Phase

In the pre-construction phase, the impacts on hydrology and hydraulics result from the clearing, weeding, and installation of the construction site. Soil compaction and vegetation removal can reduce infiltration and increase surface runoff, causing

minor changes in the drainage regime; these effects are localized and reversible after the stabilization of the affected areas.

**Impact Assessment:** In general, the hydrological and hydraulic impacts in this phase are negative and localized, temporary, and of low magnitude, with an ISI ranging from 20 to 25.

#### 6.4.3.2 Construction Phase

During the construction phase, impacts on hydrology and hydraulics intensify due to works on the riverbanks and riverbed. Excavations and foundations can temporarily alter water flow, increase turbidity, and promote sediment deposition. Machinery traffic and material storage near the river can cause soil compaction, surface erosion, and risk of water contamination from accidental spills of fuel or cement.

**Impact Assessment:** The impacts on hydrology and hydraulics in this phase are classified as moderate, temporary, and localized, with an ISI between 50 and 80.

#### 6.4.3.3 Post Construction Phase

In the post-construction phase, activities are likely to produce effects on hydrology and hydraulics, as they are restricted to the restoration of intervened areas, with soil stabilization and normalization of runoff.

### 6.4.4 Impacts on Topography and Geology

#### 6.4.4.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts on topography and geology refer particularly to the alteration of the landscape configuration limited to the cleaning and clearing of the land and the installation of support infrastructure (construction site), with no deep excavations or large-scale soil movements that could significantly modify the natural relief. Initial interventions may cause minor changes in microtopography and localized soil exposure, resulting in limited visual modifications to the landscape and a slight increase in the risk of surface erosion in the event of heavy rainfall.

**Impact Assessment:** the impacts are localized, temporary and of low magnitude with an ISI of 20 to 30.

#### 6.4.4.2 Construction Phase

During the construction phase, the impacts become more evident due to excavations, earthmoving, and the installation of bridge foundations. These

activities can cause temporary changes in the relief, soil exposure, and visual alterations to the landscape, especially on the riverbanks. Earthmoving and vegetation removal increase susceptibility to erosion and slope instability, in addition to causing slight disturbances to the superficial geological structure.

**Impact Assessment:** The impacts on topography and geology in this phase are classified as moderate, temporary, and reversible. The overall significance is medium to high (ISI between 50 and 80).

#### 6.4.4.3 Post Construction Phase

In the post-construction phase, project activities such as rehabilitation of affected areas, removal of temporary structures, and revegetation of degraded areas must not impact the local topography and geology.

### 6.5 Social Environment

The impacts on the social environment refer to the changes that the proposed reconstruction project of the bridge over the Natete River may cause in the living conditions, social dynamics, and well-being of local communities. These impacts include both positive impacts, associated with improved accessibility, job creation, and economic dynamism, and temporary negative impacts resulting from construction activities, such as increased noise, dust, and interference with local traffic.

During the execution of the project, the social environment may experience direct and indirect changes related to the presence of workers, the mobilization of resources, and the temporary alteration of community routines. However, with the proper implementation of mitigation measures and social communication, adverse effects can be minimized, ensuring that the social and economic benefits resulting from the new infrastructure prevail in a sustainable and lasting way for the local population.

#### 6.5.1 Involuntary Resettlement

##### 6.5.1.1 Pre-construction Phase

No activities that could promote physical displacement or temporary restrictions on land use and local natural resources are expected, as this stage only involves defining the intervention area, topographic surveys, and identifying existing infrastructure and occupations within the project's area of direct intervention (DIA).

##### 6.5.1.2 Construction Phase

Due to the bridge construction work, land expropriations and limited resettlements will be necessary. A total of eight people, including farms with crops, two

dwelling, and fishponds, occupying agricultural and residential areas on the riverbanks, will be displaced for the development of the project.

#### 6.5.1.3 Post Construction Phase

During the post-construction phase, no activity is expected that could cause involuntary resettlement, since expropriation and compensation activities will have already been completed in previous phases (before construction).

### 6.5.2 Impacts on Vulnerable / Low-Income Populations

#### 6.5.2.1 Pre-construction Phase

In the pre-construction phase of the project, the impacts on the vulnerable and low-income population will mainly stem from planning activities, topographic surveying, site clearing, and the installation of the construction site and related infrastructure. Concerns may arise regarding the loss of land or access to resources, generating insecurity among family's dependent on the area. There is also a risk of information inequality and low participation in public consultations process.

**Impact Assessment:** In general, these impacts are temporary, localized, likely to occur, indirect, and of low magnitude significance with an ISI between 20 and 25.

#### 6.5.2.2 Construction Phase

During the project construction phase, the impacts on vulnerable and low-income populations become more evident due to increased construction activities, movement of heavy machinery, and the presence of external workers in the AIP (Area of Public Interest).

Temporary effects such as mobility restrictions, interference with access to basic services, as well as increased noise and dust may occur, especially affecting groups with less adaptive capacity, such as low-income families, the elderly, and female heads of household.

In addition, social tensions related to labor hiring may arise. Despite this, the project also generates positive impacts during construction, such as temporary employment, as well as income opportunities for the local population, which, if prioritized, can improve the socio-economic conditions of these groups.

**Impact assessment:** Impacts are classified as likely occurrence, temporary, localized, indirect, and of low magnitude and moderate significance and ISI (30 and 25).

### 6.5.2.3 Post Construction Phase

During the post-construction phase, there are no project activities that impact vulnerable and low-income populations. Work activities cease, and the social and economic benefits of the new infrastructure begin to be felt by local communities.

## 6.5.3 Impacts on Local Communities and Ethnic Groups

### 6.5.3.1 Pre-construction Phase

During the pre-construction phase of the project, impacts on local communities and ethnic groups result mainly from planning activities, topographic surveys, and land preparation. At this stage, expectations, uncertainties, and concerns may arise regarding the potential loss of land and access to natural resources, especially for more culturally vulnerable groups.

**Impact Assessment:** The expected impacts at this stage are punctual, indirect, and of low magnitude, temporary, and of low significance, corresponding to an ISI of 15-25.

### 6.5.3.2 Construction Phase

During the construction phase, the impacts on local communities and ethnic groups become more evident due to the presence of external workers, the movement of heavy machinery, and temporary restrictions on access to roads and common areas. Disruptions to local routines, increased noise and dust, and social tensions associated with labor hiring and pressure on local services and resources may occur. Despite these effects, there are also social benefits, such as job creation and boosting the local economy associated with the project.

**Impact Assessment:** Overall, the impacts are negative, highly likely to occur, temporary, localized, of low intensity and moderate significance, with an ISI of 35-60.

### 6.5.3.3 Post Construction Phase

In the post-construction phase, the impacts on local communities and ethnic groups are predominantly positive, resulting from improved mobility, accessibility, and territorial integration provided by the new bridge. The infrastructure facilitates access to basic services, the flow of agricultural products, and the strengthening of commercial and social relations among riverside communities.

**Impact Assessment:** Overall, this phase is characterized by positive and lasting impacts that contribute to local socioeconomic development and the strengthening of social and cultural cohesion in the affected communities, equivalent to an ISI of 70-80.

## 6.5.4 Impacts on Local Economy and Livelihoods

### 6.5.4.1 Pre-construction Phase

During the pre-construction phase of the project, impacts on the local economy and livelihoods are localized, as activities are mainly limited to land clearing, topographic surveys, and initial resource mobilization. Minor disruptions may occur to local agricultural or commercial activities, especially in areas near the construction site or access zones.

**Impact Assessment:** These impacts are classified as negative, localized, temporary, and reversible, of low magnitude and significance corresponding to an ISI of 15-20.

### 6.5.4.2 Construction Phase

During the construction phase, the impacts on the local economy and livelihoods become more significant due to the increase in economic activities generated by the works, such as informal trade, the supply of goods and services, and temporary employment opportunities. However, negative effects may also occur, such as disruptions in transportation and access to agricultural areas, temporary reductions in productivity, and dependence on short-term jobs.

**Impact Assessment:** the impacts are moderate and temporary, of moderate magnitude, of district extent, indirect and reversible, corresponding to an ISI of 40-60.

### 6.5.4.3 Post Construction Phase

In the post-construction phase, the impacts on the local economy and livelihoods are predominantly positive and sustainable, as the bridge improves access to markets, schools, health units, and shopping centers, strengthening the flow of agricultural production and encouraging the growth of local economic activities. The infrastructure will contribute to reducing transportation costs, increasing business opportunities, and diversifying the livelihoods of riverside communities.

**Impact Assessment:** The effects are very likely to occur, of moderate magnitude, long-lasting and cumulative, and of high regional extent and significance, resulting in an ISI of 70-80.

## 6.5.5 Impacts on Water Use and Rights

### 6.5.5.1 Pre-construction Phase

During the pre-construction phase of the project, no impacts on water use and rights are expected, since the activities associated with this stage of the project are limited to land preparation, deforestation, and equipment mobilization.

#### 6.5.5.2 Construction Phase

During the construction phase, impacts on water use and rights become more relevant due to the proximity of the works to the riverbed and the activities of excavation, foundation work, and operation of heavy machinery. Temporary restrictions on water access for local communities may occur, as well as risks of diffuse contamination due to accidental spills of fuels, cement, and other materials. These effects can affect the traditional use of water for consumption, fishing, and irrigation, especially in nearby riparian zones.

**Impact Assessment:** The impacts are negative, of low magnitude and probable occurrence, localized and temporary, and mitigable, with moderate significance and an ISI of 40-60.

#### 6.5.5.3 Post Construction Phase

In the post-construction phase, the impacts on water use and rights are predominantly positive, as the stabilization of the banks and the improvement of infrastructure reduce the risk of erosion and contamination. The bridge will facilitate access for communities to riverbanks, promoting better circulation and sustainable use of water resources.

**Impact Assessment:** The impacts are positive, of low magnitude, likely to occur, indirect, of local extent, with moderate significance equivalent to an ISI of 70-80.

### 6.5.6 Impacts on Infrastructure and Social Services

#### 6.5.6.1 Fase de Pré- Construction

It is not expected that there will be any impact on infrastructure and social services in the AIP at this stage.

#### 6.5.6.2 Construction Phase

During the construction phase, the impacts on infrastructure and social services become more significant due to the intensification of construction activities and increased circulation of vehicles and workers. Temporary damage may occur to local roads and secondary bridges, and there may be increased pressure on health and safety services due to the growth of the floating population.

**Impact Assessment:** The impacts are negative, of low magnitude, district-wide, indirect and reversible, of moderate significance, with an ISI around 40-60.

### 6.5.6.3 Post Construction Phase

In the post-construction phase, the impacts on infrastructure and social services are positive and lasting, as the new bridge will provide better connectivity between communities, reduced travel time, and easier access to schools, health centers, markets, and public services. Improved transportation conditions will contribute to increased efficiency of local supply and social assistance networks, boosting regional development.

**Impact Assessment:** The impacts are likely to occur, of moderate magnitude and high significance, of regional scope and long-term impact, resulting in an ISI between 70-80.

### 6.5.7 Impacts on Local Social Institutions

#### 6.5.7.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts on local social institutions are indirect, localized, and of low magnitude, since this stage only involves preparatory activities for the works. Expectations, doubts, and concerns may arise among community and traditional leaders regarding the possible social and economic changes caused by the project.

**Impact Assessment:** These impacts are negative, localized, indirect, of low magnitude, temporary, and reversible, resulting in an ISI of 10-15.

#### 6.5.7.2 Construction Phase

During the construction phase, the impacts on local social institutions become more relevant due to the presence of external workers, increased social interactions, and a greater need for community coordination. Local institutions, such as traditional leaders, development committees, and community associations, may face additional pressure to mediate conflicts, manage population expectations, and monitor the execution of the project works.

At the same time, this phase offers opportunities for institutional strengthening through active participation in communication between the project and the communities and in social monitoring.

**Impact Assessment:** The impacts are negative, of low magnitude, temporary, of district extent, and of moderate significance, resulting in an ISI in the range of 40-60.

### 6.5.7.3 Post Construction Phase

During the post-construction phase of the project, the impacts on local social institutions are positive and lasting, resulting from the strengthening of organizational capacity and the role of leadership in managing the project's benefits. With the completion of construction and the start of operation of the new bridge, local institutions become more active in coordinating socioeconomic development, maintaining community cohesion, and liaising with district authorities.

Institutional adjustments may also occur to respond to new social and economic dynamics, but these effects are beneficial and strengthen local governance.

**Impact Assessment:** Overall, this phase presents positive and sustainable impacts of low magnitude and high significance, corresponding to an ISI in the 70-80 range.

### 6.5.8 Impacts on the Distribution of Benefits and Harms

#### 6.5.8.1 Pre-construction Phase

During the pre-construction phase of the project, no impacts on the distribution of benefits and damages are expected, since the project is in the preparation and planning phase.

#### 6.5.8.2 Phase construction

During the construction phase, the impacts on the distribution of benefits and damage become more visible, given the mobilization of resources, job creation, and local economic activity. Although the project creates temporary benefits, such as employment and boosting local commerce, imbalances in the distribution of these benefits can also occur, with specific groups being more favored (e.g., hired workers) and others more exposed to negative impacts, such as noise, dust, access restrictions, and temporary loss of agricultural income.

The lack of fair compensation and labor selection criteria can generate social tensions and perceptions of injustice.

**Impact Assessment:** The impacts are negative, of moderate magnitude and significance, localized extent, and temporary, resulting in an ISI in the range of 40-60.

#### 6.5.8.3 Post Construction Phase

In the post-construction phase, the impacts on the distribution of benefits and damages become predominantly positive, as the social and economic benefits of

the bridge are widely distributed among the communities. Improved mobility, accessibility, and regional integration promote equitable access to markets, services, and development opportunities.

The temporary damages associated with the construction phase are eliminated, and the collective gains become lasting, although differences in the enjoyment of benefits may persist among groups with distinct economic and social capacities.

**Impact Assessment:** Overall, this phase presents positive and sustainable impacts of moderate magnitude and high significance, with regional scope resulting in an ISI of 80-90.

## 6.5.9 Impacts on Local Conflicts of Interest

### 6.5.9.1 Pre-construction Phase

During the pre-construction phase of the project, occasional tensions may arise between communities and local leaders due to differences in perception regarding the bridge's location, access to benefits, compensation, or the delimitation of intervention areas.

**Impact Assessment:** The impacts are indirect, negative, of low magnitude and localized, temporary in duration, and fully reversible. The probability of occurrence is low, and the sensitivity of the receiving environment is moderate and of low significance, with an ISI of 15-20.

### 6.5.9.2 Construction Phase

During the construction phase, impacts related to the presence of external workers, the unequal distribution of economic opportunities, and the temporary restriction of access to productive areas can generate tensions between local groups. Conflicts may be linked to the hiring of labor, the use of community infrastructure, and the perception of favoritism in the distribution of benefits.

**Impact Assessment:** The impacts are negative, of moderate magnitude, local and district extent, temporary duration, reversible, with a high probability of occurrence, moderate sensitivity of the receiving environment, and moderate significance, resulting in an ISI of 35-45.

### 6.5.9.3 Post Construction Phase

In the post-construction phase, no project activities are expected that could promote local conflicts of interest, since the new bridge will bring social and economic benefits that will be widely distributed among the communities.

## 6.5.10 Impacts on Gender

### 6.5.10.1 Pre-construction Phase

During the pre-construction phase of the project, gender-related impacts may occur at the level of differences in the perception and participation of men and women in planning processes, especially due to unequal access to information, as well as decision-making in some rural communities.

**Impact Assessment:** The impacts are negative, of low magnitude and localized, temporary and reversible, with a medium probability of occurrence and moderate sensitivity, being considered of low significance, resulting in an ISI of 15 to 20.

### 6.5.10.2 Construction Phase

During the construction phase, the impacts on gender become more pronounced due to the presence of external workers, temporary social and economic changes, and changes in family and community dynamics. Risks of harassment, gender-based violence, and sexual exploitation may occur, especially in communities near the construction site, in addition to an increased burden of domestic responsibilities for women due to the temporary absence of men involved in the works.

**Impact Assessment:** The impacts are negative, of moderate magnitude and localized, temporary duration, reversible, with a high probability of occurrence, high sensitivity of the receiving environment, and moderate significance, resulting in an ISI 30-40.

### 6.5.10.3 Post Construction Phase

In the post-construction phase, no project activities are expected that could impact gender, in the hope that the new bridge will improve women's access to health services, education, markets, and economic opportunities.

## 6.5.11 Impacts on Infectious Diseases (HIV/AIDS and Others)

### 6.5.11.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts related to infectious diseases (HIV/AIDS and others) are minimal, limited to the initial mobilization. However, the start of the circulation of workers and service providers may introduce small risks of transmission of infectious diseases and respiratory infections, especially in communities with limited access to health services.

**Impact Assessment:** The impacts are negative, of low magnitude, localized and temporary, of probable occurrence and moderate sensitivity and significance, resulting in an ISI of 15 to 20.

#### 6.5.11.2 Construction Phase

During the construction phase, impacts are related to the presence of external workers, increased population mobility, and intensified social and economic interactions. This context can increase the risk of transmission of sexually transmitted diseases (including HIV/AIDS), malaria, respiratory infections, and waterborne diseases, especially in vulnerable communities.

**Impact Assessment:** Overall, the impacts are negative, of moderate magnitude, district-wide extent, and medium-term duration, with a high probability of occurrence and high sensitivity and significance, resulting in an ISI of between 40-50.

#### 6.5.11.3 Post Construction Phase

In the post-construction phase, no project activities are expected that could impact gender, in the hope that the new bridge will improve women's access to health services, education, markets, and economic opportunities.

### 6.5.12 Impacts on Occupational Health and Safety

#### 6.5.12.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts on occupational health and safety are reduced, since the activities are limited to the mobilization of equipment, site preparation, and installation of the construction site. In this phase, there may be minor risks of work accidents related to the handling of tools, movement of materials, and circulation of heavy machinery.

**Impact Assessment:** The impacts are negative, of low magnitude and localized, temporary, with unlikely occurrence, moderate sensitivity and significance, resulting in an ISI of 15-20.

#### 6.5.12.2 Construction Phase

During the construction phase, the impacts on occupational health and safety are related to the operation of heavy machinery, work at height, excavations, transportation of materials, and adverse environmental conditions. Workplace accidents, injuries, falls, and exposure to dust, noise, and vibrations may occur, in addition to physical fatigue and work-related stress.

**Impact Assessment:** The impacts are negative in nature, of moderate magnitude, localized, of district extent and temporary duration, reversible, of very probable

occurrence, and of high sensitivity and moderate significance, resulting in an ISI of 60-70.

#### 6.5.12.3 Post Construction Phase

In the post-construction phase of the project, the impacts on occupational health and safety are significantly reduced. At this stage, activities are limited to cleaning the area and environmental rehabilitation, with a low risk of accidents and improved working conditions due to the stabilization of operations.

**Impact Assessment:** The impacts are negative, of low magnitude and localized, of temporary to medium-term duration, reversible, with a low probability of occurrence of significance, corresponding to an ISI of around 20-25.

### 6.5.13 Impacts on the Common Use of Water and Natural Resources

#### 6.5.13.1 Pre-construction Phase

During the pre-construction phase of the project, no impacts are expected that could affect the common use of water and natural resources in the AIP (Area of Intervention and Protection), since the activities of this phase are basically one-off and limited to project planning, namely area clearing, deforestation, and construction site installation. These activities are not likely to cause any temporary disruptions to local communities' access to water sources used for domestic consumption, artisanal fishing, irrigation, and livestock watering.

#### 6.5.13.2 Construction Phase

During the construction phase, impacts on the common use of water and natural resources become more significant due to works on the riverbanks and riverbed, movement of heavy machinery, and storage of construction materials.

Temporary restrictions on access to water and diffuse contamination from accidental spills of fuels, oils, and other chemicals may occur, affecting domestic and productive use. There is also potential for reduced water quality and a temporary decrease in the availability of fish and aquatic fauna.

**Impact Assessment:** The impacts are negative in nature, of moderate magnitude, local in extent, and temporary, reversible, with a high probability of occurrence and high sensitivity with moderate significance, resulting in an ISI of 40-50.

#### 6.5.13.3 Post Construction Phase

In the post-construction phase, the impacts on the common use of water and natural resources become predominantly positive, as the stabilization of the banks and the completion of the works allow for the gradual recovery of water and ecosystem resources. The new bridge improves access and mobility for riverside

communities, facilitating the sustainable management of natural resources and the equitable use of water.

**Impact Assessment:** The impacts are negative, of moderate magnitude and localized extent, of medium to long-term duration, reversible and cumulative, with a high probability of occurrence and moderate sensitivity and significance, resulting in an ISI of 35-40.

## 6.5.14 Impacts on Climate Change / Global Warming

### 6.5.14.1 Pre-construction Phase

During the pre-construction phase of the project, the impacts related to climate change and global warming are minimal. At this stage, greenhouse gas (GHG) emissions are sporadic and mainly associated with the mobilization of machinery, transportation of materials, and initial deforestation.

**Impact Assessment:** The impacts are negative, of low magnitude and localized, temporary, with unlikely occurrence and low significance with an ISI in the range of 15-20.

### 6.5.14.2 Construction Phase

During the construction phase, the impacts on climate change become more significant due to the intensification of construction activities and the increase in direct emissions of CO<sub>2</sub> and other gases resulting from the burning of fossil fuels by heavy machinery, transportation of materials, and the production of concrete and asphalt.

**Impact Assessment:** The impacts are negative, of moderate magnitude and localized, temporary duration, reversible, with a high probability of occurrence and moderate sensitivity and moderate significance, corresponding to an ISI of 45-50.

### 6.5.14.3 Post Construction Phase

In the post-construction phase of the project, no activities that could promote climate change/global warming are expected.

## 6.5.15 Impacts of Accidents and Road Hazards

### 6.5.15.1 Pre-construction Phase

During the pre-construction phase of the project, impacts related to accidents and road hazards are predictable but localized, as activities are limited to the mobilization of machinery, initial transport of materials, and site preparation. In this phase, risks are associated with a temporary increase in heavy vehicle traffic, as

well as interference with local traffic, which may generate minor accidents or damage to existing roads.

**Impact Assessment:** The impacts are negative, temporary, of low magnitude and localized, reversible, with an unlikely occurrence and low significance with an ISI of 15-20.

#### 6.5.15.2 Construction Phase

During the construction phase, road and accident risks become more relevant due to the increased circulation of heavy machinery, trucks transporting materials and workers, especially on unpaved roads with mixed traffic (vehicles and pedestrians). The probability of road accidents, run-overs, falls and collisions increase considerably.

**Impact Assessment:** In general, the impacts are negative, of moderate magnitude, district-wide, temporary, with a high probability of occurrence and high sensitivity of the receiving environment, with moderate significance, corresponding to an ISI 40-50.

#### 6.5.15.3 Post Construction Phase

In the post-construction phase of the project, the impacts on accidents and road risks become positive, as the new bridge will provide safe and efficient mobility conditions, reducing the risk of accidents during improvised river crossings, especially during flood periods. The improvement of road infrastructure will result in better traffic flow, less vehicle wear and tear, and a reduction in risks associated with poor access conditions.

**Impact Assessment:** The impacts are positive in nature, of moderate magnitude and district extent, long-term and cumulative, highly probable in occurrence and moderate sensitivity of the receiving environment, and moderate significance, resulting in an ISI of 35-40.

Table 6-1 presents a summary of the main impacts identified for each environment and phase, as well as their nature, magnitude, and final significance (ISI).

Table 6-3 - Summary of Environmental and Social Impacts by Component

| Environmental / Social Component | Phase             | Main Impacts Identified                                                                                                                        | Nature of Impact | Magnitude        | ISI     |
|----------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|---------|
| <b>Air Quality</b>               | Pre-Construction  | Point-source emissions of dust and gases (CO, NO <sub>x</sub> ) from machinery and transport.                                                  | Negative         | Low              | ■ 10–15 |
|                                  | Construction      | Significant emissions of dust and gases (CO, NO <sub>x</sub> , SO <sub>2</sub> , particles) from vehicles, excavations, and material handling. | Negative         | Moderate to High | ■ 40–70 |
|                                  | Post-Construction | Residual emissions from equipment removal and final site cleaning.                                                                             | Negative         | Low              | ■ 15–25 |
| <b>Water Quality</b>             | Pre-Construction  | Risk of diffuse contamination by fuels and lubricants; temporary alteration of drainage patterns.                                              | Negative         | Low              | ■ 10–15 |
|                                  | Construction      | Increased turbidity; risk of hydrocarbon and cement pollution; temporary obstruction of flow.                                                  | Negative         | Moderate to High | ■ 40–70 |
|                                  | Post-Construction | Improvement in hydrological conditions; residual risk of solid waste deposition.                                                               | Positive         | Moderate         | ■ 15–25 |
| <b>Waste Generation</b>          | Pre-Construction  | Generation of small volumes of vegetative waste, soil, and hazardous waste (maintenance residues).                                             | Negative         | Low              | ■ 15–25 |
|                                  | Construction      | High generation of inert (concrete, wood) and hazardous waste (oils, solvents).                                                                | Negative         | Moderate to High | ■ 50–80 |
|                                  | Post-Construction | Low generation of inert and hazardous waste during demobilization.                                                                             | Negative         | Low              | ■ 20–25 |
| <b>Noise and Vibration</b>       | Pre-Construction  | Point noise from light machinery; minimal vibrations.                                                                                          | Negative         | Low              | ■ 15–25 |
|                                  | Construction      | Intense noise and vibration from heavy machinery (excavations, piling).                                                                        | Negative         | Moderate to High | ■ 50–80 |
|                                  | Post-Construction | Residual noise from demobilization; negligible vibrations.                                                                                     | Negative         | Low              | ■ 15–30 |
| <b>Biodiversity</b>              | Pre-Construction  | Localized vegetation loss; temporary fauna disturbance and displacement.                                                                       | Negative         | Low to Moderate  | ■ 20–25 |
|                                  | Construction      | Habitat loss and fragmentation of riparian vegetation; fauna displacement; effects on aquatic organisms.                                       | Negative         | Moderate         | ■ 40–50 |
|                                  | Post-Construction | No significant impacts expected.                                                                                                               | -                | -                | -       |
| <b>Hydrology and</b>             | Pre-Construction  | Reduced infiltration and increased runoff due to soil                                                                                          | Negative         | Low              | ■ 20–25 |

| Environmental / Social Component           | Phase             | Main Impacts Identified                                                                        | Nature of Impact                 | Magnitude     | ISI                                                                                         |
|--------------------------------------------|-------------------|------------------------------------------------------------------------------------------------|----------------------------------|---------------|---------------------------------------------------------------------------------------------|
| <b>Hydraulics</b>                          |                   | compaction.                                                                                    |                                  |               |                                                                                             |
|                                            | Construction      | Alteration of surface flow, turbidity increase, sediment deposition, and erosion risks.        | Negative                         | Moderate      |  50–80   |
|                                            | Post-Construction | Soil stabilization and normalization of runoff conditions.                                     | Negative                         | Moderate      |  -       |
| <b>Topography and Geology</b>              | Pre-Construction  | Minor microtopographic changes; increased risk of surface erosion.                             | Negative                         | Low           |  20–30   |
|                                            | Construction      | Terrain modification; increased susceptibility to erosion and slope instability.               | Negative                         | Moderate      |  50–80   |
|                                            | Post-Construction | No significant impacts expected.                                                               | -                                | -             | -                                                                                           |
| <b>Population Vulnerability</b>            | Pre-Construction  | Apprehension and uncertainty about land loss and resource access.                              | Negative                         | Low           |  20–25   |
|                                            | Construction      | Mobility restrictions, interference with services, noise and dust increase; job opportunities. | Negative (with positive aspects) | Low           |  25–30   |
|                                            | Post-Construction | No negative impacts; infrastructure benefits perceived.                                        | -                                | -             | -                                                                                           |
| <b>Local Communities</b>                   | Pre-Construction  | Expectations and concerns about the project.                                                   | Negative                         | Low           |  15–25   |
|                                            | Construction      | Routine disturbances, social tension, increased noise and dust; job creation.                  | Negative                         | Low Intensity |  35–60   |
|                                            | Post-Construction | Improved mobility, accessibility, and territorial integration.                                 | Positive                         | Moderate      |  70–80   |
| <b>Local Economy</b>                       | Pre-Construction  | Minor disruptions to agricultural or commercial activities.                                    | Negative                         | Low           |  15–20  |
|                                            | Construction      | Temporary employment and trade stimulation; transport interruptions.                           | Negative (with positive aspects) | Moderate      |  40–60 |
|                                            | Post-Construction | Improved market access, product flow, and economic growth.                                     | Positive                         | Moderate      |  70–80 |
| <b>Distribution of Benefits or Damages</b> | Pre-Construction  | No impacts expected.                                                                           | -                                | -             | -                                                                                           |
|                                            | Construction      | Unequal distribution of benefits (jobs) and exposure to negative impacts (noise, dust).        | Negative                         | Moderate      |  40–60 |
|                                            | Post-Construction | Broadly distributed benefits (mobility, market, and service access).                           | Positive                         | Moderate      |  80–90 |

| Environmental / Social Component      | Phase             | Main Impacts Identified                                                              | Nature of Impact | Magnitude | ISI   |
|---------------------------------------|-------------------|--------------------------------------------------------------------------------------|------------------|-----------|-------|
| <b>Gender</b>                         | Pre-Construction  | Inequality in access to information and participation in planning.                   | Negative         | Low       | 15–20 |
|                                       | Construction      | Risks of harassment, gender-based violence, and increased domestic burden for women. | Negative         | Moderate  | 30–40 |
|                                       | Post-Construction | Improved access to services and economic opportunities for women.                    | Positive         | -         | -     |
| <b>Infectious Diseases</b>            | Pre-Construction  | Low risk of disease transmission during initial worker mobilization.                 | Negative         | Low       | 15–20 |
|                                       | Construction      | Increased risk of HIV/AIDS, malaria, and waterborne diseases.                        | Negative         | Moderate  | 40–50 |
|                                       | Post-Construction | Improved access to health services.                                                  | Positive         | -         | -     |
| <b>Occupational Health and Safety</b> | Pre-Construction  | Minor risks of accidents with tools and machinery.                                   | Negative         | Low       | 15–20 |
|                                       | Construction      | High risk of occupational accidents; exposure to dust, noise, and vibration.         | Negative         | Moderate  | 60–70 |
|                                       | Post-Construction | Reduced risks; low-risk activities (site cleaning and rehabilitation).               | Negative         | Low       | 20–25 |
| <b>Road Accidents</b>                 | Pre-Construction  | Temporary increase in heavy vehicle traffic; minor accidents.                        | Negative         | Low       | 15–20 |
|                                       | Construction      | High risk of road accidents and collisions due to heavy machinery.                   | Negative         | Moderate  | 40–50 |
|                                       | Post-Construction | Reduced accidents due to improved crossing and road safety conditions.               | Positive         | Moderate  | 35–40 |

#### Legend (Impact Significance Index – ISI):

 Green (≤ 10) Insignificant (Negligible); 
  Light Green (11 – 25) Low; 
  Yellow (26–60) Moderate; 
  Orange (61–120) High; e 
  Red (>120) Critical

#### General Summary

- Negative impacts predominate in the Pre-Construction and Construction phases, mainly on water and land resources, but they are temporary and mitigable.
- Positive impacts prevail in the post-construction phase, with emphasis on socioeconomic benefits and improved regional connectivity.

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- No identified impact presents critical significance ( $ISI > 120$ ), without environmental impediment to the execution of the project, provided that the recommended mitigation and monitoring measures are implemented.

## 7 PROPOSAL FOR MITIGATION AND/OR ENHANCEMENT MEASURES

Mitigation measures will be taken to minimize the expected environmental and social impacts of the reconstruction activities on the bridge over the Natete River in the Ribaué district. Before the start of construction, the affected people and properties will be compensated by the Government (project owner – ANE). During the construction phase, on the other hand, mitigation measures will be taken by the contractors under the supervision of the Project Management Unit (PMU) from ANE.

Table 7.1 presents the mitigation and/or enhancement measures for the environmental and social impacts of the project identified and responsible for implementation.

Table 7.1 - Mitigation and Enhancement Measures by Project Phase.

| Item                                         | Impacts                                                                                                                                                                                | Mitigation and/or Enhancement Measures                                                                                                                                                                  | Responsible Organization     |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| <b>Pre-Construction phase</b>                |                                                                                                                                                                                        |                                                                                                                                                                                                         |                              |
| <b>Air pollution</b>                         | Temporary alteration of air quality due to point source emissions of dust and exhaust gases (CO, NO <sub>x</sub> and particulate matter)                                               | Dust control through water spraying and preventive maintenance of machinery to ensure it is operating within manufacturer standards                                                                     | Contractor                   |
| <b>Water quality</b>                         | Risk of widespread contamination of water resources by fuels and lubricants and slight disruption of surface runoff                                                                    | Delineating intervention zones, avoiding excessive removal of riparian vegetation, installing drainage ditches, and controlling rainwater runoff                                                        | Contractor                   |
| <b>Waste generation</b>                      | Proliferation of vectors and widespread contamination of soil and surface water                                                                                                        | Waste segregation at the source, temporary storage in delimited and waterproofed areas, routing of hazardous waste to licensed operators, and reuse or composting of plant waste                        | Contractor                   |
| <b>Noising and Vibration</b>                 | Temporary inconvenience and discomfort to the local population                                                                                                                         | Proper planning of activities, restriction of operating hours, and preventive maintenance of equipment                                                                                                  | Contractor                   |
| <b>Biodiversity (fauna e flora)</b>          | Localized loss of vegetation cover, temporary reduction of micro-habitants, and disturbance to wildlife                                                                                | Delineation of the intervention area, minimization of deforestation, prohibition of hunting and killing of fauna, and vegetation rehabilitation of the affected areas after the completion of the works | Contractor                   |
| <b>Topography and geology</b>                | Limited changes in landscape configuration and minor alterations in microtopography and localized soil exposure make it more susceptible to erosion during rainy periods               | Delineating the intervention area, minimizing soil movement, maintaining vegetation cover outside the construction zone, and properly planning activities according to weather conditions               | Contractor                   |
| <b>Population Vulnerability / low income</b> | Social anxieties and uncertainties related to the possibility of losing land, access to resources, or involuntary displacement, causing worry and insecurity among low-income families | Clear dissemination of project information, inclusive community consultation, and prioritization of local labor in subsequent phases                                                                    | Contractor SPDI<br>LC<br>ANE |

| Item                                             | Impacts                                                                                                                                                                                    | Mitigation and/or Enhancement Measures                                                                                                                                                                | Responsible Organization        |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Local communities and ethnic groups</b>       | Expectations, uncertainties, and concerns regarding the potential loss of land, access to natural resources, and possible displacement, especially among more culturally vulnerable groups | Inclusive community consultations, clear dissemination of project information, and ensuring the active participation of community and traditional leaders in the decision-making process              | Contractor SPDI<br>LC<br>ANE    |
| <b>Local Economy and Livelihoods</b>             | Risk of minor disruptions to local agricultural activities, especially in areas near the construction site or access areas                                                                 | Proper coordination with community leaders, fair compensation for any affected individuals, and prioritization of hiring local labor                                                                  | Contractor<br>SPDI<br>LC<br>ANE |
| <b>Local social institutions</b>                 | There is both anticipation and concern among community leaders, especially regarding the definition of intervention areas and potential resettlement                                       | Transparent communication, advance information sharing, and direct involvement of traditional leaders and local authorities in the project preparation process                                        | Contractor SPDI<br>LC<br>ANE    |
| <b>Local Conflicts and Interests</b>             | Disagreements between communities or local leaders regarding the location of infrastructure, the delimitation of affected areas, and expectations about future compensation and benefits   | Transparent public consultations, equitable stakeholder participation, and community communication and mediation mechanisms to ensure consensus and avoid anticipated tensions                        | Contractor SPDI<br>LC<br>ANE    |
| <b>Gender</b>                                    | Differences in the perception and participation of men and women in public consultations and planning processes, due to unequal access to information and decision-making                  | Gender inclusion strategies, such as separate and accessible consultations for women, the use of clear and inclusive language, and ensuring equitable participation in all stages of project planning | Contractor<br>SPDI<br>LC<br>ANE |
| <b>Infectious Diseases (HIV/AIDS and others)</b> | Introduction of small risks of transmission of infectious diseases and respiratory infections                                                                                              | Preventive awareness campaigns, coordination with local health authorities, and integration of health and safety measures on-site                                                                     | Contractor                      |
| <b>Occupational</b>                              | Low risk of workplace accidents related to                                                                                                                                                 | Adoption of basic safety standards, mandatory use of                                                                                                                                                  | Contractor                      |

| Item                              | Impacts                                                                                                                                                                                                                               | Mitigation and/or Enhancement Measures                                                                                                                                                                            | Responsible Organization |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Health and Safety</b>          | handling tools, handling materials, and operating heavy machinery                                                                                                                                                                     | Personal Protective Equipment (PPE), initial training in occupational safety, and delimitation of risk areas on the construction site                                                                             |                          |
| <b>Climate changes</b>            | Point-source greenhouse gas emissions associated with the mobilization of machinery, transportation of materials, and initial deforestation                                                                                           | Efficient planning for equipment mobilization, reduction of unnecessary travel, preventive maintenance of vehicles and machinery, and minimization of vegetation removal, preserving natural carbon sequestration | Contractor               |
| <b>Road Accidents and Hazards</b> | Risks of minor accidents associated with the movement of heavy vehicles on local roads and the presence of pedestrians near the yard                                                                                                  | Adequate temporary signage, transportation route planning, speed limits, driver training, and prior communication with affected communities regarding mobilization activities                                     | Contractor               |
| <b>Construction phase</b>         |                                                                                                                                                                                                                                       |                                                                                                                                                                                                                   |                          |
| <b>Air pollution</b>              | Degradation of air quality due to dust and exhaust fumes can cause discomfort to neighboring communities, especially during periods of strong winds and low humidity                                                                  | Dust control through water spraying and preventive maintenance of machinery to ensure it is operating within manufacturer standards                                                                               | Contractor               |
| <b>Water quality</b>              | Potential for compromising water quality and aquatic life, and a possible increase in water turbidity due to liquid effluents                                                                                                         | Safe storage of fuels in waterproofed areas, installation of containment trenches, segregation and periodic removal of solid waste, and treatment of effluents before disposal                                    | Contractor               |
| <b>Waste generation</b>           | Risk of soil and water pollution, proliferation of vectors, and visual degradation of the environment, especially on riverbanks and drainage areas, in the case of poor management of inert, non-hazardous, and hazardous solid waste | Segregation at the source, storage in identified and waterproofed containers, reuse of inert materials, and routing of hazardous waste to licensed operators                                                      | Contractor               |
| <b>Noising and Vibration</b>      | Annoyance caused by abnormal noise and vibration to the local population due to the                                                                                                                                                   | Restricting noisy operating hours, regular machinery maintenance, use of natural or artificial sound barriers, and                                                                                                | Contractor               |

| Item                                | Impacts                                                                                                                                                                                                                                                                                                                                            | Mitigation and/or Enhancement Measures                                                                                                                                                                                                                                            | Responsible Organization |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                     | intensive use of heavy machinery and civil engineering activities                                                                                                                                                                                                                                                                                  | periodic monitoring of noise and vibration levels at sensitive points                                                                                                                                                                                                             |                          |
| <b>Biodiversity (fauna e flora)</b> | Localized loss of natural habitats and fragmentation of riparian vegetation areas; temporary displacement of fauna, reduction in reproductive activity and alteration in the behavioral patterns of birds, reptiles and small mammals; temporary turbidity of the water, affecting sensitive aquatic organisms such as fish and macroinvertebrates | Delineation of the intervention area, minimization of deforestation, prohibition of hunting and killing of fauna, and vegetation rehabilitation of the affected areas after the completion of the works                                                                           | Contractor               |
| <b>Topography and geology</b>       | Temporary changes in the natural flow of surface water and increased turbidity and sediment deposition in the river course due to the intensification of work activities, especially those carried out on the banks and in the riverbed                                                                                                            | Strict control of drainage and sediment containment practices. Installation of drainage ditches and sedimentation basins, delimitation of riparian protection areas, safe storage of hazardous substances, and execution of works preferably during periods of drought            | Contractor               |
| <b>Water quality</b>                | Temporary modifications to the local topography and noticeable visual changes in the landscape, especially along the riverbanks and shipyard support areas, and increased susceptibility to erosion                                                                                                                                                | Slope stabilization, drainage control, progressive revegetation of the intervened areas, and limiting soil movement to strictly necessary zones                                                                                                                                   | Contractor               |
| <b>Involuntary Resettlement</b>     | Partial disruption to two, including agricultural areas, in addition to alterations in local social and economic routines. There may also be occasional traffic interruptions in areas near construction sites and other restricted access areas such as aggregate                                                                                 | Proper implementation of the ARAP and ensures that all compensation and socioeconomic support are duly provided. Monitoring of implementation and ongoing dialogue with communities are fundamental to preventing conflicts and ensuring that the process is fair and transparent | ANE/SDPI                 |

| Item                                                       | Impacts                                                                                                                                                                                                                      | Mitigation and/or Enhancement Measures                                                                                                                                              | Responsible Organization           |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
|                                                            | extraction sites.                                                                                                                                                                                                            |                                                                                                                                                                                     |                                    |
| <b>Vulnerable / Low-Income Population</b>                  | Mobility restrictions and interference with access to basic services, as well as potential social tensions related to labor recruitment and pressure on local resources                                                      | Prioritizing local hiring, community awareness programs, transparent communication, and targeted social support for vulnerable families                                             | Contractor SPDI<br>LC<br>ANE       |
| <b>Local Communities and Ethnic Groups</b>                 | Disruptions to local routines, increased noise and dust, and social tensions associated with hiring labor and pressure on local services and resources. Social benefits, such as job creation and boosting the local economy | Community communication plans, preferential hiring of local labor, and sociocultural awareness among workers and communities                                                        | Contractor SPDI<br>LC<br>ANE       |
| <b>Local economy, including employment and livelihoods</b> | Increased economic activity, such as informal trade, the supply of goods and services, and temporary employment opportunities                                                                                                | Community communication plan, support for affected small producers, and transparent management of local procurement                                                                 | Contractor SPDI<br>LC<br>ANE       |
| <b>Use and Rights Regarding Water</b>                      | Temporary restrictions on access to water for local communities and risks of widespread contamination from accidental spills of fuel, cement, and other materials, especially in nearby riverside areas                      | Installation of containment barriers, secure fuel storage, proper wastewater treatment, and coordination with communities to ensure alternative access to water during construction | Contractor SPDI<br>LC<br>ARA-Norte |
| <b>Infrastructure and Social Services</b>                  | Temporary damage to local secondary roads and increased pressure on health and safety services                                                                                                                               | Traffic management plans, institutional coordination with public service providers, repair of occasional damage, and reinforcement of road safety and signage                       | Contractor SPDI<br>LC              |
| <b>Local Social Institutions</b>                           | Risk of social tensions related to labor hiring, use of local infrastructure, and redistribution of benefits. Local institutions, such as community leaders, management                                                      | Mechanisms for community dialogue, capacity building for local leaders, and inclusive participation in project management                                                           | Contractor SPDI<br>LC              |

| Item                               | Impacts                                                                                                                                                                                                                                                                                                                                                                  | Mitigation and/or Enhancement Measures                                                                                                                                                                                                 | Responsible Organization        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|                                    | committees, and local associations, may face an overload of responsibilities and challenges in mediating conflicts                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                        |                                 |
| <b>Local Social Institutions</b>   | The creation of temporary benefits, such as employment and the revitalization of local commerce, still carries risks of imbalances in the distribution of these benefits, with specific groups being more favored (e.g., contract workers). The lack of fair criteria for compensation and workforce selection can generate social tensions and perceptions of injustice | Establishing transparent social management plans, equitable hiring and compensation criteria, and participatory community monitoring                                                                                                   | Contractor<br>SPDI<br>LC        |
| <b>Local Conflict of Interests</b> | Risk of tensions between local groups, especially regarding the prioritization of jobs, the supply of goods and services to the project, and access to areas near the construction site, as well as potential complaints about heavy traffic, increased noise, and interference with local economic and social activities.                                               | Implementation of formal complaint resolution mechanisms (QRM), ongoing community mediation, regular meetings with local leaders, and application of fair and transparent criteria for workforce selection and benefit distribution    | Contractor<br>SPDI<br>LC        |
| <b>Gender</b>                      | Risks of harassment, gender-based violence, and sexual exploitation, especially in communities near construction sites, and an increased burden of domestic responsibilities for women due to the temporary absence of men involved in the construction work                                                                                                             | Clear policies for preventing and responding to gender-based violence (GBV), community awareness campaigns, training of work teams in ethical conduct, and promotion of employment opportunities for women, ensuring equity and safety | Contractor<br>SPDI<br>LC<br>ANE |

| Item                                             | Impacts                                                                                                                                                                                                                                                                                                         | Mitigation and/or Enhancement Measures                                                                                                                                                                                                                                 | Responsible Organization                        |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <b>Diseases (HIV/AIDS and others)</b>            | Increased risk of transmission of sexually transmitted diseases (including HIV/AIDS), malaria, respiratory infections and waterborne diseases, especially in vulnerable communities                                                                                                                             | Establishment of HIV/AIDS and other STI prevention programs, regular health and vaccination campaigns, agreements with local health units, training of health and safety workers, and partnerships with the public health sector for epidemiological surveillance      | Contractor<br>SPDI<br>LC                        |
| <b>Occupational Health and Safety</b>            | Risks of workplace accidents, injuries, falls, and exposure to dust, noise, and vibrations, as well as physical fatigue and work-related stress                                                                                                                                                                 | Strict implementation of an Occupational Health and Safety Plan (HSE Plan), regular safety inspections, preventive equipment maintenance, ongoing worker training, installation of hazard signage, and provision of first aid kits and on-site emergency medical staff | Contractor SPDI<br>LC<br>ANE<br>Police<br>MISAU |
| <b>Common Use of Water and Natural Resources</b> | Possible temporary restrictions on access to water and widespread contamination from accidental spills of fuels, oils, and other chemicals, affecting the domestic and productive use of water and natural resources                                                                                            | Installation of containment and drainage barriers, safe storage of hazardous products, prohibition of dumping into the river, sediment control, and water quality monitoring                                                                                           | Contractor<br>SPDI<br>LC<br>ARA-Norte           |
| <b>Climate Change / Global Warming</b>           | Increased direct emissions of CO <sub>2</sub> and other gases resulting from the burning of fossil fuels by heavy machinery, material transport, and concrete and asphalt production; and indirect emissions associated with deforestation and soil compaction, temporarily reducing carbon absorption capacity | Adoption of efficient and low-energy equipment, rational use of fuels, proper environmental management of the construction site, control of dust and emissions, and compensatory reforestation of deforested areas                                                     | Contractor                                      |
| <b>Road Accidents and Hazards</b>                | The risk of traffic accidents, pedestrian collisions, and other incidents is related to a lack of signage, congestion, reduced                                                                                                                                                                                  | Implementation of a Road Safety Plan, installation of visible signage and physical barriers, strict speed control, road safety training, regular inspection of vehicles and                                                                                            | Contractor<br>SPDI<br>LC                        |

| Item                                       | Impacts                                                                                                                                                                                                                      | Mitigation and/or Enhancement Measures                                                                                                                                                                                                                                                                                                                  | Responsible Organization   |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|                                            | visibility, and operator fatigue. The presence of external workers and heavy traffic in neighboring communities increases the likelihood of incidents, affecting both workers and local residents.                           | equipment, and awareness campaigns with local communities                                                                                                                                                                                                                                                                                               | ANE<br>Police<br>MISAU     |
| <b>Post-Construction phase</b>             |                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                         |                            |
| <b>Air pollution</b>                       | Changes in air quality associated with the point generation of dust and residual gas emissions from the movement of vehicles and machinery                                                                                   | Dust control through water spraying and preventive maintenance of machinery to ensure it is functioning according to the manufacturers' specifications.                                                                                                                                                                                                 | Contractor                 |
| <b>Waste generation</b>                    | Risk of point source soil and water contamination due to poor management of final construction site cleanup waste (inert, non-hazardous, and hazardous waste) and removal of temporary structures from the construction site | Implementation of the environmental management measures foreseen in the PGR (Environmental Management Plan), such as selective collection, transport by licensed operators and rehabilitation of the affected areas, thus guaranteeing the elimination of the remaining sources of pollution and the environmental restoration of the intervention zone | Contractor                 |
| <b>Noising and vibration</b>               | Annoyance caused by noise generated by occasional operations such as dismantling construction sites, transporting equipment, and final cleaning of the area                                                                  | Proper planning of final activities, adherence to operating schedules, and complete rehabilitation of the shipyard and aggregate extraction area                                                                                                                                                                                                        | Contractor                 |
| <b>Local communities and ethnic groups</b> | Improved mobility, territorial integration, access to basic services, transportation of agricultural products, and strengthening of commercial and social relations among riverside communities                              | Enhancement through local development programs.                                                                                                                                                                                                                                                                                                         | District government<br>ANE |
| <b>Local economy,</b>                      | Improved access to markets, schools,                                                                                                                                                                                         | Enhancement through local development programs.                                                                                                                                                                                                                                                                                                         | District                   |

| Item                                             | Impacts                                                                                                                                              | Mitigation and/or Enhancement Measures                                                                                             | Responsible Organization   |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>including employment and livelihoods.</b>     | health facilities, and shopping centers, strengthening the flow of agricultural production and encouraging the growth of local economic activities   |                                                                                                                                    | government                 |
| <b>Use and Rights Regarding Water</b>            | The bridge will facilitate access for communities to the riverbanks, promoting better circulation and sustainable use of water resources             | Enhancement through local development programs.                                                                                    | District government<br>ANE |
| <b>Infrastructure and Social Services</b>        | Improved connectivity between communities, reduced travel time, and easier access to schools, health centers, markets, and public services           | Enhancement through local development programs.                                                                                    | District government<br>ANE |
| <b>Local Social Institutions</b>                 | Improved connectivity between communities, reduced travel time, and easier access to schools, health centers, markets, and public services           | Enhancement through local development programs.                                                                                    | District government<br>ANE |
| <b>Distribution of Benefits and/or Losses</b>    | Improving mobility, accessibility, and regional integration promotes equitable access to markets, services, and development opportunities            | Enhancement through local development programs.                                                                                    | District government<br>ANE |
| <b>Occupational Health and Safety</b>            | Low risk of accidents and improved working conditions due to the stabilization of operations (controllable occupational risks)                       | Final safety inspections, training of closing teams, and verification of compliance with occupational health and hygiene standards | District Govern<br>ANE     |
| <b>Common Use of Water and Natural Resources</b> | Improving access and mobility for riverside communities, facilitating the sustainable management of natural resources and the equitable use of water | Enhancement through local development programs.                                                                                    | District government<br>ANE |

| Item                              | Impacts                                                                                                                           | Mitigation and/or Enhancement Measures        | Responsible Organization          |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------|
| <b>Road Accidents and Hazards</b> | Improved traffic flow and road safety, more efficient traffic management, shorter travel times, and reduced vehicle wear and tear | Maintain signage and road safety inspections. | District government<br>PRM<br>ANE |

## **8 PUBLIC CONSULTATION PROCESS**

### **8.1 Introduction**

The public consultation process is a fundamental step in the EIA process, being mandatory for activities in categories A+, A, and B, in accordance with national legislation and international guidelines, including JIC standards, thus allowing the community, local authorities, and other stakeholders to actively participate in identifying and mitigating project impacts.

In the context of the bridge reconstruction project over the Natete River, in the Ribaué district, the public consultation was conducted to promote transparency, inform about the project activities, and create communication channels between the population and the technical team, ensuring that the community's concerns and expectations are considered in the planning and implementation of the proposed project.

### **8.2 Objective of the Public Consultation and Dissemination Meeting**

The main objective of the public consultation, as well as the information meetings, is to inform the community about the project phases, its activities, and the identified environmental and social impacts; to collect perceptions, concerns, and suggestions from the population, authorities, and other stakeholders; to ensure transparency in the decision-making process; to identify mitigation measures and opportunities for benefit that can be integrated into the project; and to ensure compliance with national legislation and international guidelines, including JICA standards.

### **8.3 Approach and Methodology**

The approach adopted combined participatory and qualitative methods, seeking to effectively engage all relevant stakeholders. Community leaders, local authorities, representatives of civil society organizations, farmers, traders, and river users were identified and mapped. Prior dissemination of project information was carried out through posters, announcements on local radio stations, direct invitations, and preparatory meetings, ensuring that all participants were aware of the project and the consultation agenda.

The meetings were structured to present the project in detail, explain the identified impacts, present proposed mitigation measures, and the feedback channels available. All contributions received during the meetings, including questions, comments, and suggestions, were systematically recorded for integration into the Final Public Consultation Report and this SES. Participants received feedback on how their contributions were considered in the project decisions.

#### 8.4 Public Consultation Meetings (PCMs)

Two Public Consultation meetings were held near the bridge in the community of Nathete, Matharya Locality, covering the entire AIP of the project (direct and indirect).

The first meeting included a presentation of the project, as well as the Terms of Reference that guided the preparation of this SES, while the second public consultation meeting was held to present the preliminary results of the study, as well as the main activities of the project, discussion of the environmental and social impacts of the respective mitigation measures and opportunities for benefits to the community.

During the consultations, question and answer sessions were opened so that all participants could express their opinions and concerns, and systematic recording of contributions, which were incorporated into the final reports (Terms of Reference and SES). This process ensured that the community had effective participation, allowing the project to be aligned with local needs and reducing possible negative impacts.

The results of the second Public Consultation meeting are presented in a separate report, designated Volume II.

## 9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) AND MONITORING INDICATORS

### 9.1 Introduction

This ESMP is an integral part of the SES, and its main objective is to organize and systematize all environmental mitigation, prevention, and compensation measures identified throughout the SES, ensuring that negative impacts are minimized and project benefits are maximized. This plan defines responsibilities, schedules, necessary resources, and implementation procedures during the pre-construction, construction, and post-construction phases.

The ESMP incorporates a set of environmental and social management instruments, including environmental and social plans and monitoring indicators, allowing for continuous evaluation of the effectiveness of the measures adopted, monitoring of legal and regulatory compliance, and timely corrective decision-making.

### 9.2 Environmental and Social Monitoring Plans (ESMP)

The ESMP aims to monitor the implementation of mitigation, prevention, and compensation measures defined in the SES, ensuring the minimization of negative impacts and the maximization of the socioeconomic benefits of the project. The ESMP also aims to ensure legal compliance, promote continuous improvement, and provide information for corrective decision-making.

The ESMP will be applied in all phases of the project, i.e., pre-construction, construction, and post-construction, and is organized into thematic environmental and social plans, each encompassing objectives, monitoring parameters, frequency, measurement methods, target/limit, means of verification, management measures, and responsibilities.

Table 9.1 shows the environmental and social monitoring plans that aim to track the most significant environmental and social impacts to ensure that negative effects are prevented, reduced, or compensated for, and that the planned mitigation measures are effectively applied. Annex C presents the routine environmental and social inspection Form.

Table 9.1 - Project Environmental and Social Monitoring Plans.

**1. Monitoring of Physical Resources**

| Objective                                                                                                                    | Monitoring parameters                                                                                                 | Duration & Frequency                                                                                                                                  | Applicable Standards                                             | Responsible                                                  |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------|
| <b>1.1. Air quality</b>                                                                                                      |                                                                                                                       |                                                                                                                                                       |                                                                  |                                                              |
| <b>To verify compliance with air quality standards and the effectiveness of dust suppression measures</b>                    | Particulate Matter (PM <sub>10</sub> , PM <sub>2.5</sub> ), Nitrogen Dioxide (NO <sub>2</sub> ), Carbon Monoxide (CO) | <b>Phase C:</b> 6 months, quarterly. Focus on sensitive areas (nearby communities)                                                                    | WHO/WHO Standards; National Legislation on Emissions             | Contractor (with subcontracting to an accredited laboratory) |
| <b>1.2. Water quality</b>                                                                                                    |                                                                                                                       |                                                                                                                                                       |                                                                  |                                                              |
| <b>Monitor turbidity and potential contamination in the Natete River, upstream, downstream, and at the construction site</b> | Turbidity (NTU), pH, Dissolved Oxygen, Oils and Fats, Heavy Metals                                                    | <b>Phase C:</b> Throughout the entire construction process, monthly and after heavy rains. <b>Post-Phase C:</b> 1 year, quarterly (to check recovery) | Water Framework Directive; National Legislation on Water Quality | Contractor (with subcontracting to an accredited laboratory) |
| <b>1.3. Waste generation</b>                                                                                                 |                                                                                                                       |                                                                                                                                                       |                                                                  |                                                              |
| <b>To ensure the proper management, segregation, and final disposal of waste, especially hazardous waste</b>                 | Quantity (m <sup>3</sup> ) and type of waste generated (inert, hazardous, domestic); Proper disposal fee              | <b>Phases P-C, C and Post-C:</b> Throughout the intervention, monthly.                                                                                | Basel Convention; National Waste Management Legislation          | Contractor                                                   |

**2. Monitoring of the Natural Environment**

| Objective                                                                                       | Monitoring parameters                                                                           | Duration & Frequency                                                   | Applicable Standards                                      | Responsible                                  |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------|
| <b>2.1. Biodiversity (Fauna and Flora)</b>                                                      |                                                                                                 |                                                                        |                                                           |                                              |
| <b>To assess the recovery of riparian vegetation and the return of wildlife after the works</b> | Vegetation cover in borrow/rehabilitation areas; Sighting of key fauna species (birds, mammals) | <b>Post-C Phase:</b> 2 years, every six months (rainy and dry seasons) | National Red Lists; Biodiversity Conservation Legislation | Inspection (with the support of a biologist) |
| <b>2.2. Hydrology and Hydraulics</b>                                                            |                                                                                                 |                                                                        |                                                           |                                              |
| <b>To verify the stability of the banks</b>                                                     | Slope and bank stability; Drainage                                                              | <b>Fase Pós-C:</b> 3 years,                                            | Hydraulic Design                                          | Inspection                                   |

|                                                                        |                                       |                               |                                                    |  |
|------------------------------------------------------------------------|---------------------------------------|-------------------------------|----------------------------------------------------|--|
| and the effectiveness of the drainage system of the new infrastructure | system function; Downstream siltation | annually (end of rain season) | Standards; Good Naturalistic Engineering Practices |  |
|------------------------------------------------------------------------|---------------------------------------|-------------------------------|----------------------------------------------------|--|

### 3. Monitoring the Socioeconomic Environment

| Objective                                                                                                   | Monitoring parameter                                                                                                                                                          | Duration & Frequency                                                                           | Applicable Standards                                                                                    | Responsible                                                      |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>3.1. Noising and vibration</b>                                                                           |                                                                                                                                                                               |                                                                                                |                                                                                                         |                                                                  |
| Ensure that noise levels do not exceed legal limits, especially in nearby communities                       | Equivalent (Leq) and peak sound pressure levels (dB(A))                                                                                                                       | <b>Phase C:</b> 6 months, quarterly, and upon request. Points: closest communities             | WHO standards (55 dB day / 45 dB night); National Noise Legislation                                     | Contractor (with subcontracting of an acoustics technician)      |
| <b>3.2. Vulnerable Population and Local Economy</b>                                                         |                                                                                                                                                                               |                                                                                                |                                                                                                         |                                                                  |
| Monitor the distribution of benefits (jobs, contracts) and the occurrence of negative impacts               | Number and type of local jobs created; Number and value of contracts with local companies; Record of complaints related to dust, access, etc.                                 | <b>Phase C:</b> Throughout the entire project, quarterly (through research and record keeping) | Social Safeguard Policies of the Funder (e.g., World Bank); Project Social Management Plan              | Project Social Manager / Oversight                               |
| <b>3.3. Resettlement and Compensation</b>                                                                   |                                                                                                                                                                               |                                                                                                |                                                                                                         |                                                                  |
| Ensure that compensation and resettlement are completed according to the established plan                   | Number of families resettled/compensated; Satisfaction with the process; Completion of payments and delivery of new land/housing                                              | <b>Phases P-C and C:</b> Until the complete conclusion of the process, monthly                 | Funder's Involuntary Resettlement Policy; Resettlement Action Plan                                      | Project Social Manager / Oversight                               |
| <b>3.4. Gender and protection</b>                                                                           |                                                                                                                                                                               |                                                                                                |                                                                                                         |                                                                  |
| To prevent and monitor cases of harassment, sexual exploitation and abuse (SEA/SH) and female work overload | Number of SEA/SH formal complaints registered and resolved; Female participation in training and employment; Indicators of perceived safety (through confidential interviews) | <b>Phase C:</b> Throughout the entire construction process, quarterly                          | Funder's Gender Policy; Contractor's Code of Conduct; Protection Standards                              | Project Social Manager / Gender Focal Point                      |
| <b>3.5. Occupational and public health</b>                                                                  |                                                                                                                                                                               |                                                                                                |                                                                                                         |                                                                  |
| To prevent the increase of infectious diseases and workplace accidents                                      | Number of workplace accidents recorded; Number of malaria/STI cases reported at local clinics; Safety conditions at the construction site                                     | <b>Phase C:</b> Throughout the entire construction process, monthly                            | ILO standards; National Occupational Health and Safety Legislation; Contractor's Health and Safety Plan | Contractor (Occupational Safety); Social Manager (Public Health) |

| <b>3.6. Conflicts and Local Institutions</b>                                     |                                                                                                                                                      |                                                                     |                                            |                                    |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------|------------------------------------|
| <b>To proactively identify and manage social tensions related to the project</b> | Number and type of conflicts recorded (e.g., over access to employment, land);<br>Level of participation of local institutions in follow-up meetings | <b>Phases P-C, C and Post-C:</b> Throughout the project, quarterly  | Project Complaint and Grievance Mechanisms | Project Social Manager / Oversight |
| <b>3.7. Road Accidents</b>                                                       |                                                                                                                                                      |                                                                     |                                            |                                    |
| <b>To minimize and record accidents related to construction site traffic</b>     | Number and severity of traffic accidents recorded on access roads to the construction site                                                           | <b>Phase C:</b> Throughout the entire construction process, monthly |                                            |                                    |

### 9.3 Monitoring Indicators

The main purpose of monitoring indicators is to provide clear and measurable parameters to track the implementation of the ESMP and assess its effectiveness.

The indicators also allow for the evaluation of the effectiveness of mitigation measures applied to reduce environmental and social impacts, the detection of deviations or non-conformities in relation to legal standards, regulations, and environmental commitments undertaken by the project, and the provision of information for timely corrective decision-making, preventing significant impacts.

Additionally, the indicators monitor the evolution of critical environmental parameters, such as water quality, soil, fauna, flora, noise, and traffic, ensuring transparency and accountability to regulatory authorities, funders, and the local community. Finally, they contribute to learning and continuous improvement, allowing adjustments to environmental management practices throughout the project's life cycle.

Whenever the monitored indicators exceed the established limits, it becomes necessary to immediately implement corrective or mitigating measures to minimize adverse impacts. Finally, communication plays a central role, and monitoring results should be regularly disseminated to stakeholders, including local authorities and affected communities, promoting transparency and trust in the environmental management process.

Table 9.2 presents environmental monitoring, including air, water, noise, and vibration pollution, with specific indicators, standard values, and permitted ranges, based on WHO references, Mozambican standards, and international best practices. Table 9.3 presents a summary of Monitoring Indicators by project phase.

Table 9.2 -Environmental Monitoring – Indicators, Values and Frequency (air, water, noise, and vibration pollution)

| Component                            | Indicator                    | Unit                 | Standard value / recommended limit                                                           | Monitoring frequency          | Remarks                                             |
|--------------------------------------|------------------------------|----------------------|----------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------|
| <b>Ambient air</b>                   | Dust (TSP/PM <sub>10</sub> ) | µg/m <sup>3</sup>    | PM <sub>10</sub> : 50 µg/m <sup>3</sup> (24-hour), 20 µg/m <sup>3</sup> (annual average) WHO | Monthly                       | Assess dust deposition near sensitive areas         |
|                                      | NO <sub>2</sub>              | µg/m <sup>3</sup>    | 25 µg/m <sup>3</sup> (24-hour), 10 µg/m <sup>3</sup> (annual) WHO                            | Monthly                       | Related to emissions from machinery and transport   |
|                                      | SO <sub>2</sub>              | µg/m <sup>3</sup>    | 40 µg/m <sup>3</sup> (24-hour) WHO                                                           | Monthly                       | Control diesel fuel combustion                      |
|                                      | CO                           | mg/m <sup>3</sup>    | 4 mg/m <sup>3</sup> (24-hour) WHO                                                            | Monthly                       | Monitor near generators and traffic areas           |
| <b>Surface and abstraction water</b> | Turbidity                    | NTU                  | ≤ 5 NTU (WHO, drinking water)                                                                | Monthly                       | Assess impacts from excavation and erosion          |
|                                      | pH                           | –                    | 6.5 – 8.5 (WHO / MAAP)                                                                       | Monthly                       | Chemical neutrality                                 |
|                                      | Total Suspended Solids (TSS) | mg/L                 | ≤ 50 mg/L (discharge into water bodies)                                                      | Monthly                       | Prevent siltation                                   |
|                                      | BOD <sub>5</sub>             | mg O <sub>2</sub> /L | ≤ 5 mg/L (freshwater guideline)                                                              | Monthly                       | Assess organic load                                 |
|                                      | COD                          | mg O <sub>2</sub> /L | ≤ 20 mg/L (discharge into water bodies)                                                      | Monthly                       | Complementary organic matter analysis               |
| <b>Noise</b>                         | Continuous sound level       | dB(A)                | ≤ 55 dB(A) residential areas, ≤ 70 dB(A) construction zones (daytime)                        | Monthly / weekly during works | Use calibrated sound level meter; record peak hours |
|                                      | Maximum sound level          | dB(A)                | ≤ 70 dB(A)                                                                                   | Monthly / weekly              | Assess peaks from heavy machinery                   |
| <b>Vibration</b>                     | Peak Particle Velocity (PPV) | mm/s                 | ≤ 5 mm/s (residential buildings, ISO 4866)                                                   | Monthly                       | Assess risk of damage to nearby structures          |

Table 9.3 - Summary of Environmental and Social Monitoring Indicators by project Phase

| Project Phase           | Environmental compounds / Social | Monitoring indicator                                                                        | Frequency / Measurement Method                                  | Responsible                                      |
|-------------------------|----------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------|
| <b>Pre-Construction</b> | Soil and vegetation              | Defined intervention area, preserved vegetation cover                                       | Visual inspection, GPS, photos                                  | Environmental supervisor                         |
|                         | Agricultural land                | Number of properties affected, and compensation agreements signed                           | Administrative records, site visits                             | Environmental Engineer / Community Liaison       |
|                         | Social services                  | Health and water capacity and infrastructure assessed                                       | Technical survey and official reports                           | Project Coordinator / Local Authority            |
|                         | Communication and expectations   | Number of meetings with the community, training sessions held                               | Meeting and attendance reports                                  | Social Communication Manager                     |
| <b>Construction</b>     | Soil and erosion                 | Incidence of erosion, silting of ditches and waterways                                      | Visual inspection, sediment measurements                        | Environmental supervisor                         |
|                         | Water                            | Turbidity, pH, suspended solids, oils and greases                                           | Weekly laboratory samplings                                     | Environmental Monitoring Technician / Supervisor |
|                         | Fauna e flora                    | Restored areas, observed fauna, number of species affected                                  | Periodic inventories and direct observation                     | Biologist / Environmental supervisor             |
|                         | Safety and traffic               | Number of road and workplace accidents, compliance with PPE (Personal Protective Equipment) | Daily reports and incident logs                                 | Safety Engineer / Environmental Supervisor       |
|                         | Local work and employment        | Number of local workers hired, training provided                                            | Administrative registration and attendance at training sessions | RH / Social Supervisor                           |
| <b>Pós-Construction</b> | Soil and vegetation              | Number of local workers hired, training provided                                            | Visual inspection and comparative photographs                   | Environmental Supervisor                         |
|                         | Water and environmental quality  | Turbidity, pH, slope stability                                                              | Monthly/laboratory monitoring                                   | Monitoring Technician                            |
|                         | Local commerce and employment    | Number of post-construction opportunities seized locally                                    | Socioeconomics reports                                          | Social Engineer / Community Coordinator          |
|                         | Traffic and road safety          | Accident occurrences, safe traffic flow on the bridge and access points                     | Accident and inspection reports                                 | Local Authority / Security Supervisor            |

## 9.4 Communication and Community Engagement Plan (PCEC)

### 9.4.1 Objective

The main objective of this PCEC is to ensure transparent, continuous, and participatory communication between the National Roads Administration (ANE), the contractor, environmental and social oversight, local authorities, and potentially affected communities, ensuring that all stakeholders are properly informed and involved throughout the entire project implementation cycle. The plan is guided by the principles of transparency, inclusive participation, respect for cultural differences, accessibility to information, continuous dialogue, and co-responsibility among those involved.

Specifically, the Plan aims to ensure that relevant project information is made available in a clear, accessible, and timely manner, facilitate the identification and resolution of concerns and complaints related to the project, strengthen social acceptance of the work, and reduce social and environmental risks, ensuring compliance with national and international standards, including JICA policies.

### 9.4.2 Interested Parts (Stakeholders)

Stakeholders include various actors directly and/or indirectly affected. Table 9.3 presents the category of the different actors and the engagement strategy.

Table 9.4 – Stakeholders.

| Category                              | Stakeholder types                                                             | Engagement Strategy                                                                      |
|---------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>Local community</b>                | Residents living near the river, community leaders, neighborhood associations | Community meetings, workshops, information leaflets, communication boards                |
| <b>Government authority</b>           | District administration, environmental agencies, water and health services    | Formal consultation sessions, periodic reports, participation in monitoring committees   |
| <b>Project workers</b>                | Operators, engineers, subcontractors                                          | Training in safety, health and environmental best practices, periodic awareness meetings |
| <b>ONG sand support organization</b>  | Environmental and social NGOs operating in the region                         | Coordination meetings, report sharing, and impact monitoring                             |
| <b>Funders and technical partners</b> | JICA, BM (if applicable)                                                      | Technical reports, audits, follow-up meetings                                            |

### 9.4.3 Communication Strategies

The communication strategies to be adopted in the context of this Plan include proactively disseminating information about schedules, impacts, and mitigation measures, creating formal channels for registering and monitoring MRQs with a response protocol within 7 business days, and holding periodic face-to-face

meetings with local communities to discuss project activities, impacts, and employment opportunities.

Furthermore, the strategy will include the distribution of printed and digital informational materials, as well as education and awareness activities on safety, health, environmental protection, and social conduct for both workers and the community.

#### 9.4.4 Communication Tools and Channels

Communication channels include monthly community meetings, permanent bulletin boards and posters, a telephone hotline or WhatsApp for registering complaints, quarterly workshops and training sessions, and semi-annual reports to the funder and authorities.

Table 9.5 - Communication Tools and Channels.

| Tool / Chanel                         | Objective                                      | Frequency             | Responsible                                |
|---------------------------------------|------------------------------------------------|-----------------------|--------------------------------------------|
| <b>Community meetings</b>             | Inform, listen to concerns.                    | Monthly or as needed. | Social Supervisor / Environmental Engineer |
| <b>Informative murals and posters</b> | Disclosure of impacts and timelines            | Permanent             | Project Communication Team                 |
| <b>Phone line / WhatsApp</b>          | Complaint registration and quick feedback      | Continuous            | MRQ Team                                   |
| <b>Workshops and training</b>         | Training on health, safety and the environment | Quarter               | Technical and Environmental Team           |
| <b>Reports and bulletin</b>           | Accountability to funders and authorities      | Semiannual            | ANE                                        |

#### 9.4.5 Engagement Procedures

The **PCEC** includes clear engagement procedures, such as the identification and continuous mapping of stakeholders, formal recording of meetings with agendas and decisions, follow-up on complaints received via MRQ with priority classification and documented response, as well as periodic monitoring and evaluation of the effectiveness of engagement actions, allowing adjustments when necessary.

#### 9.4.6 PCEC Indicators of Monitoring

Table 9-5 contains the indicators, targets, and frequency, as well as the respective means of verification.

Table 9.5 - PCEC Indicators and Monitoring

| Indicator                                           | Target / Limit                                         | Frequency    | Method of Verification       |
|-----------------------------------------------------|--------------------------------------------------------|--------------|------------------------------|
| <b>Number of meetings held</b>                      | ≥1 monthly meeting with each affected community.       | Monthly      | Minutes and attendance lists |
| <b>Number of complaints registered and resolved</b> | 100% complaints were answered within 7 business days   | Monthly      | MRQ Reports                  |
| <b>Community participation (%)</b>                  | ≥70% of the participation of local representatives     | Semiannual   | Meeting records              |
| <b>Informational materials distributed</b>          | 100% of the areas of influence                         | Continuation | Distribution reports         |
| <b>Community satisfaction</b>                       | ≥80% Stakeholders report understanding of the project. | Annual       | Survey and interviews        |

#### 9.4.7 Responsibility

The implementation of the PCEC will be a shared responsibility between ANE, the contractor, the environmental and social oversight bodies, and the local authorities of the Ribáuè district. ANE, through its environmental and social focal point, will assume overall coordination and supervision of the plan's implementation, ensuring coordination among the stakeholders.

The contractor will designate a Communication and Community Engagement Officer, responsible for carrying out activities, recording interactions, and supporting complaint management. The environmental and social oversight bodies will independently monitor the process, verify the conformity of the implemented actions and report periodically to the Provincial Environmental Service (SPA) of Nampula. The local authorities, in turn, will play an essential role as a bridge between the project and the communities, facilitating dialogue and the dissemination of information.

### 9.5 Grievance Redress Mechanism (GRM)

Complaint Management Systems constitute an essential instrument for dialogue between the project and stakeholders, allowing for the rapid and transparent identification, recording, analysis, and resolution of any concerns, complaints, or conflicts that may arise during the different phases of the proposed project's implementation.

The main objective of this mechanism is to ensure that affected communities, workers, and other stakeholders have an accessible and reliable channel to express their concerns related to environmental, social, health, and safety impacts, or the overall performance of the project.

The complaint management system will operate through various communication channels, such as suggestion boxes, physical forms available in public locations (local administration, project headquarters, community centers), dedicated telephone lines, email addresses, and direct contact with designated project representatives.

All complaints and grievances received will be recorded in a dedicated book or database, indicating the date, identification (when provided), nature of the complaint, and status of its handling. The resolution process will follow clear steps, including:

- Receipt and registration of the complaint;
- Preliminary analysis and verification of its nature;
- Investigation and proposal of a response or solution;
- Communication of the decision to the complainant;
- Monitoring and closure of the case.

The following table presents an institutional arrangement for the Complaints Resolution Mechanism (GRM), explicitly defining the roles and responsibilities at each stage.

Table 9.6 - Institutional Responsibilities by Step

| GRM Step                                         | Responsible Entity                                                                                                | Key Responsibilities                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Receipt and Registration of Complaints</b> | <b>Community Liaison Officer (CLO) / Social Safeguards Officer (SSO)</b><br>under the PIU                         | <ul style="list-style-type: none"><li>• Receive complaints orally or in writing at community, site, or PIU level;</li><li>• Assist illiterate complainants;</li><li>• Register all complaints in the GRM logbook/database; and</li><li>• Issue an acknowledgement of receipt to the complainant within the agreed timeframe.</li></ul>                          |
| <b>2. Preliminary Analysis and Verification</b>  | <b>Environmental and Social Safeguards Team (PIU)</b> in coordination with<br><b>Contractor's E&amp;S Officer</b> | <ul style="list-style-type: none"><li>• Review the nature, category, and admissibility of the complaint;</li><li>• Verify facts through site visits, document review, and consultations;</li><li>• Determine whether the grievance is environmental, social, labor-related, land-related, or safety-related;</li><li>• Propose the level at which the</li></ul> |

| GRM Step                                                    | Responsible Entity                                                                                                           | Key Responsibilities                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                             |                                                                                                                              | grievance should be resolved (site, community, or higher level).                                                                                                                                                                                                                                                                               |
| <b>3. Investigation and Proposal of Response / Solution</b> | <b>Grievance Redress Committee (GRC)</b><br>comprising PIU, District Government, Community Representative(s), and Contractor | <ul style="list-style-type: none"> <li>• Conduct detailed investigation, where required;</li> <li>• Consult affected persons and relevant stakeholders;</li> <li>• Identify corrective or remedial actions consistent with national law and JICA safeguards;</li> <li>• Agree on a proposed resolution and implementation timeline.</li> </ul> |
| <b>4. Communication of Decision</b>                         | <b>PIU Social Safeguards Officer / CLO</b>                                                                                   | <ul style="list-style-type: none"> <li>• Communicate the proposed resolution clearly to the complainant, in the local language;</li> <li>• Record acceptance or rejection of the proposed solution;</li> <li>• Ensure transparency and confidentiality where required (e.g., gender-based or sensitive complaints).</li> </ul>                 |
| <b>5. Implementation of Corrective Measures</b>             | <b>Contractor</b> (for site-related issues) under supervision of <b>PIU E&amp;S Team</b>                                     | <ul style="list-style-type: none"> <li>• Implement agreed corrective actions (e.g., repair, compensation, mitigation measures);</li> <li>• Provide evidence of implementation;</li> <li>• Comply with ESMP and contractual obligations.</li> </ul>                                                                                             |
| <b>6. Monitoring and Follow-up</b>                          | <b>PIU Environmental and Social Safeguards Team</b> with oversight from <b>ANE Supervision Mission</b>                       | <ul style="list-style-type: none"> <li>• Monitor effectiveness of corrective actions;</li> <li>• Verify complainant satisfaction;</li> <li>• Update the grievance register with monitoring results; • Identify systemic issues and recommend preventive measures.</li> </ul>                                                                   |
| <b>7. Case Closure</b>                                      | <b>PIU Safeguards Coordinator</b>                                                                                            | <ul style="list-style-type: none"> <li>• Formally close the case once resolution is implemented and verified;</li> <li>• Document closure date and</li> </ul>                                                                                                                                                                                  |

| GRM Step                             | Responsible Entity                                                                | Key Responsibilities                                                                                                                                                                                                                |
|--------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      |                                                                                   | outcome;<br><ul style="list-style-type: none"> <li>• Archive records for audit and supervision purposes.</li> </ul>                                                                                                                 |
| <b>8. Escalation (if unresolved)</b> | <b>District Administration →<br/>Provincial Authorities →<br/>Judicial System</b> | <ul style="list-style-type: none"> <li>• Escalate unresolved grievances to higher administrative or legal levels;</li> <li>• Ensure the GRM does not restrict access to formal legal remedies, in line with JICA policy.</li> </ul> |

The GRM will be managed by the PIU through designated Environmental and Social Safeguards Officers, with active involvement of contractors, local authorities, and community representatives. The mechanism ensures clear institutional responsibilities, transparent procedures, timely resolution, monitoring of corrective actions, and unrestricted access to judicial remedies, in full compliance with JICA Environmental and Social Safeguards.

Furthermore, the GRM's performance will be periodically evaluated based on the number of complaints received, resolved, and pending, to promote continuous improvement in the project's social and environmental management and strengthen trust between the proponent and the communities involved. Table 9.7 presents Key Performance Indicators (KPIs) for GRM Monitoring. Annex D presents the GRM Form.

Table 9.7 - Key Performance Indicators (KPIs) for GRM Monitoring

| Indicator                                                 | Definition / Measurement Method                                | Target (JICA-Aligned) |
|-----------------------------------------------------------|----------------------------------------------------------------|-----------------------|
| <b>Number of grievances received</b>                      | Total complaints recorded in GRM register (by type and source) | Tracked continuously  |
| <b>% of grievances acknowledged within timeline</b>       | (Acknowledged within 3 days ÷ total grievances) × 100          | ≥ 95%                 |
| <b>% of grievances registered correctly</b>               | Complete records with date, category, action, and status       | 100%                  |
| <b>% of grievances resolved within agreed timeframe</b>   | (Resolved within 30 days ÷ total grievances) × 100             | ≥ 85–90%              |
| <b>Average resolution time</b>                            | Mean number of working days from receipt to closure            | ≤ 30 days             |
| <b>% of grievances resolved at community / site level</b> | (Resolved locally ÷ total grievances) × 100                    | ≥ 70%                 |
| <b>% of grievances escalated</b>                          | (Escalated cases ÷ total grievances) × 100                     | ≤ 10–15%              |
| <b>% of complainants satisfied with resolution</b>        | Based on follow-up confirmation or feedback                    | ≥ 80%                 |
| <b>Number of repeat grievances</b>                        | Similar complaints received after closure                      | Decreasing trend      |
| <b>% of corrective actions</b>                            | (Actions implemented ÷ actions                                 | 100%                  |

|                                 |                                       |                                  |
|---------------------------------|---------------------------------------|----------------------------------|
| <b>implemented</b>              | agreed) × 100                         |                                  |
| <b>GRM reporting compliance</b> | Inclusion of GRM data in ESMP reports | <b>100% of quarterly reports</b> |

## 9.6 Waste Management Plan (WMP)

### 9.6.1 Introduction and Objectives

The Waste Management Plan (WMP) defines the guidelines, procedures, and responsibilities for the proper handling and disposal of solid and liquid waste generated during the pre-construction, construction, and post-construction phases of the proposed Natete River Bridge Construction Project, located in the Ribáuè district, Nampula province.

The plan's central objective is to prevent pollution, minimize the environmental and social impacts associated with waste generation, and ensure compliance with national legislation, especially Decree n° 94/2014, which regulates solid waste management, and Decree n° 67/2010, on hazardous waste management, as well as the JICA Guidelines (2022).

Specifically, the WMP aims to ensure the environmentally sound management of generated waste, minimize its production through prevention and reuse measures, avoid soil, water, and air contamination, and promote good hygiene, safety, and environmental education practices among workers and the communities involved.

The plan also aims to establish control, monitoring, and reporting mechanisms, ensuring the traceability of waste and compliance with the legal and contractual requirements of the project.

### 9.6.2 Scope of Application

This plan applies to all types of waste generated during the project's lifecycle, encompassing domestic, industrial, hazardous, biomedical waste, and liquid effluents. The Waste Management Plan (WMP) is applicable to all project operation areas, including construction sites, camps, excavation zones, maintenance workshops, material storage areas, concrete zones, and administrative units, and its implementation is mandatory for all contractors, subcontractors, and service providers involved in project activities.

### 9.6.3 Generated Wastes Typology

Any waste that may be generated within the scope of the project can be classified according to its nature and origin, as shown in the table below:

Table 9-8 - Main Types of Waste Generated by the Project

| <b>Category</b>    | <b>Common Types</b>      | <b>Potential Impact</b>            |
|--------------------|--------------------------|------------------------------------|
| <b>Inert waste</b> | Concrete debris, bricks, | Landscape degradation and drainage |

|                          |                                            |                                          |
|--------------------------|--------------------------------------------|------------------------------------------|
|                          | rubble, excess soil                        | obstruction                              |
| <b>Organic wastes</b>    | Food scraps, kitchen waste                 | Bad odors and attraction of vectors      |
| <b>Recycling wastes</b>  | Plastic, glass, metal, paper and cardboard | Pollution if not properly segregated.    |
| <b>Dangerous wastes</b>  | Oils, fuels, paints, solvents, batteries   | Soil and water contamination             |
| <b>Biomedical wastes</b> | First aid supplies, syringes               | Risk to public health                    |
| <b>Liquid Effluents</b>  | Wash water and domestic wastewater         | Water pollution and vector proliferation |

#### 9.6.4 Waste Management Strategy

The waste management strategy is based on a hierarchy of priorities, which prioritizes the prevention of waste generation, followed by reduction, reuse, recycling, treatment, and final disposal.

Segregation at the source is the fundamental step in the process, and waste must be separated at the point of generation into containers properly identified by colors and labels: green for organic waste, blue for paper and cardboard, yellow for plastic and metal, red for hazardous waste, black for inert waste, and white for biomedical waste.

The collected waste will be sent to a central storage facility on the construction site, properly covered, ventilated, and waterproofed, with separate compartments for hazardous and non-hazardous waste. The maximum storage time for the generated waste should not exceed 30 days, and transportation will only be carried out by licensed operators, ensuring traceability and safety.

The destination will be defined according to the nature of the waste: aggregates will be reused in construction landfills or land leveling; recyclables will be sent to local cooperatives; Organic waste is destined for composting or municipal collection; hazardous waste will be sent to licensed/authorized facilities; and treated effluents are stored in septic tanks or retention tanks.

#### 9.6.5 Mitigation Measurements

To prevent negative impacts associated with poor waste management, the following measures will be implemented:

- Prohibit the open burning of waste and its disposal in waterways.
- Collect and properly dispose of oils, greases, and solvents using appropriate containers.
- Install containment basins in fuel supply and equipment maintenance areas.
- Ensure periodic cleaning of operational and support areas.

- Promote awareness campaigns and good practices for waste segregation and reduction among workers.

### 9.6.6 Monitoring and Indicators

Monitoring the performance of waste management will be based on quantitative and qualitative indicators, allowing for the evaluation of the effectiveness of the measures adopted and the identification of any shortcomings. The main monitoring parameters are shown in the table below:

Table 9-9 - Waste Monitoring Parameters

| Monitoring parameters              | Indicator                      | Method/Frequency          | Responsible                        | Target/Limit          |
|------------------------------------|--------------------------------|---------------------------|------------------------------------|-----------------------|
| Volume of waste generated          | m <sup>3</sup> /month          | Registration and weighing | Environmental Supervisor           | < 5% monthly increase |
| Percentage of recycled waste       | %                              | Recycling reports         | Contractor / Environmental Manager | ≥ 40%                 |
| Compliance in storage              | Number of positive inspections | Bi-weekly inspections     | Environmental Inspector            | 100% accordance       |
| Oil spill cases                    | Number of incidents            | Records and observations  | H&S Officer                        | Zero occurrences      |
| Sanitation conditions in the camps | Number of critical points      | Weekly visual inspection  | Social/Environmental Officer       | 0 critical points     |

### 9.6.7 Training and Awareness

Monthly training sessions will be conducted for all workers and supervisors on proper waste segregation, handling of hazardous materials, emergency procedures, and environmental hygiene. Training activities will be documented in specific forms and filed with the Project Environmental Manager. Additional sessions will be offered during audits and environmental safety campaigns.

### 9.6.8 Responsibility

Monthly training sessions will be conducted for all workers and supervisors on proper waste segregation, handling of hazardous materials, emergency procedures, and environmental hygiene. Training activities will be documented in specific forms and filed with the Project Environmental Manager. Additional sessions will be offered during audits and environmental safety campaigns.

Table 9.10 - Responsibilities for Implementing the PGR.

| Entity          | Main responsibility                                                                                   |
|-----------------|-------------------------------------------------------------------------------------------------------|
| Main Contractor | Fully implement the Waste Management Plan (PGR), ensuring the segregation and safe transport of waste |

|                                        |                                                                      |
|----------------------------------------|----------------------------------------------------------------------|
| <b>Project Environmental Manager</b>   | To supervise, monitor, and report on environmental compliance        |
| <b>Environmental and Social Fiscal</b> | Conduct audits and recommend improvements                            |
| <b>Local Authorities (SDAE/MAAP)</b>   | To oversee and authorize the final disposal of hazardous waste       |
| <b>ANE</b>                             | Evaluate reports and verify contractual and environmental compliance |

### 9.6.9 Records and Reports

All waste generated, transported, and disposed of must be documented on standardized forms containing information about type, quantity, origin, destination, and responsible operator.

Monthly management and monitoring reports will be submitted to the Environmental Manager and subsequently to the competent environmental authorities. These reports are an integral part of the project's environmental monitoring system.

## 9.7 Health, Safety and Environment Management Plan

### 9.7.1 Introduction, Objectives e Politic of HSE

The construction of the bridge over the Natete River represents a milestone in the region's infrastructure development; however, it involves significant risks that require proactive and integrated management.

This HSE Plan establishes the strategic framework to ensure that all project activities are carried out in a way that relentlessly protects the well-being of workers, the surrounding community, and the Natete River ecosystem, in strict compliance with national legislation and JICA's high international standards.

The project's HSE policy is based on fundamental commitments: prevention of injuries, illnesses, and environmental damage as an absolute priority; compliance with all applicable legal requirements; continuous performance improvement through periodic review of targets; accountability across all hierarchical levels; empowerment of all workers through appropriate training; and consultation and active participation of workers and communities.

### 9.7.2 Organizational Structure and Responsibilities

The effectiveness of the plan depends on a clear definition of responsibilities, as set out in the table below.

Table 9.11 - Organizational Structure and Key Responsibilities in HSE.

| <b>Job Title/Function</b> | <b>Key Responsibilities in HSE</b>                    |
|---------------------------|-------------------------------------------------------|
| <b>Project Manager</b>    | Ultimate responsibility for HSE performance; resource |

|                                     |                                                                                                                   |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------|
|                                     | allocation; ensuring HSE integration into all decisions                                                           |
| <b>HSE Supervisor/Coordinator</b>   | Implement and monitor this plan; conduct inspections; investigate accidents; coordinate training; prepare reports |
| <b>Engineers and Supervisors</b>    | Ensure that the activities under your supervision comply with established safety rules and procedures             |
| <b>Construction Foremen</b>         | Implement HSE rules in daily operations; ensure your team uses PPE and follows safe work methods                  |
| <b>Occupational Physician/Nurse</b> | Provide first aid and medical assistance; generate occupational health reports; conduct medical examinations      |
| <b>All Workers</b>                  | Working safely; using PPE; participating in training; reporting unsafe conditions and incidents                   |

### 9.7.3 Hazard Identification, Risk Assessment and Control

The risk management process begins with the proactive identification of hazards and the implementation of robust control measures. Detailed Risk Analyses will be conducted for all critical activities, maintaining a dynamic Risk Register that documents hazards, assesses probability and severity, and defines specific control measures.

Table 9.12 - Identification of corresponding Project Hazards and Risks

| Activity                             | Hazard             | Risk                    | Control Measures                                                                                    |
|--------------------------------------|--------------------|-------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Working at Heights</b>            | Worker fall        | Serious injuries, death | Use of safety harness anchored to a lifeline; work platforms with guardrails; equipment inspection. |
| <b>Excavation</b>                    | Trench collapse    | Burial, death           | Proper shoring; slope stabilization; daily inspection by a supervisor                               |
| <b>Lifting of Loads</b>              | Falling materials  | Impact, injuries        | Area signage; cables and straps in good condition; certified crane operator                         |
| <b>Work on the river</b>             | Drowning           | death                   | Use of life jackets; definition of safe areas; rescue plan                                          |
| <b>Handling of Chemical Products</b> | Inhalation/contact | Poisoning, burns        | Use of specific PPE (gloves, mask, goggles); access to the Safety Data Sheet (SDS)                  |

### 9.7.4 Specific Management Programs

The operationalization of the PHSE materialized through specific programs designed to address each aspect in an integrated manner.

#### Occupational Health Program

The health program ensures the physical and mental well-being of workers through pre-employment, periodic, and termination medical examinations; a fully equipped medical post with trained personnel; measures to control endemic diseases such as

the provision of mosquito nets; as well as the maintenance of hygiene and comfort facilities (toilets, changing rooms, and canteens) in exemplary conditions.

### **Operational Safety Program**

Safety in the field is guaranteed by a set of operational procedures, including a Work Permit system for high-risk activities; daily and weekly safety inspections; mandatory management of PPE; and comprehensive and clear safety signage throughout the construction site.

### **Environmental Management Program**

The protection of the environment, especially the Natete River, is a cross-cutting priority. The environmental program integrates a detailed PGR; erosion and sedimentation control measures (such as the installation of \*silt fences\*); Control of atmospheric and noise emissions; and the strict protection of biodiversity through the delimitation of the intervention area, as well as the prohibition of hunting or fishing activities.

### **Emergency Response Plans**

An emergency plan is established to ensure a quick and effective response to any incident. This includes clear activation procedures, with posted emergency numbers; a designated and trained emergency team; the carrying out of quarterly drills to validate the procedures; and escape routes and meeting points that are properly signposted and known to all construction workers.

### **Competence, Training and Awareness**

The human factor is the cornerstone of this system. To this end, a training program is implemented that includes a mandatory HSE Induction for all new workers; specific training for high-risk operations; and Toolbox Talks - short daily meetings to discuss the specific risks of the day's tasks.

## **9.7.5 Performance Monitoring, Auditing and Review**

Continuous improvement is supported by a robust monitoring and review system. Key Performance Indicators (KPIs), such as the accident frequency rate, are defined.

All incidents and accidents are monitored and investigated to identify root causes. Semi-annual internal audits verify compliance with this plan, the results of which are analyzed by Management in a formal quarterly HSE performance review.

## 9.8 Emergency Response Plan (ERP)

### 9.8.1 Introduction and Objectives

This PRE (Environmental, Social, and Environmental Management Plan) is an integral part of the environmental and social management system of the Natete River Bridge Reconstruction Project in the Natete district. Its main objective is to define the procedures and resources necessary to prevent, prepare for, and effectively respond to emergencies that may occur during the execution of the works, in order to minimize human, environmental, and material damage.

Specifically, this Plan aims to:

- Ensure a rapid and coordinated response in emergency situations; Protect the lives and health of workers and local communities;
- Avoid or reduce environmental damage;
- Minimize material losses and interruptions to activities;
- Define responsibilities and clear lines of communication; and
- Comply with national legislation and international safety and environmental standards.

This document applies to all phases of the project, especially to mobilization, construction, material transport, fuel handling, and demobilization activities.

### 9.8.2 Legal and Regulatory References

The implementation of this PRE must comply with Mozambican legislation and applicable international standards for safety, health, and environmental protection. It is based on the Environmental Law (Law n° 20/97), which guides the prevention and mitigation of environmental impacts; the Occupational Safety and Health Regulation (Decree n° 61/2009), which defines accident prevention measures and worker training; the Solid Waste Management Regulation (Decree n° 13/2006), which regulates the handling and disposal of waste; and the Fire Safety Regulation (Decree n° 15/2012), which establishes fire prevention and fighting standards.

The plan also follows the World Bank's Health, Safety and Environment (HSE) Guidelines, which promote the best international practices in emergency management and community protection.

### 9.8.3 Identification of Risks and Potential Emergency Situations

During the reconstruction work on the bridge over the Natete River, different types of emergency situations may occur related to construction activities, material handling, equipment movement, and local environmental conditions. The main risks and emergency scenarios are listed in the following table.

Table 9.13 - Potential Types of Risks and Emergency Scenarios of the Project

| Type of emergency                    | Description                                              | Potential Consequences                   |
|--------------------------------------|----------------------------------------------------------|------------------------------------------|
| <b>Fire in a yard or vehicles</b>    | Short circuits, combustion of fuel or flammable material | Injuries, property damage, air pollution |
| <b>Explosion or fuel spill</b>       | Improper handling or failure in storage tanks            | Soil and water contamination, injuries   |
| <b>Workplace accident</b>            | Falls, cuts, crashing injuries, electrocution            | Serious or fatal injuries                |
| <b>Road accident</b>                 | Collision of vehicle transporting materials              | Human casualties, property damage        |
| <b>Yard flooding</b>                 | Flooding of the Natete River during the rainy season     | Work stoppage, damage to equipment       |
| <b>Temporary structural collapse</b> | Failure in shoring or platforms                          | Injuries, damage to infrastructure       |
| <b>Public health emergency</b>       | Infectious diseases, food poisoning                      | Collective illness, temporary shutdown   |
| <b>Conflict with the community</b>   | Disputes, vandalism, protests                            | Risk to worker safety                    |

Each risk must be periodically reassessed by the Health and Safety Supervisor.

#### 9.8.4 Organization and Responsibility

Emergency responses will be coordinated by the Emergency Management Team (EGE), responsible for the immediate implementation of containment, evacuation, rescue, and communication actions during any critical situation occurring at the construction site. This team ensures coordination between the different levels of response, guaranteeing that all interventions are conducted quickly, safely, and effectively.

The composition and responsibilities of the EGE are as follows:

**Emergency Coordinator (Site Manager):** responsible for activating the Emergency Response Plan, for the overall coordination of operations, for strategic decision-making, and for direct communication with the Project Owner, local authorities, and rescue entities (Fire Department, INGD, District Hospital, PRM).

**Health and Safety Supervisor (HSE):** responsible for assessing risks, supervising response actions, ensuring the proper use of Personal Protective Equipment (PPE), maintaining detailed incident records, and leading emergency training and simulations.

**Environmental Manager:** ensures the proper management of emergencies with potential environmental impact, including fuel or chemical spills, collection and disposal of contaminated waste, and communication to the competent environmental authorities.

**First Response Team:** operational group trained to provide first aid, fight initial fires, and support the evacuation of personnel in at-risk areas.

**General Works Supervisor:** ensures the immediate mobilization of workers under their supervision, facilitates access for rescue teams, and ensures compliance with the Emergency Coordinator's instructions.

**Drivers and Equipment Operators:** must stop operations, safely immobilize vehicles or machinery, and assist in evacuation when necessary.

**All Employees and Subcontractors:** All employees and subcontractors must be familiar with the plan's content, follow EGE instructions, remain calm during critical situations, and travel in an orderly manner to designated assembly points.

A functional emergency response organizational chart should be posted in visible locations on the construction site (main entrance, workshops, and offices), identifying managers, telephone contacts, and the chain of command during emergencies.

### 9.8.5 Response Procedures

#### Personal Accidents

- Immediately stop the activity and provide first aid;
- Notify the Safety Supervisor;
- Evacuate the victim to the medical post or hospital in Ribáuè;
- Record the incident and apply preventive measures.

#### Fires

- Activate the alarm and alert the entire team;
- Cut off power and isolate the area;
- Use appropriate fire extinguishers (CO<sub>2</sub>, dry chemical powder);
- Evacuate to the meeting point;
- Notify the district fire department and INGD.

#### Fuel or Oil Spills

- Immediately stop the source of the leak;
- Use containment barriers (sand, sawdust);
- Avoid using flames;
- Notify the Environmental Manager;
- Dispose of contaminated material safely.

#### Floods

- Suspend activities and remove personnel and equipment from the riverbank;
- Turn off power and fuel;
- Strengthen temporary protections;

- Reassess conditions before resuming work.
- **Road Accidents**
- Mark the location with triangles and cones;
- Assist the injured (without moving seriously injured individuals);
- Notify the police and the coordinator;
- Complete the accident report.

### 9.8.6 Emergency Equipment and Resources

Emergency equipment and resources are essential to ensure a rapid and effective response in case of incidents during the reconstruction of the bridge over the Natete River. Their availability, proper maintenance, and correct use are fundamental to minimizing human, material, and environmental damage.

The main emergency response equipment and resources are included in the table below.

Table 9.14 - List of Main Emergency Equipment and Resources

| Type of equipment                                                  | Quantity               | Location                            |
|--------------------------------------------------------------------|------------------------|-------------------------------------|
| <b>Fire extinguishers (CO<sub>2</sub> and dry chemical powder)</b> | According to yard area | Workshops, warehouses, vehicles     |
| <b>First aid kits</b>                                              | 1 per work team        | Shipyard, vehicles                  |
| <b>Emergency radios/cell phones</b>                                | 1 per team             | Supervisors and front-line managers |
| <b>Lanterns and generators</b>                                     | As needed              | Shipyard                            |
| <b>Barrels of sand / sawdust</b>                                   | 2 sets                 | Near the fuel storage area          |
| <b>Emergency contact list</b>                                      | 1 fixed                | Courtyard entrance and offices      |

### 9.8.7 Communication and Emergency Numbers

Communication and emergency contact management are fundamental elements to ensure a coordinated, rapid, and effective response in case of incidents during construction work. An efficient communication system allows for the activation of internal teams, contacting external services, and keeping the competent authorities informed.

During any emergency, communication should follow this structure:

**Alarm Activation:** any worker who identifies an emergency must immediately inform the Health and Safety Supervisor (HSE) or the Superintendent, who will activate the alarm and notify the Emergency Coordinator.

**Internal Communication:** the Emergency Coordinator will inform all members of the Emergency Management Team (EGE) and coordinate evacuation, containment, and first aid actions.

**External Communication:** the Emergency Coordinator will be responsible for contacting local authorities and rescue services, according to the nature of the emergency (firefighters, hospital, police, INGD, environmental authorities).

**Incident Report:** After the situation is under control, an Incident Report should be prepared, describing the nature of the event, the measures taken, and the lessons learned to prevent recurrence.

Emergency contacts should be kept up-to-date and posted in visible locations on the premises, including offices, workshops, and dormitories. The following table presents a model for displaying key emergency contacts.

Table 9.15 - Primary Emergency Contacts

| Entity                                              | Phone numbers   | Location / Observation       |
|-----------------------------------------------------|-----------------|------------------------------|
| <b>Emergency Coordinator (Construction Manager)</b> | [Insert number] | Shipyard                     |
| <b>Health and Safety Supervisor (HSE)</b>           | [Insert number] | Shipyard                     |
| <b>Environmental Manager</b>                        | [Insert number] | Shipyard / Office            |
| <b>Ribáuè Firefighters</b>                          | [Insert number] | Ribáuè village               |
| <b>Ribáuè District Hospital</b>                     | [Insert number] | Ribáuè village               |
| <b>Police of the Republic of Mozambique (PRM)</b>   | [Insert number] | District Command             |
| <b>INGD – District Delegation</b>                   | [Insert number] | Ribáuè                       |
| <b>Environmental Authority (SPA Nampula)</b>        | [Insert number] | Nampula city                 |
| <b>Fuel Supplier</b>                                | [Insert number] | [Inserir local]              |
| <b>First Aid Team</b>                               | [Insert number] | Shipyard / Construction Site |

### 9.8.8 Training, Awareness and Simulations

Training, awareness, and simulations are fundamental to ensuring the adequate preparation of everyone involved in construction projects in the face of possible emergency situations.

This plan should be reviewed and tested periodically through practical exercises, ensuring that all workers know the evacuation procedures, meeting points, and corresponding emergency contacts.

The main actions planned include:

- Initial training of all workers on evacuation procedures, first aid, and the use of emergency equipment;
- Fire and fuel or hazardous product leak simulation exercises, carried out every six months;
- Quarterly refresher sessions for the First Response Team, focused on firefighting, victim assistance, and incident communication; and

- Evaluation of the results of each simulation, identifying strengths and weaknesses, followed by updating the Emergency Response Plan (ERP) whenever necessary.

These actions promote a culture of safety and preparedness, ensuring that all workers know how to act in a coordinated, effective, and safe manner in any critical situation.

### 9.8.9 Registrations and Reports

Records and reports are fundamental tools for monitoring, evaluating, and continuously improving the effectiveness of the Emergency Response Plan (ERP) during construction. Proper documentation maintenance ensures traceability of actions, institutional learning, and compliance with legal and contractual requirements.

The main documents and records include:

- Incident and near-miss registration form, detailing date, location, event description, probable causes, corrective measures taken, and those responsible for follow-up;
- Simulation and safety audit reports, containing performance evaluations of teams, response times, effectiveness of procedures, and recommendations for improvement;
- Annual update of the equipment inventory and emergency contacts, ensuring that all resources are operational and telephone numbers are properly updated.

All records must be filed by the Health and Safety Supervisor (HSE), as well as made available for consultation by the competent authorities, the Developer, and environmental or social audit entities, as applicable.

### 9.8.10 Review and Actualization

The purpose of reviewing and updating the Emergency Response Plan (ERP) is to ensure that the document remains adequate, effective, and aligned with the actual conditions of activities on site.

The ERP will be reviewed annually or whenever a significant emergency occurs, a substantial change in operations takes place, or after audits and simulations reveal the need for adjustments.

The responsibility for the review lies with the Health and Safety Supervisor (HSE), who must analyze the effectiveness of the measures implemented, incorporate lessons learned, and propose any improvements. The updated version of the ERP must be approved by the Emergency Coordinator (Construction Manager) and the

Environmental Manager, thus ensuring the integration of safety, health, and environmental aspects.

Updated copies of the ERP must be distributed to the Emergency Management Team (EMT), subcontractors, and relevant local authorities, ensuring that all those involved have current and valid information for emergency response. Figure 8.1 shows the emergency response organizational chart, and Annexes E (incident and emergency registration forms) and Annex F (simulation and training log) are presented.

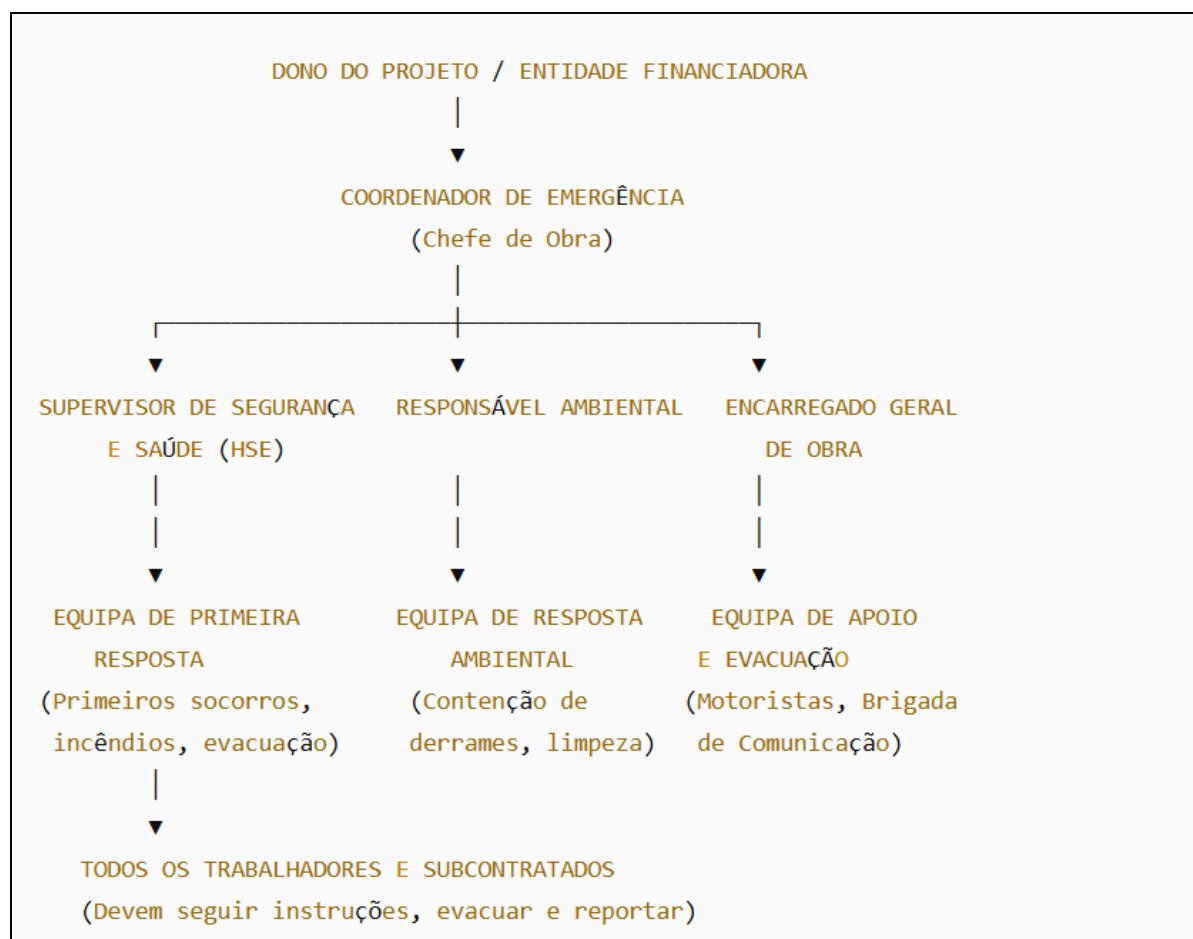


Fig. 8.1 - Emergency Response Organizational Chart

## 9.9 Environmental Rehabilitation Plan (ERP)

The ERP for the Natete River Bridge Reconstruction Project is a management tool aimed at ensuring that, after the completion of the construction phase, the areas temporarily occupied or affected by the work are properly recovered, preventing permanent environmental impacts and guaranteeing the landscape and ecological integration of the site.

This plan covers the bridge implantation area, the river slopes and banks, the areas occupied by shipyards, access roads, soil borrow areas, and inert waste disposal sites. The rehabilitation actions focus on the physical and biological recovery of the

altered areas. In the yard and support areas will be demobilized, including containers, warehouses, and workshops, followed by the removal and proper disposal of solid and liquid waste in licensed locations.

Subsequently, these areas will be leveled, covered with fertile soil, and revegetation with native species will be promoted. On the riverbanks and slopes, stabilization techniques will be applied, combining adequate drainage, erosion protection, and planting of herbaceous and shrub species native to the region, to ensure soil consolidation, as well as protection of the banks against gully erosion.

In the material borrowing areas and waste disposal sites, topographic regularization, covering with a layer of fertile soil, and the introduction of native vegetation will be carried out, aiming to reduce susceptibility to erosion and restore the ecological value of degraded areas. The revegetation and afforestation program will prioritize species adapted to local conditions, such as *Acacia nigrescens*, *Brachystegia spp.*, and grasses such as *Pennisetum spp.*, ensuring maintenance and initial irrigation for a minimum period of three months after planting, until stabilization.

The ERP also includes the complete removal of debris, scrap metal, excess concrete and wood, ensuring its environmentally appropriate disposal or eventual reuse in local infrastructure. Following these actions, the areas must have a minimum vegetation cover of 80% at the end of one year, absence of residues and environmental liabilities, as well as visible soil stability after the first rainy season following the rehabilitation carried out.

The implementation of the planned measures will be the direct responsibility of the contractor, with environmental oversight of the actions and the MAAP, through its competent authorities, carrying out audits and final validation of the rehabilitation. The ERP execution schedule foresees the start of rehabilitation actions in the last months of the work, extending for a period of three to six months after its completion, with periodic monitoring up to twelve months later.

The budget for implementing the ERP should correspond to a fraction of the overall investment of the project, estimated between 2% and 5%, covering costs of demobilization, waste disposal, agricultural inputs, revegetation and monitoring.

The adoption and implementation of this ERP will ensure that the reconstruction of the bridge over the Natete River is completed in accordance with the principles of environmental sustainability, guaranteeing not only the functionality of the new road infrastructure, but also the protection of the environment and the well-being of local communities.

## 9.10 Project Code of Conduct

The Code of Conduct for the Natete River Bridge Reconstruction Project establishes the principles, rules, and responsibilities to be followed by all workers, contractors, subcontractors, consultants, and other parties involved. The project has technical assistance from JICA, which implies compliance not only with national legislation but also with international standards of ethics, environmental and social safeguards, transparency, and good governance.

The document is based on fundamental principles, including respect for Mozambican laws, as well as compliance with JICA's environmental and social safeguard standards, integrity and the fight against corruption, environmental protection, occupational health and safety, and good relations with local communities.

Regarding worker behavior, all forms of harassment, discrimination, intimidation, or violence are prohibited. The consumption of drugs or alcohol during work, the carrying of weapons on the construction site, and any form of sexual exploitation or abuse are also prohibited, with an emphasis on the protection of minors. The use of PPE is mandatory, and all workers must wear visible identification.

In terms of occupational health and safety, safety standards must be strictly followed, and regular training in accident prevention and first aid is conducted. First aid kits and means of rapid response to medical emergencies must be available. Any accident or hazardous situation must be immediately reported to supervisors.

In the environmental component, the code requires compliance with the measures defined in the ESMP and ERP, including proper waste management, the prohibition of discharges in unlicensed areas, as well as the protection of riverbanks and riparian vegetation, and the rational use of natural resources such as water and energy.

The relationship with local communities must be based on respect for traditions and cultural practices. Abusive or exploitative behavior towards the population is prohibited. The project should promote the hiring of local labor whenever possible in local communities and establish accessible communication channels for community complaints and concerns.

In the context of integrity and professional ethics, the code strictly prohibits any form of bribery, fraud, or conflict of interest. All actions must be conducted transparently, and the management of resources must adhere to principles of responsibility and accountability to national authorities and JICA.

All project workers and partners must sign a declaration of commitment confirming that they have read and understood this Code of Conduct. Failure to comply with the established rules will result in disciplinary sanctions that may include warnings,

suspension, dismissal, or exclusion from the project. Serious cases, such as corruption, harassment, violence, or sexual exploitation, will be reported to the competent authorities and JICA, and may give rise to criminal proceedings.

The implementation of this Code is the responsibility of the contractor, who must promote regular awareness sessions in a language accessible to all workers. Environmental and social oversight will monitor compliance with the code through periodic audits and visits. Local communities may also use established complaint mechanisms to report any non-compliance.

Thus, the Code of Conduct becomes an essential instrument to ensure that the reconstruction of the bridge over the Natete River is carried out responsibly, ethically and sustainably, protecting workers, local communities and the environment.

### 9.11 ESMP Responsibility for Execution

The responsibility for implementing the Environmental and Social Management Plan (ESMP) falls on the project proposing entity, in this case ANE, which must ensure the integration and effective implementation of all mitigation, monitoring, and environmental and social management measures foreseen in the plan. This responsibility covers everything from the planning phase to the decommissioning or closure of the project works, guaranteeing compliance with legal standards and good environmental management practices.

To ensure effective implementation, the proponent must designate a full-time Environmental Officer (EO) responsible for directly supervising the implementation of the ESMP, liaising with environmental authorities, and communicating with local communities and other SPIs. This professional must have adequate technical qualifications and proven experience in environmental and social management.

ANE must also hire an accredited Environmental Auditor, responsible for conducting annual environmental audits, with the aim of identifying any non-conformities, as well as proposing corrective measures in accordance with ESMP, national legislation, and applicable international standards, namely those of JICA.

During execution, the ANE (Environmental and Social Management Agency) must also ensure that all contractors, subcontractors, and service providers comply with the environmental, social, health, and safety provisions established in the ESMP. To this end, environmental and social clauses must be included in the contracts, making compliance with mitigation and monitoring measures mandatory.

The competent environmental authorities (at the central, provincial, or district level) will have the role of supervising and overseeing the effective implementation of the plan, while environmental and social consultants may provide specialized technical support in the execution of monitoring actions, training, and environmental audits.

Finally, it is the responsibility of the ANE to ensure the allocation of adequate human, financial, and material resources for the implementation of the ESMP, as well as to prepare and submit periodic environmental performance reports to the competent authorities, ensuring transparency and compliance with current environmental legislation.

In this way, the ESMP execution structure ensures shared responsibility, continuous technical supervision, and compliance with legal and institutional requirements, promoting the continuous improvement of the project's environmental and social performance.

## 9.12 Environmental Audits

Environmental audits will be conducted to ascertain the project's environmental performance, adherence to the conditions of the Environmental License, and the objectives specified in this ESMP, which also includes the monitoring program.

The environmental audit program should be based on the Regulation on the Environmental Audit Process approved by Decree No. 45/2024, of June 26, a management instrument for the systematic, documented, and objective evaluation of the functioning and organization of the environmental control and protection process management system. Therefore, the main objectives of the audit are to assess compliance with the requirements stipulated in this document, identify any cases of non-compliance, and determine whether the objectives and targets have been achieved.

The audit will also be used to finalize previous requests and/or recommendations for corrective actions presented in previous audit reports.

To bring labor and operational processes into compliance with current environmental legal requirements, the Proponent must hire an Independent Auditor to independently examine the process and prepare quarterly independent audit reports based on site visits and analysis of existing monitoring reports, as well as submit them to AQUA and identify the corrective actions required by the Environmental Management Plan (EMP) and national legislation.

Aspects requiring specific actions will be identified from the recommendations made. The execution of the recommended audit actions will be evaluated during the subsequent audit.

It is emphasized that the nature of the environmental audit should be conservative. Records must be kept of all actions taken to fulfill the purposes of this Environmental Management Plan, and records and justifications for all changes or alterations to this document.

ANE thus commits to carrying out its activity within a framework of balanced sustainable development, aiming for progress compatible with achieving increasingly higher levels of environmental performance. Therefore, it agrees to undergo regular inspections, in accordance with current or future laws, as well as to introduce necessary acceptable and sustainable technologies at each stage of activity at the facility.

### 9.13 Communication and Capacitation

The communication and capacity-building component is an essential pillar for ensuring transparency, the active participation of SPIs and AS, and the effectiveness of the implementation of the project's Environmental Management Plan. In this context, periodic meetings will be held with the local community and administrative and traditional authorities, with the aim of promoting open dialogue, clarifying doubts, raising concerns, and ensuring that the population is properly informed about ongoing activities, potential impacts, and mitigation measures being implemented.

In addition, the dissemination of environmental and social monitoring results will be ensured in easily accessible public places, such as neighborhood headquarters, district administrations, and community centers, to foster transparency and community involvement in monitoring the project's environmental performance.

At the same time, a continuous training and capacity-building program for workers will be implemented, covering topics related to good environmental practices, waste management, pollution prevention, rational use of resources, occupational health, and workplace safety. These ongoing and regular training and capacity-building activities aim not only to reinforce compliance with environmental and safety standards, but also to consolidate an organizational culture of socio-environmental responsibility among all project stakeholders.

### 9.14 ESMP Review and Update

The review and updating of the ESMP are a fundamental step to ensure its continued effectiveness and suitability to the actual conditions of project implementation. The ESMP should be reviewed whenever justified, systematically, to assess the degree of compliance with mitigation measures, the environmental and social performance achieved, and the effectiveness of monitoring and capacity-building programs.

In addition to periodic review, the document should be updated whenever significant changes occur in the project, whether in terms of design, construction methods, location of activities, technologies employed, or execution schedule.

Similarly, updating will be mandatory whenever new risks or environmental and social impacts not initially foreseen are identified, or when additional recommendations and requirements are issued by the competent environmental authorities.

This process of continuous review and updating will ensure that the EMP remains a dynamic, flexible instrument adjusted to the reality of the proposed undertaking, contributing to the continuous improvement of environmental and social performance and to strengthening the legal and institutional compliance of the project.

### 9.15 ESMP Implementation Systems

The ESMP Implementation System is the operational core that ensures that all mitigation, monitoring, and social and environmental enhancement measures are effectively applied, supervised, and reported throughout the project lifecycle. The following is the proposed structure for the implementation of the ESMP for the Natete River Bridge Project.

#### 9.15.1 Objective

The ESMP implementation system has the main objective of ensuring the effective and coordinated execution of the environmental and social mitigation, monitoring, and enhancement measures identified in the SES and incorporated into present ESMP.

This system ensures that all parties involved — the Project Owner, Contractor, Environmental Inspector, and local institutions — fulfill their responsibilities in accordance with Mozambican environmental legislation and international environmental safeguards.

#### 9.15.2 Institutional Implementation Structure

The implementation of this ESMP will be conducted by a multi-level management structure, integrating national and district institutions and the technical support of JICA. This structure is composed of four main levels:

##### a) Project Owner / Executing Entity (ANE / MOPRH)

- Responsible for the overall coordination and technical and financial execution of the project;
- Ensures the integration of environmental and social management measures into contracts and work plans;
- Supervises the environmental and social compliance of the Contractor, with the support of the Consultant and JICA;

- Submits periodic reports to SPA and JICA, including monitoring data and compliance with the ESMP.

#### **b) JICA**

- Acts as an international technical assistant and supervision entity, ensuring the application of its environmental and social guidelines;
- Provides technical support and ongoing training to the ANE and Inspection teams;
- Conducts environmental and social review and audit missions, verifying compliance with the Environmental and Social Considerations Guidelines (JICA, 2022);
- Facilitates coordination with the Government of Japan and ensures transparency in the implementation of the Environmental and Social Management Plan (ESMP).

#### **c) Contractor**

- Directly responsible for the daily implementation of environmental and social measures in the field;
- Must appoint a certified and full-time available Health, Safety and Environment Officer (EHS Officer);
- Implements the Environmental Management Plan, Waste Management Plan, HSE Plan, Communication and Community Engagement Plan, and Erosion and Drainage Control Plan;
- Prepares monthly environmental and social performance reports submitted to the Inspector and the Owner.

#### **d) Environmental and Social Inspector / Supervision Consultant**

- Acts under contract with ANE, with technical support from JICA, as an independent inspector of compliance with the ESMP;
- Verifies the environmental, social, and safety compliance of activities;
- Issues monthly and quarterly compliance reports, including field observations, non-conformities, and corrective actions;
- Facilitate coordination between ANE, the Contracting Authority, local authorities, JICA, and affected communities.

## **e) Local Authorities and Communities**

- The Ribáuè District Administration, through the SDAE and SDPI, supports the monitoring and local management of the project;
- The Local Coordination Committee (CLC) ensures community participation, complaint management, and social mediation, in accordance with the Complaints and Grievances Management Mechanism (GRM);
- Communities participate in public consultations, awareness campaigns, and environmental and safety training programs.

### **9.15.3 Coordination and Communication Mechanism**

The implementation of the ESMP is ensured by a horizontal and vertical communication and coordination mechanism:

- Weekly field meetings between the Contractor and the Environmental Inspector;
- Monthly coordination meetings between ANE, JICA and the Consultant;
- Quarterly meetings with district authorities and CLC;
- Formal community communication channels, including public information boards, a direct contact line and open meetings;
- A Complaint Management System (QMS), with digital registration and response within 15 business days.

### **9.15.4 ESMP Operational Instruments**

The implementation system integrates the following operational plans and subprograms:

- Environmental and Social Monitoring Plan (ESMP)
- Waste Management Plan (WMP)
- HSE Management Plan
- Communication and Community Engagement Plan (CCEP)
- Emergency Response Plan (ERP)

Each plan defines specific objectives, indicators, monitoring frequency, verification methods, and direct responsibilities.

### 9.15.5 Training and Capacity Requirements

In accordance with JICA guidelines, team training is essential to ensure the quality of the implementation of the ESMP. The Contractor, with the support of the Inspection and JICA, shall:

- Conduct quarterly technical training sessions in environmental management, occupational safety, and social management;
- Promote community awareness campaigns on health, hygiene, HIV/AIDS, gender equality, and road safety;
- Ensure continuous training for construction site personnel, supervisors, and local workers;
- Incorporate specific training in JICA safeguard standards, including aspects of biodiversity, resettlement, and gender.

### 9.15.6 Reporting and Supervision Systems

The environmental and social reporting system will follow this structure:

- Contractor: monthly environmental and social performance reports → Environmental Inspector;
- Environmental Inspector: monthly and quarterly compliance reports → ANE and JICA;
- ANE: quarterly progress reports → SPA of Nampula;
- JICA: audit reports and technical missions → Government of Japan and SPA.

Environmental and social audits will be conducted semi-annually by JICA, accompanied by joint field verifications with the Owner and the Environmental Consultant.

### 9.15.7 Reporting and Responsibility Structure

Table 9.16 - Primary Emergency Contacts.

| Entity / Agent     | Main responsibility                                                              | Action frequency   | Report instrument                                        |
|--------------------|----------------------------------------------------------------------------------|--------------------|----------------------------------------------------------|
| <b>ANE / MOPRH</b> | Coordination and integration of the ESMP; submission of reports to MITA and JICA | Quarterly / Annual | Consolidated environmental and social compliance reports |
| <b>Contractor</b>  | Daily implementation of mitigation and safety measures                           | Monthly            | Environmental and social reports                         |
| <b>Fiscal</b>      | Independent technical                                                            | Monthly /          | Compliance reports                                       |

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|                                             |                                                                           |            |                                                   |
|---------------------------------------------|---------------------------------------------------------------------------|------------|---------------------------------------------------|
| <b>Environmental<br/>e Social</b>           | supervision; monitoring and<br>recommendations                            | Quarterly  | and internal audits                               |
| <b>SPA/MAAP</b>                             | Monitoring and validation of<br>execution reports                         | Semiannual | Inspection reports<br>and technical<br>opinions   |
| <b>District<br/>administration/<br/>CLC</b> | Local social management,<br>communication and<br>participatory monitoring | Continuous | MGQR records,<br>minutes and<br>community reports |

## 10 COST ESTIMATE FOR ENVIRONMENTAL MITIGATION AND MONITORING MEASURES

### 10.1 Introduction

Cost estimation for environmental mitigation and monitoring measures is an essential component of the ESMP, ensuring that the proposed actions are feasible and adequately budgeted within the project lifecycle. The budget forecast covers the pre-construction, construction, and post-construction phases, encompassing mitigation measures, monitoring programs, training, communication, and environmental emergency management.

The inclusion of these costs in the overall project budget aims to ensure that the execution of environmental and social measures is effectively implemented, monitored, and reported, in accordance with national legal requirements and JICA guidelines.

### 10.2 Cost Structure

Estimated costs are organized by category, according to the main components of the ESMP.

#### General Environmental Management

- Environmental and social coordination and supervision (resident consultant and support team);
- Coordination meetings, environmental reports and audits;
- Field equipment, PPE and monitoring logistics.

#### Environmental and Social Mitigation Measures

These measures aim to prevent, minimize, or remediate negative impacts during pre-construction, construction, and post-construction phases:

- **Erosion and Sedimentation Control:** Construction of ditches, containment basins, and silt fences; e Revegetation of disturbed areas;
- **Solid and Hazardous Waste Management:** Provision of containers, collection, transport, and final disposal;
- **Water Resource Protection and Water Quality:** Installation of floating barriers and settling tanks and Regular laboratory analyses of water quality
- **Dust and Noise Mitigation:** Irrigation of access roads to reduce dust; Maintenance of construction equipment; and Temporary acoustic barriers near sensitive areas;
- **Rehabilitation and Post-Construction Vegetation:** Restoration of degraded sites and Replanting of native vegetation; and

- **Community Engagement and Communication:** Awareness campaigns and stakeholder consultations

### **Occupational Health and Safety (HSE)**

- Safety and first aid training;
- Installation and maintenance of signage, lighting, and emergency equipment;
- First aid and fire-fighting kits;
- Monitoring working conditions (noise, vibration, dust, and ergonomics).

### **Environmental and Social Monitoring Measures**

Monitoring ensures compliance and provides data for adaptive management:

- **Water, Air, and Soil Quality Monitoring:** Sampling, laboratory analysis, and reporting;
- **Periodic Environmental and Social Inspections:** Field checks during all project phases;
- **External Compliance Audits:** Semi-annual audits to verify adherence to ESMP requirements;
- **Complaint Registration and Response (MRQ):** Recording and addressing community concerns related to environmental and social issues

### **Complementary Management Plans**

- Implementation and monitoring of specific plans:
  - Waste Management Plan;
  - Health, Safety, and Environment (HSE) Management Plan;
  - Community Communication and Involvement Plan (PCEC);
  - Environmental Contingency and Emergency Plan.

## **10.3 Methodology Estimation**

The cost estimate is based on unit market values and recent experiences from similar projects in Mozambique, with reference to standard costs in the civil construction and public works sector. Direct costs (materials, labor, and equipment) and indirect costs (supervision, transportation, reports, and training) were considered.

The methodology includes:

- Quantification of the activities and inputs required for each mitigation measure;
- Estimation of unit costs of goods and services;
- Application of contingency margins (10–15%) for unforeseen events;

- Inclusion of continuous monitoring costs for a minimum period of 12 months after the completion of the work.

#### 10.4 Indicative Cost Structure

The following table presents an indicative cost structure by main category (illustrative values, subject to revision during the execution phase).

Table 10.1 - Indicative Cost Structure by Principal Category.

| Principal category                         | Activities description                                       | Estimated cost (USD) | Observations                      |
|--------------------------------------------|--------------------------------------------------------------|----------------------|-----------------------------------|
| <b>General Environmental Management</b>    | Coordination, reporting, logistics and oversight             | 25.000               | Includes local technical support  |
| <b>Environmental and social mitigation</b> | Erosion, dust, and debris control measures, and revegetation | 40.000               | Materials and labor               |
| <b>Health and safety (HSE)</b>             | Equipment, training and emergency kits                       | 20.000               | Includes periodic training        |
| <b>Environmental and Social Monitoring</b> | Sampling, laboratory analysis and audits                     | 30.000               | During and after the work         |
| <b>Complementary Plans (ESMP)</b>          | Implementation of management and contingency plans           | 15.000               | Includes community communication. |
| <b>Total estimated</b>                     |                                                              | <b>130.000 USD</b>   | (Approximated)                    |

The following tables provide specific details on environmental and social mitigation measures and environmental and social monitoring.

Table 10.2 - Detailed Breakdown of Costs for Environmental and Social Mitigation Measures

| Mitigation Component                                       | Description of Activities                                                                           | Estimated Cost (USD) |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------|
| <b>Erosion and Sedimentation Control</b>                   | Construction of ditches, containment basins, silt fences, sediment traps                            | 12,000               |
| <b>Dust Control Measures</b>                               | Irrigation of roads and exposed soil, equipment maintenance, temporary ground covers                | 8,000                |
| <b>Debris and Waste Management</b>                         | Collection and safe disposal of construction debris, provision of bins, hazardous material handling | 10,000               |
| <b>Post-Construction Rehabilitation &amp; Revegetation</b> | Restoration of disturbed areas, soil stabilization, planting native vegetation, monitoring          | 10,000               |
| <b>Total</b>                                               |                                                                                                     | <b>40,000</b>        |

Table 10-3-Detailed Breakdown of Costs for Environmental and Social Monitoring Measures.

| Monitoring Component | Description of Activities | Estimated Cost |
|----------------------|---------------------------|----------------|
|----------------------|---------------------------|----------------|

|                                                        |                                                                                       | (USD)         |
|--------------------------------------------------------|---------------------------------------------------------------------------------------|---------------|
| <b>Water Quality Monitoring</b>                        | Sampling, laboratory analysis of physicochemical and biological parameters, reporting | 10,000        |
| <b>Air and Soil Quality Monitoring</b>                 | Sampling and analysis of dust, noise, and soil parameters                             | 5,000         |
| <b>Periodic Environmental &amp; Social Inspections</b> | Field inspections during pre-construction, construction, and post-construction phases | 5,000         |
| <b>External Compliance Audits</b>                      | Semi-annual audits by independent experts to verify ESMP adherence                    | 5,000         |
| <b>Complaint Registration &amp; Response (MRQ)</b>     | Recording, handling, and responding to community complaints and grievances            | 5,000         |
| <b>Total</b>                                           |                                                                                       | <b>30,000</b> |

## 10.5 Financing and Responsibility

Funding will be provided by the overall project budget, under the responsibility of the Contractor, with oversight from the Environmental and Social Inspection and the Owner.

The Contractor must include all mitigation and monitoring costs in its budget and execution schedule, ensuring adequate human, material, and financial resources. The Environmental Inspector is responsible for validating the implementation and periodically reporting progress and compliance to the Environmental Authority and JICA.

The budget must be reviewed and updated as the project phases progress, adjusting to actual field conditions and recommendations from periodic environmental audits.

## 11 CONCLUSIONS AND RECCOMENDATIONS

The SES of the Natete River Bridge Project presents a comprehensive analysis of the potential environmental and social impacts resulting from the proposed intervention, considering the biophysical, socioeconomic, and institutional characteristics of the PAI. The study concludes that the reconstruction of the bridge is environmentally sustainable, socially beneficial, and technically feasible, provided that the mitigation, management, and monitoring measures defined in the ESMP are rigorously applied.

In general, the project reveals a dual nature of impacts. On the one hand, during the construction phase, negative environmental impacts are recorded, such as soil and riverbank disturbance, risks of erosion and siltation, temporary alteration of water and air quality, noise, generation of waste and effluents, as well as potential interference with local vegetation and fauna. These impacts are, however, temporary, localized, and mitigable, not presenting a permanent or irreversible character. On the other hand, the positive impacts are significant and long-term, reflecting in the substantial improvement of mobility, road safety, the flow of agricultural production, and regional economic integration, with multiplier effects on local development.

The assessment of the significance of the impacts allowed them to be ranked according to their magnitude and relevance. The risks of water contamination, soil erosion, and road accidents were classified as highly significant, requiring rigorous mitigation measures, such as sediment control, efficient drainage, revegetation of riverbanks, and adequate signage during construction. The positive social impacts were classified as very highly significant, as they promote employment opportunities, local income, and improved living conditions for local and regional communities.

Among the less significant negative impacts are the temporary alteration of the landscape, the emission of dust and noise, the production of solid waste, and the punctual disturbance of vegetation. All these effects can be controlled through the application of the measures contained in the environmental and social management plans, namely, the WMP, the HSE Plan, the Workforce Management Plan, the ERP and CCEP.

The results obtained during the public consultations show strong community support for the project, with the population highlighting the importance of the new bridge for local development and for easier access to markets, schools and health units. The main concerns raised – related to pedestrian safety, dust control, noise and priority in hiring local labor – were duly considered and incorporated into the measures of the ESMP.

The study recommends the full implementation of the GRM, ensuring that any community concerns are recorded and resolved quickly and transparently. It is also recommended that an ESO be permanently present throughout the construction phase, responsible for overseeing compliance with environmental and social measures, preparing monthly reports, and coordinating with local and provincial authorities.

The implementation of the ESMP is estimated to cost around USD 130,000,00 covering mitigation, monitoring, and capacity-building activities. The Contractor will be responsible for its implementation, under supervision by ANE, JICA, and the SPA of Nampula. ESO will oversee compliance, prepare monitoring reports, and coordinate communication with stakeholders.

It is concluded, therefore, that the negative environmental impacts associated with the proposed project of reconstruction of the bridge over the Natete River are controllable and compensable, while the positive impacts are substantial, lasting, and strategic for regional development and for the Province of Nampula in particular. The new bridge will strengthen road connectivity, reduce the isolation of communities, boost local and regional trade, and promote the climate resilience of public infrastructure.

Considering the above, the SES recommends the issuance of the Environmental License for the project, conditional upon full compliance with the management and mitigation measures established in the ESMP and the execution of periodic environmental audits.

It is also recommended that ANE ensure the integration of environmental and social monitoring into the overall work schedule and guarantee the continuous training of the technical team and local workers in good environmental practices, safety, and social coexistence.

Finally, the project of reconstruction of the bridge over the Natete River Natete should be seen not only as an engineering work, but as an integrated development initiative capable of generating transformative socioeconomic impacts and consolidating the infrastructure.

## 12 REFERENCES

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# ANNEXES

Annex A

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Approval of the ToR by the  
SPA of Nampula



REPÚBLICA DE MOÇAMBIQUE  
PROVÍNCIA DE NAMPULA  
CONSELHO DOS SERVIÇOS PROVINCIAIS DE REPRESENTAÇÃO DO ESTADO  
SERVIÇO PROVINCIAL DO AMBIENTE

À:  
ADMINISTRAÇÃO NACIONAL DE ESTRADAS - ANE

**MAPUTO**

N/Ref<sup>N</sup>º 1359/SPA/RLA/220

Nampula, 10/10/2025

Assunto: Envio do Relatório de Revisão dos Termos de Referência (TdR) do Projecto de Reconstrução da Ponte Sobre o Rio Natete, Localidade de Matharya, Posto Administrativo de Iapala, Distrito de Ribáuè, Província de Nampula, proposto pela Administração Nacional de Estradas-ANE, Província de Nampula

Para os devidos efeitos e demais providências legais, junto se envia a V.Excia o relatório sobre o documento acima indicado, o qual foi apreciado positivamente, nos termos da alínea b) do nº 1, artigo 13 do Decreto nº 54/2015 de 31 de Dezembro, atinente ao Regulamento Sobre o Processo de Avaliação do Impacto Ambiental.

Nesta conformidade, V.Excia deverá submeter a este Serviço Provincial do Ambiente de Nampula (SPAN), a proposta do EAS em número de 7 cópias e um suporte electrónico (Flash), para a devida análise e tomada de decisão.

Cordialmente.

O Director do Serviço  
  
José Júlio Luís  
(Técnico Superior N.º 1)

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Serviço Provincial do Ambiente, Av. do Trabalho, 1º Andar, Telefone 26216479, Telefax 26216478 - Nampula

**Relatório de Revisão dos Termos de Referência (TdR) do Projecto de Reconstrução da Ponte Sobre o Rio Natete, Localidade de Matharva, Posto Administrativo de Iapala, Distrito de Ribáuê, Província de Nampula, proposto pela Administração Nacional de Estradas-ANE, Província de Nampula.**

**1. Introdução**

O projecto acima mencionado foi submetido ao Serviço Provincial do Ambiente de Nampula para apreciação e tomada de decisão. O empreendimento acima referenciado consistirá na reconstrução da Ponte sobre o Rio Natete que se encontra em estado de degradação, devido a precariedade da estrutura da base e respectiva plataforma.

**2. Localização da Ponte**

A infra-estrutura em destaque, será implantada no Rio Natete à 7 km do Distrito de Ribáuê, ao longo da EN. 13, nas seguintes coordenadas: **Latitude 14°58'20" e Longitude 38°06'40"**.

**3. Identificação do Proponente e Valor de Investimento**

O proponente do projecto é a Administração Nacional de Estradas – ANE, localizada na Avenida de Moçambique, Número 1225, CP. 403, Bairro Luís Cabral, Cidade de Maputo, Contacto: +258 21476163, Email: geral@ane.gov.mz, e o valor de investimento é de 5.000.000,00USD.

**4. Actividades principais e componentes do projecto**

De acordo com as especificações constantes nos pontos 3 a 3.6 das páginas 07 à 19 do documento, se indicam as actividades que incorporam o projecto, pese embora a não observância da sequência prevista na alínea d), do número 2 do artigo 12 do RAIA.

**5. Enquadramento Legal**

Neste item foi descrito o quadro legal nacional, internacional aplicáveis, incluindo as entidades envolvidas para o bom andamento do projecto (vide ponto 4 a 4.4 das págs. 21 à 25 do documento). Quanto a esta matéria legislativa, tudo se mostra assente com excepção da legislação sobre as mudanças climáticas sendo tema actual e factor determinante para a degradação da infra-estrutura bem como convenções internacionais a respeito.

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#### 6. Âmbito de Revisão dos TdR's

Para a emissão do parecer técnico do EAS, constituiu-se a respectiva Comissão Técnica de Avaliação (CTAIA), composta pelas seguintes Instituições:

- Serviço Provincial do Ambiente;
- Serviço Provincial de Infra-Estruturas;
- Direcção Provincial da Indústria e Comércio;
- Direcção Provincial dos Transportes e Comunicações.

#### 7. Contexto de Realização dos TdR's

Os TdR's foram elaborados na fase posterior da actividade, visto que a infra-estrutura já existe e vai na fase de reconstrução.

#### 8. Participação do Público

Está prevista a realização de duas consultas públicas, tendo uma, tido lugar na fase de apresentação do projecto, com envolvimento das parte interessadas e afectadas, em conformidade do artigo 15 do Decreto 54/2015 de 31 de Dezembro, que obriga a todos projectos de categoria "B", a realização da consulta pública para auscultação da parte afectada e interessada do projecto. (Vide pontos 10 e 11 de págs. 54 à 57). Neste item serão observados todos os critérios exigidos para as consultas públicas, incluindo a observância dos critérios de reassentamento da comunidade afectada.

#### 9. Avaliação da Equipa Técnica de elaboração dos TdR's

Para a elaboração destes Termos de Referência e do respectivo estudo ambiental simplificado, a Katahira International Group do Japão, subcontratou a Eanviestudos, Limitada, empresa de Consultoria Ambiental, sediada no Bairro KaMfumu, Rua Viana da Mota, nº 72, 1º Andar, Cidade de Maputo, ajuramentada pelo Ministério da Agricultura, Ambiente e Pescas – MAAP, ao nosso ver se ajustam ao projecto, apesar da falta de inclusão de um Engenheiro de Construção Civil.

#### 10. Áreas de Influência do Projecto

Foram definidas e delimitadas as áreas de influência do projecto, que condizem com a realidade presente no terreno real do empreendimento e arredores do mesmo, conforme se confirma dos pontos 3.1.2 à 3.1.2.2 das páginas 7 e 8.

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### 11. Avaliação dos impactos

Apresentam nas págs. 33 e 34, desde a fase de construção, operação e desativação, na nossa análise os mesmos respondem a natureza e complexidade do projecto.

### 12. Comunicação dos resultados dos TdR's

Os TdR's foram elaborados em observância do n° 2, artigo 12, conjugado com a alínea b) do n°1 do artigo 13, ambos do Decreto n° 54/2015 de 31 de Dezembro, atinente ao Regulamento Sobre o Processo de Avaliação do Impacto Ambiental.

### 13. Constatções

Depois de uma leitura atenciosa e análise do documento, a CTAIA constatou o seguinte:

- ✓ Os Termos de Referência não aludem o processo de movimentação de pessoas mas sabe-se que haverá reassentamento na área de acomodação do Estaleiro Operacional;
- ✓ Na descrição das actividades, não se observou a sequência prevista na alínea d), do número 2 do artigo 12 do RAIA;
- ✓ A não inclusão de um Engenheiro de Construção Civil na equipa técnica;
- ✓ Não foram anexados nos TdR's o Certificado da empresa de Consultoria Ambiental e CV's dos integrantes da equipa técnica.

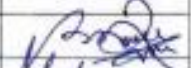
### 14. Conclusão

A CTAIA considera que os TdR's reúnem os requisitos exigidos para a elaboração do Estudo Ambiental Simplificado, sendo por isso apreciados e aprovados de acordo com a legislação vigente.

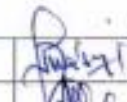
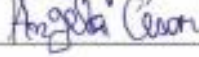
### 15. Recomendação

- ✓ Face as constatações acima, o proponente deverá integrar no EAS.

#### A Equipa Técnica de Revisão de Projectos:

| Nome              | Instituição | Especialidade               | Assinatura                                                                            |
|-------------------|-------------|-----------------------------|---------------------------------------------------------------------------------------|
| Boaventura Manuel | SPA         | Técnico Superior N1         |  |
| Ali Armando       | SPA         | Téc. Sup. Adm , Pública. N1 |  |

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|                       |      |                             |                                                                                     |
|-----------------------|------|-----------------------------|-------------------------------------------------------------------------------------|
| Mendes D. S. Muzé     | DPIC | Técnico Superior N1         |  |
| Alcino A. S. Fernando | DPCT | Ins. e Técn. Ped. N1        |  |
| Ângela C. Augusto     | SPEI | Técn. Sup. Rec. Minerais N1 |  |

Nampula, 10 de Outubro de 2025

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Serviço Provincial do Ambiente, Av. do Trabalho, 1º Andar, Telefone 26216479, Telefax 26216478 - Nampula

## Annex B

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### Results of Laboratory Analyses



Laboratório de Controle de Qualidade

## RELATÓRIO DE ENSAIO Nr.: 250434

Cliente: Enviestudos, Lda

Versão: 1

Cliente Nr: 131

Estado: Boletim Definitivo

Morada: Rua Viana Mota, 1º Andar 72 - Maputo,

|                              |                                                |                            |                     |
|------------------------------|------------------------------------------------|----------------------------|---------------------|
| Ponto de Amostragem:         | Rio Natete (1)                                 | Data de Colheita:          | 13/09/2025 (1)      |
| Referência:                  | Águas dos Rios (1)                             | Data de Receção:           | 15/09/2025          |
| Descrição da Amostra:        | Ponte sobre o Rio Natete - 5m Profundidade (1) | Data de Início da Análise: | 15/09/2025          |
| Responsável pela Amostragem: | Cliente                                        | Data de Fim da Análise:    | 30/09/2025          |
|                              |                                                | Data de Emissão:           | 30/09/2025 13:05:00 |

| Ensaio                                  | Método de Análise              | Resultados      | Unidades  | Valor Limite |
|-----------------------------------------|--------------------------------|-----------------|-----------|--------------|
| <b>Físico-Química</b>                   |                                |                 |           |              |
| Determinação de pH *                    | MI(IT/SwissLab/FQL/007)(Rev.6) | 6,21 (a 23,9°C) | Sorensen  | ---          |
| Sólidos Suspensos Totais (STS) *        | SMEWW 2540 D, 24ª Edição       | 24              | mg/L      | ---          |
| Oxigênio Dissolvido *                   | SMEWW 4500- O D, 24ª Edição    | 4,9             | mg/L      | ---          |
| Demanda Bioquímica de Oxigenio (DBO5) * | SMEWW 5210D, 24ª Edição        | 34              | mg/L      | ---          |
| Turvação *                              | SMEWW 2130B, 24ª Edição        | 17,4            | NTU       | ---          |
| Cheiro *                                | SMEWW 2150 B, 24ª Edição       | Presente        |           | ---          |
| Óleos e Graxas *                        | SMEWW 5520 D, 24ª Edição       | < 1,0 (LQ)      | mg/L      | ---          |
| <b>Microbiologia</b>                    |                                |                 |           |              |
| Quantificação de Coliformes Fecais *    | MI/PE/SwissLab/ML/003/Rev05    | 890             | Ufc/100mL | ---          |

**Observações**

Os resultados se referem apenas aos itens ensaiados e se aplicam às amostras conforme rececionadas.  
Os dados fornecidos pelo cliente são da sua responsabilidade. (1)

Joel Macandja

(Gestor da Qualidade)

Os ensaios assinalados com \* não estão incluídos no âmbito de acreditação.

A amostragem não está incluída no âmbito da acreditação.

A reprodução proibida sem a permissão do laboratório, salvo na íntegra.

Sempre que o resultado da amostra estiver associado ao sinal (±), quer dizer que a amostra apresenta valor da incerteza associada ao respectivo ensaio.

A incerteza é determinada com o grau de confiança aproximadamente 95% e k igual a 2 para uma distribuição normal.

As opiniões e apreciações estão fora do âmbito da acreditação. Na declaração da conformidade para a regra de decisão não é contabilizada a incerteza.

MLIT/Swisslab - Método interno de instrução de trabalho; U - Incerteza expandida; LQ - Limite de Quantificação; UFC - Unidades Formadoras de Colónias; NTU - Nephelometric Turbidity Units; TCU - True Colour Unit; mg/L - miligramas por litro, µg/L - microgramas por litro, µs/cm - microsiemens por centímetro, MI/PE/SwissLab - Método Interno de Procedimento de Ensaio; SMEWW - Standard Method of Examination of Water and Wastewater; EPA - Environmental Protection Agency; DIN - Deutsches Institut für Normung (Instituto Alemão para Normalização); BS - British Standard; EN - European Standard; NP - Norma Portuguesa; ISO - International Organization for Standardization; AOAC - Association of Official Agricultural Chemists; NIR - Near Infrared Spectroscopy, CMMEF - Compendium of Methods for the Microbiological Examination of Foods.

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Página: 1/1

SwissLab - Laboratório de Controle de Qualidade, E-mail: swisslab.moz@gmail.com, Tel: (+258) 21 780 405, Tel2: (+258) 84/87 30 08 193, Avenida da Nampacha, nr 2229 Q.20, Bairro do Fomento - Matola

Prepared to:  
Administração Nacional de Estradas (ANE)  
Avenida de Moçambique, nº 1225, CP 403  
Tel.: +258-21476163 | Bairro Luís Cabral, Maputo

Prepared by:  
Enviestudos, Lda.  
Rua Viana da Mota nº 72, 1º Andar  
Tel.+25882/84-3289330, Município de Maputo



Laboratório de Controle de Qualidade

## RELATÓRIO DE ENSAIO Nr.: 250691

Cliente: Enviestudos, Lda

Versão: 1

Cliente Nr: 131

Estado: Boletim Definitivo

Morada: Rua Viana Mota, 1º Andar 72 - Maputo,

|                              |                    |                            |                     |
|------------------------------|--------------------|----------------------------|---------------------|
| Ponto de Amostragem:         | Rio Natete (1)     | Data de Colheita:          | 20/10/2025 (1)      |
| Referência:                  | Águas dos Rios (1) | Data de Receção:           | 21/10/2025          |
| Descrição da Amostra:        | NI (1)             | Data de Início da Análise: | 21/10/2025          |
| Responsável pela Amostragem: | Cliente            | Data de Fim da Análise:    | 03/11/2025          |
|                              |                    | Data de Emissão:           | 04/11/2025 12:34:00 |

| Ensaio                                  | Método de Análise              | Resultados | Unidades  | Valor Limite |
|-----------------------------------------|--------------------------------|------------|-----------|--------------|
| <b>Físico-Química</b>                   |                                |            |           |              |
| Determinação de pH *                    | MI/IT/SwissLab/FQL/007 (Rev.6) | 6,26       | Sorensen  | ---          |
| Sólidos Suspensos Totais (STS) *        | SMEWW 2540 D, 24ª Edição       | 437        | mg/L      | ---          |
| Oxigênio Dissolvido *                   | SMEWW 4500- O D, 24ª Edição    | 1,7        | mg/L      | ---          |
| Demanda Bioquímica de Oxigenio (DBO5) * | SMEWW 5210D, 24ª Edição        | 19         | mg/L      | ---          |
| Turvação *                              | SMEWW 2130B, 24ª Edição        | 170        | NTU       | ---          |
| Cheiro *                                | SMEWW 2150 B, 24ª Edição       | Presente   |           | ---          |
| Óleos e Graxas *                        | SMEWW 5520 D, 24ª Edição       | < 1,0 (LQ) | mg/L      | ---          |
| <b>Microbiologia</b>                    |                                |            |           |              |
| Quantificação de Coliformes Fecais *    | MI/PE/SwissLab/ML/003/Rev05    | 58         | Ufc/100mL | ---          |

**Observações**

Os resultados se referem apenas aos itens ensaiados e se aplicam às amostras conforme rececionadas.  
Os dados fornecidos pelo cliente são da sua responsabilidade. (1)

Joel Macandja

(Gestor da Qualidade)

Os ensaios assinalados com \* não estão incluídos no âmbito de acreditação.

A amostragem não está incluída no âmbito da acreditação.

A reprodução proibida sem a permissão do laboratório, salvo na íntegra.

Sempre que o resultado da amostra estiver associado ao sinal (±), quer dizer que a amostra apresenta valor da incerteza associada ao respectivo ensaio.

A incerteza é determinada com o grau de confiança aproximadamente 95% e k igual a 2 para uma distribuição normal.

As opiniões e apreciações estão fora do âmbito da acreditação. Na declaração da conformidade para a regra de decisão não é contabilizada a incerteza.

MI/IT/SwissLab - Método Interno de Instrução de trabalho; U - Incerteza expandida; LQ - Limite de Quantificação; UFC - Unidades Formadoras de Colónias; NTU - Nephelometric Turbidity Units; TCU - True Colour Unit; mg/L - miligramas por litro, µg/L - microgramas por litro, µs/cm - microsiemens por centímetro, MI/PE/SwissLab - Método Interno de Procedimento de Ensaio; SMEWW - Standard Method of Examination of Water and Wastewater; EPA - Environmental Protection Agency; DIN - Deutsches Institut für Normung (Instituto Alemão para Normalização); BS - British Standard; EN - European Standard; NP - Norma Portuguesa; ISO - International Organization for Standardization; AOAC - Association of Official Agricultural Chemists; NIR - Near Infrared Spectroscopy, CMMEF - Compendium of Methods for the Microbiological Examination of Foods.

Prepared to:  
Administração Nacional de Estradas (ANE)  
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Tel.: +258-21476163 | Bairro Luís Cabral, Maputo

Prepared by:  
Enviestudos, Lda.  
Rua Viana da Mota nº 72, 1º Andar  
Tel.+25882/84-3289330, Município de Maputo



Laboratório de Controle de Qualidade

## RELATÓRIO DE ENSAIO Nr.: 250692

**Ciente:** Enviestudos, Lda  
**Ciente Nr:** 131  
**Morada:** Rua Viana Mota, 1º Andar 72 - Maputo,

**Versão:** 1  
**Estado:** Boletim Definitivo

**Ponto de Amostragem:** Furo Natete (1)  
**Referência:** Água Bruta (1)  
**Descrição da Amostra:** N2 (1)  
**Responsável pela Amostragem:** Cliente

**Data de Colheita:** 20/10/2025 (1)  
**Data de Receção:** 21/10/2025  
**Data de Início da Análise:** 21/10/2025  
**Data de Fim da Análise:** 03/11/2025  
**Data de Emissão:** 04/11/2025 12:34:00

| Ensaio                                  | Método de Análise              | Resultados | Unidades | Valor Limite |
|-----------------------------------------|--------------------------------|------------|----------|--------------|
| <b>Físico-Química</b>                   |                                |            |          |              |
| Determinação de pH *                    | MI/IT/SwissLab/FQL/007)(Rev.6) | 5,56       | sorensen | ---          |
| Sólidos Suspensos Totais (STS) *        | SMEWW 2540 D, 24ª Edição       | 47         | mg/L     | ---          |
| Oxigénio Dissolvido *                   | SMEWW 4500- O D, 24ª Edição    | 3,7        | mg/L     | ---          |
| Demanda Bioquímica de Oxigenio (DBO5) * | SMEWW 5210D, 24ª Edição        | 7          | mg/L     | ---          |
| Turvação *                              | SMEWW 2130B, 24ª Edição        | 26,8       | NTU      | ---          |
| Cheiro *                                | SMEWW 2150 B, 24ª Edição       | Ausente    |          | ---          |
| Óleos e Graxas *                        | SMEWW 5520 D, 24ª Edição       | < 1,0 (LQ) | mg/L     | ---          |

**Microbiologia**

|                                      |                             |    |           |     |
|--------------------------------------|-----------------------------|----|-----------|-----|
| Quantificação de Coliformes Fecais * | MI/PE/SwissLab/ML/003/Rev05 | 23 | Ufc/100mL | --- |
|--------------------------------------|-----------------------------|----|-----------|-----|

**Observações**

Os resultados se referem apenas aos itens ensaiados e se aplicam às amostras conforme rececionadas.  
Os dados fornecidos pelo cliente são da sua responsabilidade. (1)

Joel Macandja

(Gestor da Qualidade)

Os ensaios assinalados com \* não estão incluídos no âmbito de acreditação.

A amostragem não está incluída no âmbito de acreditação.

A reprodução proibida sem a permissão do laboratório, salvo na íntegra.

Sempre que o resultado da amostra estiver associado ao sinal (±), quer dizer que a amostra apresenta valor da incerteza associada ao respectivo ensaio.

A incerteza é determinada com o grau de confiança aproximadamente 95% e é igual a 2 para uma distribuição normal.

As opiniões e apreciações estão fora do âmbito da acreditação. Na declaração da conformidade para a regra de decisão não é contabilizada a incerteza.

MI/IT/Swisslab - Método interno de instrução de trabalho; U - Incerteza expandida; LQ - Limite de Quantificação; UFC - Unidades Formadoras de Colónias; NTU - Nephelometric Turbidity Units; TCU - True Colour Unit; mg/L - miligramas por litro, µg/L - microgramas por litro, µs/cm - microsiemens por centímetro, MI/PE /SwissLab - Método Interno de Procedimento de Ensaio; SMEWW - Standard Method of Examination of Water and Wastewater; EPA - Environmental Protection Agency; DIN - Deutsches Institut für Normung (Instituto Alemão para Normalização); BS - British Standard; EN - European Standard; NP - Norma Portuguesa; ISO - International Organization for Standardization; AOAC - Association of Official Agricultural Chemists; NIR - Near Infrared Spectroscopy, CMMEF - Compendium of Methods for the Microbiological Examination of Foods.

RE.QMS.001\_R03

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Annex C

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Routine Environmental and  
Social Inspection Form

Project: \_\_\_\_\_  
 Location: \_\_\_\_\_  
 Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_ Time: \_\_\_\_  
 Inspection Team: \_\_\_\_\_  
 Environmental Supervisor: \_\_\_\_\_

### 1. General Conditions of the Construction Site and Work Area

| Item                                               | Compliance<br>(Yes/No) | Remarks | Corrective<br>Actions |
|----------------------------------------------------|------------------------|---------|-----------------------|
| Work area properly demarcated and signposted       |                        |         |                       |
| Construction yard and temporary accesses organized |                        |         |                       |
| Material storage on impermeable flooring           |                        |         |                       |
| Solid waste containers properly labeled and in use |                        |         |                       |
| Safe storage of fuels and chemical products        |                        |         |                       |

### 2. Soil and Vegetation

| Item                                           | Compliance<br>(Yes/No) | Remarks | Corrective<br>Actions |
|------------------------------------------------|------------------------|---------|-----------------------|
| Minimization of vegetation removal             |                        |         |                       |
| Preservation of native species and large trees |                        |         |                       |
| Sediment barriers installed                    |                        |         |                       |
| Topsoil properly stored and protected          |                        |         |                       |
| Temporary revegetation or cover implemented    |                        |         |                       |

### 3. Water and Hydrological Resources

| Item                                                          | Compliance<br>(Yes/No) | Remarks | Corrective<br>Actions |
|---------------------------------------------------------------|------------------------|---------|-----------------------|
| Drainage ditches and sedimentation ponds functioning properly |                        |         |                       |
| Absence of fuel, oil, or cement spills                        |                        |         |                       |
| Monitoring of water quality (turbidity, pH, suspended solids) |                        |         |                       |
| Washing of vehicles near the river strictly prohibited        |                        |         |                       |

### 4. Fauna, Habitats, and Sensitive Areas

| Item                                           | Compliance<br>(Yes/No) | Remarks | Corrective<br>Actions |
|------------------------------------------------|------------------------|---------|-----------------------|
| Ecological corridors preserved                 |                        |         |                       |
| Wildlife presence observed without disturbance |                        |         |                       |
| Nesting sites and sensitive habitats protected |                        |         |                       |
| Hunting or animal capture prohibited           |                        |         |                       |

### 5. Air Quality and Noise

| Item                                                      | Compliance (Yes/No) | Remarks | Corrective Actions |
|-----------------------------------------------------------|---------------------|---------|--------------------|
| Dust control measures in place (spraying, covered trucks) |                     |         |                    |
| Noise levels within acceptable limits ( $\leq 55$ dB(A))  |                     |         |                    |
| Machinery properly maintained                             |                     |         |                    |

### 6. Safety, Traffic, and Social Conduct

| Item                                                                 | Compliance (Yes/No) | Remarks | Corrective Actions |
|----------------------------------------------------------------------|---------------------|---------|--------------------|
| Use of PPE by all workers                                            |                     |         |                    |
| Adequate traffic and safety signage in place                         |                     |         |                    |
| Environmental and social training conducted                          |                     |         |                    |
| Worker behavior appropriate (no conflicts, respect toward community) |                     |         |                    |

### 7. Waste and Materials

| Item                                   | Compliance (Yes/No) | Remarks | Corrective Actions |
|----------------------------------------|---------------------|---------|--------------------|
| Segregation of hazardous waste         |                     |         |                    |
| Safe storage of construction materials |                     |         |                    |
| Waste collected from operational areas |                     |         |                    |

### 8. General Observations and Recommendations

Inspector's Signature: \_\_\_\_\_

Environmental Supervisor's Signature: \_\_\_\_\_

Annex D  
GRM Form

Project: \_\_\_\_\_  
Location: \_\_\_\_\_  
Date of Registration: \_\_\_\_ / \_\_\_\_ / \_\_\_\_  
Protocol Number: \_\_\_\_\_

**1. Complainant Information**

| Field                                | Details to be Filled          |
|--------------------------------------|-------------------------------|
| Full Name                            |                               |
| Gender                               | ( ) Male ( ) Female ( ) Other |
| Age                                  |                               |
| Contact (phone/email)                |                               |
| Place of Residence                   |                               |
| Legal Representative (if applicable) |                               |

**2. Type of Complaint / Grievance**

| Category      | Tick (✓) |
|---------------|----------|
| Environmental | ( )      |
| Social        | ( )      |
| Labor-related | ( )      |
| Safety        | ( )      |
| Other:        | ( )      |

Detailed Description of the Complaint / Grievance:

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Date of Occurrence: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Location of Incident: \_\_\_\_\_

**3. Evidence and Attachments**

- Photos, videos, documents, testimonies:

- Additional remarks:

**4. Initial Assessment**

| Criteria                     | Options                                            |
|------------------------------|----------------------------------------------------|
| Severity                     | ( ) Low ( ) Medium ( ) High                        |
| Urgency                      | ( ) Immediate ( ) Within 7 days ( ) Within 30 days |
| Responsible Area for Action: | _____                                              |

**5. Proposed Measures and Corrective Actions**

Measure / Action Responsible Person / Entity Deadline Status

**6. Complainant Confirmation**

I hereby declare that the information provided is true and I authorize the follow-up and resolution process of this complaint.

Complainant's Signature: \_\_\_\_\_

Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

**7. Internal Registration and Follow-Up**

| Date of Receipt | Responsible for Registration | Protocol Number |
|-----------------|------------------------------|-----------------|
|-----------------|------------------------------|-----------------|

| Date of Update | Action Taken | Responsible | Remarks |
|----------------|--------------|-------------|---------|
|----------------|--------------|-------------|---------|

**Annex E**

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**Incident and Emergency  
Registration Forms**

### D.1 – Incident/Accident Registration Form

| Field                                  | Information to be Completed                                                                                                                                                                  |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date and time of incident:             |                                                                                                                                                                                              |
| Location:                              |                                                                                                                                                                                              |
| Type of incident:                      | <input type="checkbox"/> Personal Accident<br><input type="checkbox"/> Fire<br><input type="checkbox"/> Spill<br><input type="checkbox"/> Traffic Accident<br><input type="checkbox"/> Other |
| Brief description of the incident:     |                                                                                                                                                                                              |
| Probable causes:                       |                                                                                                                                                                                              |
| Injuries / damages:                    |                                                                                                                                                                                              |
| First aid provided:                    |                                                                                                                                                                                              |
| Equipment used:                        |                                                                                                                                                                                              |
| Initial response lead:                 |                                                                                                                                                                                              |
| Communication made to:                 |                                                                                                                                                                                              |
| Immediate corrective measures:         |                                                                                                                                                                                              |
| Recommendations for future prevention: |                                                                                                                                                                                              |
| Name of reporting officer:             |                                                                                                                                                                                              |
| Signature:                             |                                                                                                                                                                                              |
| Date:                                  |                                                                                                                                                                                              |

### D.3 – Periodic Inspection Form for Emergency Equipment

| Equipment Type                    | Location           | Status                                                                       | Inspection Date | Next Inspection | Observations |
|-----------------------------------|--------------------|------------------------------------------------------------------------------|-----------------|-----------------|--------------|
| CO <sub>2</sub> Fire Extinguisher | Workshop           | <input type="checkbox"/> Good<br><input type="checkbox"/> Needs Repair       |                 |                 |              |
| First Aid Kit                     | Office             | <input type="checkbox"/> Complete<br><input type="checkbox"/> Incomplete     |                 |                 |              |
| Communication Radio               | Construction Site  | <input type="checkbox"/> Functional<br><input type="checkbox"/> Faulty       |                 |                 |              |
| Generator / Lantern               | Warehouse          | <input type="checkbox"/> Operational<br><input type="checkbox"/> Inoperative |                 |                 |              |
| Contact List                      | Posted at Entrance | <input type="checkbox"/> Updated<br><input type="checkbox"/> Outdated        |                 |                 |              |

Annex F  
Simulation and Training Log

| Date | Exercise Type | Location | Nº of Participants | Response Time | Observations / Lessons Learned |
|------|---------------|----------|--------------------|---------------|--------------------------------|
|      |               |          |                    |               |                                |
|      |               |          |                    |               |                                |
|      |               |          |                    |               |                                |
|      |               |          |                    |               |                                |