



CARRINHO GROUP, SA

**ENVIRONMENTAL AND SOCIAL IMPACT
STUDY OF THE OCEAN TERMINAL
"SILOS" GRAIN TERMINAL IN LOBITO-
BENGUELA**

TECHNICAL REPORT

Prepared by: HSG-Construção, Engenharia e Comércio, Lda



SEPTEMBER 2024

Luanda-Angola



INITIAL NOTE

This document is a Technical Report on the Environmental and Social Impact Study of the OCEAN GRAIN TERMINAL in the province of Benguela, municipality of Lobito. It was prepared by the company HSG - CONSTRUÇÃO, ENGENHARIA E COMÉRCIO, LDA

Luanda, September 2024

Reviewed by HSG (consultant)

TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	I
2	INTRODUCTION.....	1
2.1	GENERAL INFORMATION	1
2.2	IDENTIFICATION OF THE PROJECT PROPOSER	4
2.3	IDENTIFICATION OF THE COMPANY RESPONSIBLE FOR PREPARING THE EIAs 4	
2.4	TECHNICAL TEAM RESPONSIBLE FOR THE EIAs.....	5
3	LEGAL FRAMEWORK.....	6
3.1	National legal framework.....	6
3.2	International Protocols and Agreements.....	10
3.3	African Development Bank Integrated Safeguards System	11
3.4	Differences between Angolan Legislation and the Requirements of the AfDB and DFC.....	15
3.5	Environmental and Social Standards.....	1
3.6	NATIONAL PLANS, PROGRAMS, AND STRATEGIES	2
3.6.1	National Development Plan 2023-2027	2
3.6.2	National Plan to Promote Grain Production.....	3
3.6.3	National Food and Nutrition Security Strategy 2024-2034 (ENSAN II) 4	
3.6.4	National Environmental Quality Program.....	6
3.6.5	National Water Plan	6
3.6.6	National Irrigation Master Plan (PLANIRRIGA).....	7
3.6.7	National Strategy for Climate Change 2022-2035	8
3.6.8	National Action Program to Combat Desertification (PANCD).....	10
4	JUSTIFICATION OF THE EIAs	12
4.1	OBJECTIVES OF THE EIAs	14
4.2	SCOPE OF THE EIAs.....	15
4.2.1	Project scope and location.....	15
4.2.2	Confrontations	16
4.2.3	Access routes.....	17
4.3	THEMATIC SCOPE-DESCRIPTORS UNDER ANALYSIS	18
4.4	EIA METHODOLOGY	18

4.5	ENTITIES CONSULTED.....	21
5	PROJECT DESCRIPTION	22
5.1	JUSTIFICATION FOR THE LOCATION OF THE PROJECT	22
5.2	PROJECT ALTERNATIVE.....	23
5.2.1	Location alternatives	23
5.2.2	Technological Alternative	24
5.2.3	Temporary Alternative	24
5.2.4	Zero Alternative (non-execution of the project).....	25
5.3	GEOGRAPHICAL CONTEXT	26
5.4	GENERAL CHARACTERISTICS OF THE PROJECT	30
5.4.1	Mooring Pier	30
5.4.2	Container Yard	30
5.4.3	Quay Cranes	31
5.4.4	Cargo Handling Equipment.....	32
5.4.5	Temporary Storage Facilities	32
5.4.6	Port Management Systems.....	32
5.4.7	Land Access	32
5.4.8	Administrative and Support Facilities.....	33
5.4.9	Safety and Environmental Measures:.....	33
5.5	Activities to be carried out and Materials	33
5.5.1	Materials.....	33
5.5.2	Flooring	33
5.5.3	Earthworks	34
5.5.4	Support infrastructure.....	34
5.5.5	Expected consumption	34
5.5.6	Construction information	36
5.5.7	Labor	36
5.5.8	Schedule	37
5.5.9	Investment Value.....	37
5.6	GENERAL AND OPERATIONAL CHARACTERISTICS OF SILOS.....	38
5.6.1	Process description.....	39
5.6.2	Importance of water content in stored grains.....	41

5.6.3	Interference of temperature on the quality of stored grains	42
5.6.4	Characteristics of stored grain mass	42
5.6.5	Losses occurring during grain storage	43
5.6.6	Warning signs and damage in grain storage	44
5.6.7	Contaminants in the external environment of the grain storage unit	45
5.6.8	Insects and pests	46
5.6.9	Factors contributing to insect pest attacks	46
5.6.10	Integrated Pest Management (IPM) for insect control in storage facilities storage facilities	52
6	CHARACTERIZATION OF THE ENVIRONMENT AFFECTED BY THE PROJECT	54
6.1	GENERAL CONSIDERATIONS	54
6.2	DEFINITION OF THE PROJECT'S AREA OF INFLUENCE	54
6.2.1	Directly affected area (DAA)	55
6.2.2	Area of Direct Influence (ADI)	56
6.2.3	Area of Indirect Influence (AII)	56
6.2.4	Regional Area of Influence (RAI)	57
6.3	CLIMATE	57
6.3.1	General Considerations	57
6.3.2	Climate Classification	58
6.3.3	Characterization of Local Climate	59
6.3.4	Temperature	60
6.3.5	Precipitation	61
6.3.6	Evaporation and Evapotranspiration	62
6.3.7	Cloudiness	62
6.4	GEOLOGY AND GEOMORPHOLOGY	62
6.4.1	General considerations	62
6.4.2	Geological Setting	63
6.4.3	Geomorphological Context	64
6.4.4	Local Geomorphology	66
6.5	SOILS AND LAND USE	67
6.5.1	General Considerations	67
6.5.2	Soil Characterization	68

6.5.3	Characterization of local soil.....	69
6.5.4	Characterization of Land Occupation and Use	70
6.6	SURFACE AND GROUNDWATER RESOURCES	72
6.6.1	General considerations	72
6.6.2	Surface Water Resources	72
6.6.3	Local Hydrography.....	74
6.6.4	PHYSICAL OCEANOGRAPHY.....	75
6.7	UNDERGROUND WATER RESOURCES	76
6.7.1	Hydrogeological Framework.....	76
6.7.2	Vulnerability.....	77
6.7.3	Water Uses	77
6.8	FLORA AND FAUNA	78
6.8.1	General Considerations	78
6.8.2	Methodology	80
6.8.3	Flora and Vegetation	81
6.8.4	Characterization of the Biotic Environment of the Project Area	82
6.8.5	Fauna	89
6.8.6	Conservation Areas	98
6.9	LANDSCAPE.....	100
6.9.1	General considerations	100
6.9.2	Landscape Units	100
6.9.3	Landscape Characterization	101
6.9.4	Landscape Assessment.....	104
6.10	AIR QUALITY	106
6.10.1	General Considerations	106
6.10.2	Characterization of Air.....	106
6.10.3	Characterization of Air Quality.....	107
6.11	SOUND ENVIRONMENT	107
6.11.1	General Considerations	107
6.11.2	Noise Levels and Effects of Noise on Health	108
6.11.3	Characterization of the Acoustic Reference Framework.....	109
6.12	SOCIOECONOMICS	111

6.12.1	General Considerations.....	111
6.12.2	Administrative Framework.....	111
6.12.3	Demographics and Population.....	112
6.12.4	Employment.....	115
6.12.5	Economic activities.....	117
6.12.6	Fishing.....	121
6.12.7	Livestock farming.....	123
6.12.8	Social Facilities	134
6.13	Infrastructure.....	139
6.13.1	General Considerations	139
6.13.2	Electricity Supply Network	139
6.13.3	Water Supply Network	141
6.13.4	Basic sanitation.....	143
6.13.5	Road Network and Transportation.....	144
6.14	LAND USE PLANNING.....	145
6.14.1	General Considerations	145
6.14.2	Municipal Master Plan	145
6.14.3	Coastal Zone Management Plan (PNOOC).....	146
6.15	HISTORICAL AND CULTURAL HERITAGE	148
6.15.1	General considerations	148
6.15.2	Inventory of Existing Heritage Occurrences	148
6.16	PROJECTION OF THE CURRENT SITUATION IN THE ABSENCE OF THE PROJECT	151
7	ENVIRONMENTAL IMPACT ASSESSMENT.....	152
7.1	METHODOLOGY AND EVALUATION CRITERIA	152
7.2	MAIN ACTIONS AND POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS	157
7.17	VULNERABILITY ANALYSIS OF THE "SILOS" PROJECT IN THE FACE OF THE EFFECTS OF CLIMATE CHANGE	198
7.18	SUMMARY OF ENVIRONMENTAL IMPACTS	200
7.19	CLASSIFICATION OF ENVIRONMENTAL AND SOCIAL IMPACTS IN TERMS OF THEIR SIGNIFICANCE.....	205
8	MITIGATION MEASURES.....	213
8.1	GENERAL CONSIDERATIONS.....	213
8.2	GENERAL AND SPECIFIC MEASURES.....	214

9	CUMULATIVE IMPACTS	238
10	PROGRAM FOR MONITORING AND TRACKING ENVIRONMENTAL AND SOCIAL IMPACTS	239
11	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN	240
11.1.1	General considerations	240
11.2	MONITORING PROGRAM FOR EFFLUENTS STORED IN SEPTIC TANKS	241
11.2.1	Objective.....	241
11.2.2	Justification.....	241
11.2.3	Parameters to be analyzed and monitoring frequency	241
11.2.4	Monitoring methods	242
11.2.5	Responsibilities.....	242
11.3	WORKER SAFETY AND HEALTH PLAN.....	242
11.3.1	Objective.....	242
11.3.2	Justification.....	243
11.3.3	Parameter to be analyzed and monitoring frequency	243
11.3.4	Monitoring method	243
11.3.5	Responsibilities.....	243
11.4	ATMOSPHERIC EMISSIONS AND AIR QUALITY MONITORING PROGRAM AIR QUALITY	244
11.4.1	Objective.....	244
11.4.2	Justification.....	244
11.4.3	Parameter to be analyzed and monitoring frequency	245
11.4.4	Monitoring method	245
11.4.5	Responsibility	245
11.5	NOISE LEVEL MONITORING PROGRAM	246
11.5.1	Objective.....	246
11.5.2	Justification.....	246
11.5.3	Parameter to be analyzed and monitoring frequency	247
11.5.4	Monitoring method	247
11.5.5	Responsibility	247
11.6	ENVIRONMENTAL EDUCATION PROGRAM.....	248
11.6.1	Objective.....	248
11.6.2	Justification.....	248

11.6.3	Parameter to be analyzed and monitoring frequency	248
11.6.4	Monitoring method.....	249
11.6.5	Responsibility	249
11.7	STAKEHOLDER COMMUNICATION AND RELATIONSHIP PROGRAM	249
11.7.1	Objectives	249
11.7.2	Justification.....	249
11.7.3	Parameter to be analyzed and monitoring frequency	250
11.7.4	Methods	250
11.7.5	Responsibility	250
11.8	WASTE MONITORING AND MANAGEMENT PROGRAM	251
11.8.1	Objective.....	251
11.8.2	Justification.....	251
11.8.3	Parameter to be analyzed and monitoring frequency	252
11.8.4	Monitoring method.....	252
11.8.5	Responsibility	252
11.9	BIODIVERSITY MONITORING PROGRAM.....	253
11.9.1	Objectives	253
11.9.2	Justification.....	253
11.9.3	Parameters to be analyzed and monitoring frequency.....	254
Parameters	254
11.9.4	Methods	254
11.9.5	Responsibility	254
11.10	EMERGENCY PLAN.....	255
11.10.1	Objectives	255
11.10.2	Justification.....	255
11.10.3	Parameters to be analyzed and Monitoring Frequency	256
11.10.4	Methods	256
11.10.5	Responsibility	257
11.11	PEST CONTROL AND COMBAT PLAN.....	257
11.11.1	Objectives	257
11.11.2	Justification.....	257
11.11.3	Parameters to be analyzed and Monitoring Frequency	258

11.11.4	Methods	258
11.11.5	Responsibilities	258
11.12	MECHANISM FOR SUBMITTING EIAs MONITORING REPORTS	259
11.12.1	Objectives	259
11.12.2	Justification	259
11.12.3	Parameter to be analyzed and monitoring frequency	260
11.12.4	Method	260
11.12.5	Responsibility	260
11.13	ENVIRONMENTAL AND SOCIAL PERFORMANCE AUDITS	261
11.13.1	Objectives	261
11.13.2	Justification	261
11.13.3	Parameters to be Analyzed and Monitoring Frequency	262
11.13.4	Methods	262
11.13.5	Responsibility	262
11.14	COSTS OF IMPLEMENTING MONITORING PROGRAMS	264
12	INSTITUTIONAL CAPACITIES AND STRENGTHENING PLAN	265
13	PUBLIC CONSULTATION AND PARTICIPATION	270
13.1	GENERAL CONSIDERATIONS	270
13.2	PURPOSE OF PUBLIC CONSULTATIONS	270
13.3	LEGAL FRAMEWORK	270
13.4	METHODOLOGY	272
13.5	SUMMARY OF EVENTS HELD	273
14	TECHNICAL AND KNOWN GAPS	277
15	CONCLUSIONS AND RECOMMENDATIONS	278
16	BIBLIOGRAPHY	280
17	APPENDICES	286

INDEX OF FIGURES

Figure 1 - Geographical location of the project implementation area	15
Figure 2 - Map of confrontations.	16
Figure 3 - Access routes map.....	17
Figure 4 - Flow diagram (1).....	28
Figure 5 – Flow diagram (2).....	29
Figure 6: Mooring dock	30
Figure 7: Container yard	31
Figure 8: Quay crane.....	31
Figure 9: Cargo handling equipment.....	32
Figure 10: Neighboring developments (Sezil Lobito and mining terminal).....	36
Figure 11 - Diagram of grain storage stages using a conventional system.....	40
Figure 12 - Factors that most affect grain quality during storage.....	41
Figure 13 - Grain breakage during unloading.....	43
Figure 14 - Grain contamination by fungi	44
Figure 15 - Biological, physical, and chemical contaminants in stored grains	45
Figure 16 - Map of the area of direct influence	56
Figure 17 - Map of the indirect area of influence.	57
Figure 18 – Climate of Benguela.....	59
Figure 19 – Climate map.	60
Figure 20 – Temperature map.....	61
Figure 21 – Precipitation map.....	61
Figure 22 – Geological map of Angola	63
Figure 23 – Geological map.....	64
Figure 24 - Main geomorphological units of Angola (According to Diniz).....	64
Figure 25 – Geomorphology map	67
Figure 26 - Generalized soil map of Angola	68
Figure 27 - Soil map	69
Figure 28 - River basins of Angola.....	73

Figure 29 – Map of the Catumbela River basin (Source: IGCA 2001).....	74
Figure 30 - Type of aquifers and productivity	76
Figure 31 - Biomes of Angola Source: HUNTLEY (2023).....	80
Figure 32 - Ecoregions of Angola Source: HUNTLEY (2023).....	80
Figure 33 - Ecoregions of Angola with indication of the area under study.....	83
Figure 34: Coastal zone of Lobito Bay.....	84
Figure 35: Panorama of the port area of Lobito Bay	85
Figure 36: Flamingos in Lobito Bay.....	86
Figure 37: Main plant groups in the project area: <i>Calotropis gigantea</i> (A); <i>Moringa oleifera</i> (B); <i>Sesuvium portulacastrum</i> (C) and <i>Abutilon angulatum</i> (D).	87
Figure 38: Biodiversity survey area (fauna and flora) in Lobito Bay.....	89
Figure 39: Lobito mangrove biodiversity survey areas	89
Figure 40: Record of marine specimens inhabiting Lobito Bay.....	90
Figure 41: Photographic record of birds inhabiting the Lobito mangroves.....	90
Figure 42: Main benthic groups in the area: <i>Cardisoma armatum</i> (A); <i>Semibalanus balanoides</i> (B) and <i>Penaeus sp</i> (C).....	93
Figure 43: Some fish species inhabiting the ecosystems of the area: <i>Diplodus sargus</i> (A); <i>Sphoeroides sp.</i> (B); <i>Synodus sp.</i> (C) and <i>Lithognathus mormyrus</i> (D).....	94
Figure 44: Some bird species from the mangrove zone and Lobito Bay: <i>Phoenicopterus minor</i> (A); <i>Ardea cinerea</i> (B); <i>Microcarbo africanus</i> (C) and <i>Egretta garzetta</i> (D).....	95
Figure 45: Conservation areas in Angola: • 1 Maiombe • 2 Quiçama • 3 Cangandala • 4 Cameia • 5 Iona • 6 Bicular • 7 Mupa • 8 Luengue-Luiana • 9 Luando • 11 Chimalavera • 12 Búfalo • 13 Namibe. (Mavinga is not shown on this map due to a lack of complete data regarding the boundaries of its classification).....	99
Figure 46 - Administrative division of Benguela	111
Figure 47 - Population by gender, 2014	112
Figure 48: Projected population of Benguela by municipality	113
Figure 49: Population projection for Benguela and Lobito.....	114
Figure 50: Port of Lobito	129
Figure 51: CFB Lobito railway station.....	129

Figure 52: Bic-Lobito bank branch131

Figure 53: Lobito Regional Hospital.....138

Figure 54: Main sources of lighting in the urban area of Lobito (INE, 2016)140

Figure 55: Land use map – Lobito147

Figure 56: Lobito Lighthouse and Fort of São S. do Egípto150

Figure 57: Historical monument of the Zaire library ship (Largo 28 de Agosto).....150

Figure 58: Lobito municipal administration.....150

TABLE OF CONTENTS

Table 1: Identification of the bidder	4
Table 2: Identification of the company responsible for the EIAS.....	4
Table 3: Technical team responsible for preparing the EIAS.....	5
Table 4: National legislative framework.....	6
Table 5: International legal framework.....	10
Table 6: Differences between Angolan legislation and the requirements of the AfDB and DFC.....	15
Table 7: Geographic coordinates of the project area	16
Table 8: Moisture content of some grains in relation to harvest and storage	41
Table 9: Moisture content of grains at harvest	42
Table 10: Identification of biological hazards in post-harvest and grain storage	45
Table 11: Types of pests that can affect grains.....	47
Table 12: Köppen classification: territorial distribution	58
Table 13: Watersheds and their respective areas of extension	73
Table 14: Aquifer vulnerability classes	77
Table 15: Main botanical groups in the direct project area. LC - Least Concern, NA-Not Assessed, Category C - Vulnerable, Category D - Invasive	88
Table 16: Main fauna species in the project area: LC - Least Concern, NA - Not Assessed, Category C - Vulnerable, Category D - Invasive, CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora.....	96
Table 17: Landscape sensitivity matrix	105
Table 18: Characteristics of landscape units	105
Table 19: WHO recommended guideline values.....	106
Table 20: Exposure limit values (ELVs)	109
Table 21: Details of noise measurement survey	109
Table 22: Results obtained	110
Table 23: Population by area of residence, by gender, 2014.....	112
Table 24: Households engaged in agriculture, 2014	
Table 25: Type of crops planted in different municipalities.....	118

Table 26: Agricultural practices	119
Table 27: Food base in the province.....	12
Table 28: Livestock numbers by EE per province	124
Table 29: Number of birds raised by EEs by Province (Continued)	124
Table 30: Literacy rate by area of residence, by sex, 2014	134
Table 31: Population aged 18 or over, by level of education completed, 2014	135
Table 32: School network in the city of Lobito	136
Table 33: Health network in the city of Lobito	138
Table 32: Households with access to public electricity by area of residence, 2014.....	139
Table 35: Households with access to safe drinking water by.....	141
Table 36: Households using appropriate facilities for defecation by area of residence, 2014	143
Table 37: Summary of criteria used to assess impacts	154
Table 38: Acronyms used in the impact assessment scale	155
Table 39: Identification of significance according to colors	155
Table 40: Main project actions generating negative impacts in the implementation phase	157
Table 41: Main project actions generating negative impacts in the construction phase	158
Table 42: Main project actions generating negative impacts in the	159
Table 43: Main atmospheric pollutants emitted during the construction phase	183
Table 44: Summary of environmental impacts.....	201
Table 45: Classification of the environmental and social impacts of the project (construction phase)	206
Table 46: Identification and assessment of the project's environmental impacts (operational phase)	209
Table 47: Mitigation and enhancement measures for environmental and social impacts (construction phase)	215
Table 48: Mitigation and enhancement measures for environmental and social impacts (operation phase)	226
Table 49: Parameters to be analyzed and monitoring frequency.....	241
Table 50: Parameters to be analyzed and monitoring frequency.....	243

Table 51: Parameters to be analyzed and monitoring frequency.....245

Table 52: Parameters to be analyzed and monitoring frequency.....247

Table 53: Parameters to be analyzed and monitoring frequency.....248

Table 54: Parameter to be analyzed and monitoring frequency250

Table 55: Parameter to be analyzed and monitoring frequency252

Table 56: Parameters to be analyzed and monitoring frequency.....254

Table 57: Parameters to be analyzed and monitoring frequency.....256

Table 58: Parameter to be analyzed and monitoring frequency258

Table 59: Parameter to be analyzed and monitoring frequency260

Table 60: Parameter to be analyzed and monitoring frequency262

Table 61: Program implementation costs.....264

LIST OF ACRONYMS AND ABBREVIATIONS

- ADA - Directly affected area
- EIA: Environmental Impact Assessment
- AID - Area of direct influence
- IIA - Indirectly affected area
- WB: World Bank
- CFB - Benguela Railways
- DHANA - Human Right to Adequate Food and Nutrition
- EDA: Agricultural Development Station
- EEs-Specialized Companies
- EIA-Environmental Impact Assessment
- ENDE-National Electricity Distribution Company
- EN-National Road
- EPASB-Benguela Public Water and Sanitation Company
- EPC-Collective Protection Equipment
- PPE-Personal Protective Equipment
- WWTP-Wastewater Treatment Plant
- FAO-Food and Agriculture Organization of the United Nations
- IDA: Institute for Agricultural Development
- INE-National Institute of Statistics
- IPA-Artisanal Fisheries Institute
- LP - Preliminary License
- MINAGRIP: Ministry of Agriculture and Fisheries
- MIP-Integrated Pest Management
- MSGR: Suggestion and Complaint Management Mechanism
- The Economic and Social Development Fund – FDES
- SDG - Sustainable Development Goals
- ILO: International Labor Organization
- PDAC: Angola Commercial Agriculture Development Project

- PDN-National Development Plan
- PENSA Plans such as the National Strategy for Food Security
- PGA-Environmental Management Plan
- PGAS: Environmental and Social Management Plan
- SME: Small and Medium-sized Enterprises
- PND-National Development Plan
- PNOOC-Coastal Zone Management Plan
- RAPP-Agricultural and Fisheries Census
- EIR: Environmental Impact Report
- TDR-Terms of Reference
- UN-United Nations
- GBV: Gender-Based Violence

1 EXECUTIVE SUMMARY

This report refers to the Environmental and Social Impact Assessment (ESIA) of the project to build the Ocean Terminal for the agricultural infrastructure "Silos" in the municipality of Lobito, Benguela province.

The project proponent is Carrinho, SA, which submitted an application to **the U.S. International Development Finance Corporation (DFC)** for project financing through the **African Development Bank (AFDB)**.

In preparing this study, the provisions established in Angolan legislation were taken into account, as well as the guidelines of the AfDB and DFC, duly mentioned and detailed in Chapter 3, which also presents the Institutional Framework of the main entities involved in the agriculture sector, as well as the Ministry of the Environment.

At this stage of the Environmental and Social Impact Assessment, the aim is to identify the activities planned for the implementation of the Project, analyze their possible impacts, and define the corresponding mitigation measures.

The municipality of Lobito covers an area of 3,648 km² and had a population of 393,079 in 2014. It is bordered to the north by the municipality of Sumbe, to the east by the municipality of Bocoio, to the south by the municipality of Catumbela, and to the west by the Atlantic Ocean.

The municipality of Lobito is administratively divided into three communes, with the headquarters corresponding to the city of Lobito itself (sometimes called the commune of Lobito-Canata), and the communes of Egipto Praia and Canjala.

Although best known for its port and industrial activity, the municipality of Lobito also stands out in agriculture with the production of vegetables such as tomatoes, onions, cabbage, and lettuce, as well as fruits such as bananas, mangoes, and citrus fruits. Some rural areas of the municipality maintain this activity, taking advantage of their proximity to urban consumption centers and the logistical opportunities provided by the Port of Lobito for the distribution of production.

However, the agricultural sector faces considerable challenges, such as water scarcity due to irregular rainfall, low soil fertility in some areas, and pressure from expansion.

urban sprawl on agricultural land, as well as a lack of access to credit and modern technologies. Even so, there are good opportunities to strengthen local agriculture, especially through investments in irrigation systems, training for farmers, and better use of the strategic location for domestic supply and export.

Lobito has great potential as a logistics center for storage and distribution of products, thanks to its deep-water port, the Benguela Railway (CFB), and a road network that connects it to various regions of the country and the interior of Southern Africa. This infrastructure allows Lobito to consolidate itself as an important hub for the import and export of goods, facilitating the flow of agricultural, mineral, and industrial products, as well as promoting the growth of logistics, storage, and integrated transport services.

Therefore, taking advantage of these particular opportunities offered by the municipality, the Carrinho SA group intends to build an ocean terminal where agricultural infrastructure "silos" will be installed to store grain from various parts of the country for the export and import of other goods.

The proposed project will be implemented in an area corresponding to 229 m² and will be constructed using reinforced concrete, sun mesh, metal structures, and sheets, etc.

The project comprises a single facility, a silo block with six metal cells weighing 10,000 tons each for storing cereals (corn, wheat, rice, and soybeans), with a total capacity of 80,000 m³. Two horizontal silos with a total capacity of 120,000 m³ for raw sugar and three oil tanks with a capacity of 15,000 m³.

The silo block consists of:

- Reception circuit: Maritime, Road, or Rail with a capacity of 540 m³/h, with iron separation and weighing, central suction system per circuit.

- 6 storage cells with a total capacity of approximately 80,000 m³. 3 + 3 silo solution allowing two lines of 3 silos to operate.
- Shipping circuit: Maritime, Road or Rail with a capacity of 270m³/h with weighing and central suction per circuit.

The horizontal silo consists of:

- Reception circuits: Maritime, Road, or Rail with a capacity of 540m³/h, with iron separation and weighing, central suction system per circuit.
- 2 horizontal storage silos with a total capacity of approximately 120,000 m³. 1 + 1 silo solution allowing two lines of 1 silo to operate.
- Shipping circuit: Maritime, Road or Rail with a capacity of 270m³/h with weighing and central suction per circuit.

The oil tanks consist of:

- Reception circuit: Maritime or Road
- 3 metal storage tanks with a total capacity of approximately 16,500 m³.
- Shipping circuit: Maritime or Road

The maritime circuit involves the unloading and loading of ships. The unloading circuit, with a capacity of 540m³/h, consists of (1) ship unloader that feeds two independent reception circuits, one for the 80,000m³ silo block and the second circuit for the two horizontal silos

The loading circuit, with a capacity of 270m³/h, consists of a ship loader that receives from a single circuit common to the silo block and the horizontal silos.

The road and rail circuit is designed for the loading and unloading of trucks (road) or wagons (rail) and consists of an independent receiving hopper for the silo block and horizontal silos for unloading. With regard to the loading of trucks and wagons, we will also have independent loads for the silo block and horizontal silos.

The main environmental conditions at the project site are described below.

Lobito has an arid tropical climate (hot semi-arid), influenced by the cold Benguela current, which moderates temperatures and significantly reduces rainfall. Average annual temperatures range from 22°C to 26°C, with the hottest months occurring between February and April. Rainfall is low, generally concentrated in the summer months, but irregular, with annual totals averaging below 400 mm. High insolation, low relative humidity, and coastal winds are striking features of the local climate, which conditions both agricultural activities and water consumption in the region.

The soils in the municipality of Lobito are generally of low to moderate natural fertility, especially in areas closer to the coastline, where sandy soils poor in organic matter predominate. As one moves inland, especially near the Cavaco and Catumbela river valleys, fertility tends to improve, favoring the cultivation of certain agricultural crops. However, low water retention capacity, erosion, and soil salinization in certain areas pose significant challenges for agriculture. To improve agricultural use, soil conservation practices, adequate fertilization, and efficient irrigation management are necessary. These measures are essential to ensure the productivity and sustainability of local agricultural activity.

The hydrology of the municipality of Lobito is characterized by a scarcity of permanent surface water resources, typical of semi-arid regions. Existing watercourses, such as the Cavaco and Catumbela rivers, are fundamental for water supply, both for human consumption and for agricultural and industrial activities. However, these watercourses have intermittent regimes, with very low flows during most of the year and rapid flooding during the rainy season. These rivers are strategically important because, in addition to supplying water, they also contribute to the development of agriculture in peri-urban areas and support

industry and logistics services, which are essential for the functioning of the Port of Lobito. Proper management of these resources is crucial for the sustainability of the city and its economic activities.

The vegetation in the municipality of Lobito is predominantly arid to semi-arid, with sparse savanna formations and small shrubs adapted to dry climates. In areas close to watercourses, such as the Cavaco and Catumbela river valleys, the vegetation is slightly denser, with the presence of riparian species that take advantage of the greater availability of water. In general, vegetation cover is limited due to low rainfall and high insolation, which favors the presence of drought-resistant plants. Natural vegetation has been under pressure due to urban expansion and agricultural activity, making it important to promote conservation and recovery of existing green areas, with the adoption of sustainable practices.

The main sources of air pollution include dust emissions, combustion gases from road and rail traffic, vapors and fumes from port and industrial operations, and pollutants from the burning of fossil fuels. These activities can affect human health, especially respiratory and cardiovascular diseases, and negatively impact the local ecosystem. Mitigation measures, such as dust emission control, the use of cleaner technologies, and proper urban planning, are essential to reduce these impacts.

The sound environment in areas close to the ocean terminal construction project may be affected by various sources of noise pollution. The construction and operation of the terminal, with the use of heavy machinery, cargo vehicles, and port operations, can generate high levels of noise. In addition, increased road and rail traffic, ship movements, and industrial activity in the area contribute to the intensification of ambient noise, affecting the quality of life of local communities. Prolonged exposure to high noise levels can result in sleep disturbances, stress, and hearing health problems. To mitigate these impacts, it is essential to monitor and control noise levels in the most affected areas, implement acoustic barriers, and use technologies that reduce the sound generated by activities.

From an ecological point of view, the implementation of the silos is not expected to have a significant impact on local biodiversity, as the project is located in a heavily altered area. However, the dredging required for the construction of the ocean terminal pier may have negative impacts on marine ecology. In the marine environment, dredging can destroy natural habitats, such as corals and aquatic plants, as well as increase water turbidity, impairing photosynthesis and affecting the feeding of various marine species.

No endangered or threatened species of fauna or flora were observed in the immediate vicinity of the project.

From a landscape perspective, the intervention area is part of a semi-natural urban zone, characterized by human occupation coexisting with areas of natural vegetation, albeit not very extensive. Its location next to Lobito Bay gives it a scenic landscape, impacting its visual quality.

The municipality of Lobito has a population of around 393,079, of whom 188,169 are male and 204,910 are female. Lobito has a young and dynamic population, with more than half of its residents of working age and a young population that far outnumbers the elderly.

The population of Lobito has an above-average level of education, with a literacy rate of 80.0%.

The employment rate is 43.3%. Most of the population works in the primary sector (agriculture, animal production, hunting, forestry, and fishing) and the tertiary sector (commerce and services), followed by public administration and defense, etc.

As part of the EIA work, the following entities were contacted: Benguela Provincial Government, Lobito Municipal Administration (municipal department of environment and basic sanitation), municipal department of agriculture, livestock, and fisheries, municipal department of energy and water, and municipal department of health.

These entities are in favor of the implementation of the Project, as it will have significant implications for the economic development of the municipality.

The main negative environmental impacts of the Project will occur during the construction phase and relate to noise, heavy and light vehicle traffic, and potential disturbance to the surrounding population and marine fauna and flora due to dredging. With the implementation of measures to mitigate negative impacts and monitoring programs, it is expected that the negative impacts during the construction phase will remain at low levels.

At this stage, the revitalization of the local economy resulting from construction activity, creating jobs and boosting local restaurants and accommodation for an estimated period of 36 months, should also be noted as a positive impact.

During the project's operational phase, the negative impacts are associated with situations of potential risk, although these are unlikely to occur with the adoption of the proposed measures, namely accidental spills of polluting substances, noise, dust, and road accidents involving the population, disturbance of marine fauna due to maintenance dredging, and the movement and mooring of ships.

It is during the operational phase that all the important benefits of the project for the city and the region will emerge, such as the strengthening of the local economy through increased international trade and the attraction of investment, the generation of direct and indirect jobs, the improvement of urban and logistical infrastructure, increased tax revenue, regional integration with inland countries such as the DRC and Zambia, and the promotion of professional training and technological development, contributing to the sustainable growth of Lobito and its area of influence.

The main measures to mitigate negative impacts and monitoring programs are aimed at ensuring minimal effects on air quality and noise produced by vehicles and machinery, and safeguarding the tranquility of the population. In terms of ecological values, the development of a Biodiversity Action Plan detailing the proposed mitigation measures has been proposed.

The costs involved in implementing the measures and monitoring programs are estimated at around USD 88,000 for the construction phase and around USD 156,200 for the operational phase (annual).

The Project also includes a set of complementary Plans and Programs aimed at supporting local organizations in terms of training and equipment provision, as well as awareness-raising actions for the population.

A set of compensatory measures aimed at promoting biodiversity preservation is also proposed.

The conclusions of the EIAS are that the Project is environmentally viable with the effective adoption of the proposed mitigation measures.

It should also be noted that the province of Benguela has all the institutional capacity to successfully implement the project proposed by the Carrinho, Sa group. Nevertheless, Carrinho, Sa will have to strengthen its environmental and social capacities by hiring a technician qualified to deal with environmental and social issues in accordance with the requirements defined by the financing institution.

2 INTRODUCTION

2.1 GENERAL INFORMATION

The growing demand for food and the need to ensure food security have driven infrastructure projects such as the construction of grain storage silos. Although these projects are crucial to the efficiency of the food chain, it is imperative to consider the environmental impacts associated with their planning, construction, operation, and decommissioning phases.

As part of the expansion and diversification of its activities, this group intends to extend its silo deployment bases to various locations across the country for the storage of grain produced in the regions where these infrastructures will be built, in order to facilitate their internal distribution and export, as well as to extend their useful life and quality.

To this end, an ocean terminal will be built in the province of Benguela, specifically in the municipality of Lobito. The ocean terminal will be used for the export of goods and will facilitate the shipment and distribution of grain to various parts of the country and the world. The terminal will be equipped with specialized infrastructure for the storage of grain in silos and for handling containers, bulk cargo, and other types of cargo.

The ocean terminal will be built within the boundaries of the port of Lobito. The port of Lobito is Angola's second largest cargo port and is located in a privileged geographical area with enormous potential. A1V2's involvement in this project was part of a broader infrastructure recovery plan, which includes the rehabilitation of the current port of Lobito. This intervention covers the following components: paving; restoration of the quay walls; increase in the capacity of the container park; construction of an exclusive access road for heavy goods vehicles; and expansion of the port of Lobito through the construction of a new quay wall.

This document is a technical report on the Environmental and Social Impact Assessment (ESIA) of the Lobito Port Ocean Terminal Project, owned by Grupo Carrinho, SA. This Environmental and Social Impact Assessment was prepared in accordance with Article 4 of Presidential Decree 117-20-Environmental Impact Assessment Regulation and

Environmental Licensing Procedure, which regulates environmental protection in the course of infrastructure activities and requires the preparation of an Environmental Impact Assessment, as well as the guidelines of the project proponent.

The EIAS is a fundamental component of the environmental impact assessment process, which aims to identify and assess the main environmental impacts, analyze mitigation alternatives, including the environmental and social feasibility of the Project, supporting the decision-making of the Ministry of the Environment (MINAMB) with a view to the environmental licensing of the Project.

The project to build the ocean terminal, including the agricultural infrastructure for grain storage "silos." According to Annex I of Presidential Decree No. 117/20 of April 22, the project falls under category **B**.

Projects classified as Category B are those that may cause moderate to significant environmental and social impacts, but which can be controlled and minimized through the implementation of mitigation measures. These projects require a Simplified Environmental Impact Assessment (SEIA) or an Environmental and Social Management Plan (ESMP), but do not require a full Environmental Impact Assessment (EIA), as in Category A.

Main Characteristics of Category B Projects:

- Localized environmental impacts – Environmental effects are moderate and restricted to the project area, with less risk of severe degradation;
- Mitigation measures required – Impacts can be reduced with good environmental practices and management plans;
- Require a Simplified Environmental Impact Assessment (SEIA) – A technical report must be prepared, containing a description of the project, possible impacts, and mitigation measures.

Examples of Category B Projects:

- Small and medium-sized industrial units;
- Medium-sized agricultural and livestock infrastructure;
- Small-scale natural resource exploitation projects;

- Small power plants or substations;
- Construction of secondary and tertiary roads;
- Silos and grain storage facilities.

2.2 IDENTIFICATION OF THE PROJECT PROPOSER

Table 1: Identification of the proponent

COMPANY IDENTIFICATION	
Company name	CARRINHO INDÚSTRIA (SU), LDA
Full address	Rua de São Tomé s/n -Lobito/Benguela
Phone	+244 934719989
COMPANY REPRESENTATIVE	
Name	Décio Catarro
Position	CEO-Carrinho Indústria
Phone	+244 XXXXXXX
Email	Decio.catarro@carrinho-sa.com
PERSON CONTACT PERSON	
Name	Adriano Condumulã
Position	Licensing Technician
Phone	(+244) 923383335
Email	Adriano.condumula@carrinho-sa
REGISTRATION	
Commercial Registration Number	0002.240111
Tax Identification Number (NIF)	5000202665

2.3 IDENTIFICATION OF THE COMPANY RESPONSIBLE FOR PREPARING THE EIAS

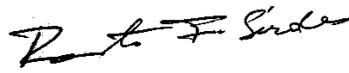
Table 2: Identification of the company responsible for the EIAS

COMPANY IDENTIFICATION	
Company Name	HSG - CONSTRUÇÃO, ENGENHARIA E COMÉRCIO, LDA
MINAMB Registration Number	8320352235
Address	Rua Nossa Senhora de Fátima, nº2-BC-105, Luanda/Angola
Tax ID	5417007978
COMPANY REPRESENTATIVES	
Name	Herineu Gomes
Position	General Manager
Phone	(+244) 923439634
Email	Euclideskid1@hotmail.com

2.4 EQUIPATÉCNICA RESPONSIBLE FOR THE EIAS

This Environmental and Social Impact Assessment (ESIA) was prepared in September 2024 by technicians and consultants from HSG - CONSTRUÇÃO, ENGENHARIA E COMÉRCIO, LDA, as detailed in the table below.

Table 3: Technical team responsible for preparing the EIAS

Technical	Qualifications	Position	Signature
Renato Feliz Sirdes	✓ Master's Degree in Management and Governance Environmental	Coordinator	
Bruno Constantino	✓ Master's Degree in Engineering of and Environment	Technician	
Albertina J. A. Pascoal	✓ Bachelor's Degree in Environmental	Technician	
Nelson Morais	✓ Geologist	Technician	
Camilo Rebocho Váz dos Santos	✓ Degree in Architecture and Urban Planning.	Technician	
Belarmino Pascoal	✓ Degree in Biology	Technician	
Verônica Pacheco	✓ Bachelor's Degree in Environmental Engineering Environmental	Technician	

3 LEGAL FRAMEWORK

This chapter establishes the legal framework for the project with regard to Angolan government legislation on environmental and social impacts. The legal framework of the project is also aligned with the environmental and social safeguard policies established by the African Development Bank (AfDB), as well as international standards and policies for the protection of the environment, occupational health and safety of workers and the local community.

3.1 National legal framework

Constitution of the Republic of Angola 2010

Article 39 of the Constitution of the Republic of Angola enshrines the right to the environment and declares the right of citizens to live in a healthy and unpolluted environment, as well as the duty to defend and preserve it. The same article requires the State to adopt the necessary measures to protect the environment and species of flora and fauna throughout the national territory, maintain ecological balance, ensure the correct location of economic activities, and promote the rational exploitation and use of all natural resources, within the framework of sustainable development and respect for the rights of future generations and the preservation of different species. It thus punishes acts that endanger or harm the preservation of the environment.

Therefore, according to the nature of the project under review, the table of applicable legislation is provided below.

Table 4: National legislative framework

Legal framework	Publication
General	
Basic Environment Law	Law No. 5/98, of June 19
Law on Environmental Protection Associations	Executive Decree No. 3/06, of January 18
Environmental Impact Assessment	
Environmental audits of public or private activities	Executive Decree No. 1/10, of January 13
Incompatibility of consulting companies registered with the Ministry of the Environment that carry out supervisory activities and cumulative auditing and environmental impact study activities	Order No. 680/11, of October 10

Legal Framework	Publication
Regulation on the Technical Registration of Environmental Consulting Companies	Executive Decree No. 86/12, of February 23
Legal Framework	Publication
Regulations on Liability for Environmental Damage	Executive Decree No. 194/11, of June 7
Regulation on Public Consultations for projects subject to Environmental Impact Assessment	Executive Decree No. 87/12, of February 24
Cancels environmental consulting activities in Environmental Impact Assessment carried out by individual environmental consultants	Executive Decree No. 85/12, of May 27
Assessment committee for each Environmental Impact Study for Environmental Licensing, coordinated by the National Director of Environmental Impact Assessment and Prevention Environmental Impacts	Order No. 2745/13, of December 6
Data to be submitted with Environmental Impact Studies for Environmental Licensing	Order No. 2746/13, of December 6
Environmental Monitoring and Industrial Audit Support Unit	Order No. 72/15, dated February 13
Commission of Evaluation of Curricula of Environmental Consultants and Calculation of the Amount Payable for Environmental Licensing	Decree No. 34/15, of October 23
Environmental Impact Assessment Unit - Repeals Order No. 87/15, of March 6	Order No. 405/15, of December 1
Classification of Environmental Consulting and Auditing Companies	Executive Decree No. 302/16, of June 30
Regulation of Environmental Environmental for Certification	Executive Decree No. 249/17, of April 25
Amends the deadline for MINAMB to submit an opinion to the project licensing entity - Repeals Executive Decree No. 241/16, of May 25	Executive Decree No. 119/19, of May 20
Approves the amendment to the wording of Article 31(1), Article 36, Article 37(3), and Article 39(1) 39 of Presidential Legislative Decree No. 8/19, of June 19, which approves the Organization and Functioning of the Auxiliary Bodies of the President of the Republic	Presidential Legislative Decree No. 4/20, of April 1

Legal framework	Publication
Approves the table of fees to be charged for the issuance and renewal of Environmental Licenses for Environmental Impact Assessment, as well as the registration and renewal of environmental consulting companies.	Presidential Decree No. 83/22, of April 22
General Regulations on Environmental Impact Assessment and the Environmental Licensing Procedure	Presidential Decree No. 117/20, of April 22
Waste	
Registration of companies operating in the areas of waste, water treatment, and wastewater	Order No. 199/12, of February 29
Regulation on Waste Management	Presidential Decree No. 190/12, of August 24
Construction and Demolition Waste Management	Executive Decree No. 17/13, of January 22
Guidelines for the Preparation of Provincial Urban Waste Management Plans	Executive Decree No. 234/13, of July 18
PESGRU - Strategic Plan for Urban Waste Management	Presidential Decree No. 196/13, dated August 30
Water and Basic Sanitation	
Law on Sanitary Regulations	Law No. 5/87, of February 23
Water Law	Law No. 6/02, of June 21
Water Sector Development Strategy	Council of Ministers Resolution No. 10/04, of June 11
Water for All Program	Council of Ministers Resolution No. 58/07, of July 30
Regulation on Water Quality	Presidential Decree No. 261/11, of October 6
Regulations for the Prevention and Control of Pollution of National Waters	Executive Decree No. 141/12, of June 21
Regulations for the General Use of Water Resources	Presidential Decree No. 82/14, dated April 21
Regulations for Public Water Supply and Wastewater Sanitation	Presidential Decree No. 83/14, of April 22
National Water Plan	Presidential Decree No. 126/17, of June 13
National Strategic Water Plan (2018-2022)	Presidential Decree No. 158/18, of June 29
General Plan for the Integrated Use of Water Resources in the Cubango River Basin (PGUIRH)	Presidential Decree No. 27/16, of January 26
Legal regime governing water abstraction charges.	Presidential Decree No. 41/21 of February 12
Regulation of Tariffs for Water Supply and Wastewater Services	Presidential Decree No. 255/20, of October 7
Regulation of Registration and Licensing of Companies that operate in the areas of waste, water treatment, and wastewater	Executive Decree No. 24/15, of January 29
Regulation on Transfer of Waste for Reuse, Recycling, and Recovery	Presidential Decree No. 265/18, of November 15
Legal Framework for Landfills	Presidential Decree No. 203/19, dated June 25

Legal framework	Publication
Flora and Terrestrial Flora	
Basic Law on Forests and Wildlife	Law No. 6/17, of October 24
Regulations for the protection of flora resources and plant species, including forest resources.	Decree No. 40.040 / 1955, of January 20
Convention on the Conservation of Nature and Natural Resources in Africa - Maputo Convention	Resolution No. 5/14 (National Assembly) of January 20
Prohibits the killing of protected species of wild fauna and flora on national territory	Executive Decree No. 469/15, of July 13
Red List of Species of Angola	Executive Decree No. 252/18, of July 13
Forestry Regulations	Presidential Decree No. 171/18, of July 23
Protected Areas	
Regulation of National Parks	Ordinance No. 10,375/1958, of October 15
Environmental Conservation Areas Law	Law No. 8/20, of April 14
Resettlement	
Rules on the resettlement of displaced populations.	Decree No. 1/01, of January 5
Regulation on Relocation Operations	Presidential Decree No. 117/16, of May 30
Hygiene, Health, and Safety at Work	
Principles for the promotion of safety, hygiene, and health at work	Decree No. 31/94, of August 5
Obligation to organize SHST services in companies.	Executive Decree No. 6/96, of February 2
Rules governing the Commissions for the Prevention Workplace Accidents, hereinafter referred to as "CPAT"	Executive Decree No. 21/98, of April 30
Regulations on HIV/AIDS. Employment and Vocational Training	Decree No. 43/03, of July 4
Regulations on Safety, Hygiene, and Health at Work.	Executive Decree No. 128/04, of November 23
The Angolan State is a member of the World Health Organization (WHO), an institution under the auspices of the International Health Regulations (2005).	Resolution 32/08, of September 1
Legal Framework for Occupational Accidents and Diseases	Decree No. 53/05, of August 15
Regulation on the legal framework for fire safety in buildings.	Presidential Decree No. 195/11, of July 8
Regulation on Licensing for the Provision of Occupational Safety, Hygiene, and Health Services	Presidential Decree No. 179/24, of August 1
Regulations on Safety Accessories, Special Alarms, Use of Fire Extinguishers, First Aid Equipment, and Light Signals for Bicycles	Presidential Decree No. 145/17 of June 26
General Labor Law	Law No. 12/23 of December 27

Land Use Planning	
Land Law	Law No. 3/04, of June 25
Political-Administrative Division Law	Law No. 14/24, of September 5
Law on Land Use Planning and Urban Development (LOTU)	Law No. 9/04, of November 9
Basic Law on the Administrative Organization of the Territory	Law No. 13/16, of September 12
State Local Administration Law	Law No. 15/16, of September 12
Regulation on the Coastal Zone Management Plan	Decree No. 4/01, of February 2
General Regulations on Territorial, Urban, and Rural Plans (REPTUR)	Decree No. 2/06, of January 23
Cultural Heritage	
Cultural Heritage Law	Law No. 14/05, of October 7
Gender	Executive Decree No. 222/13, of December 24
National Policy for Gender Equality and Equity	Executive Decree No. 222/13, of December 24
Natural Disasters	
National Plan for Preparedness, Contingency, Response, and Recovery from Calamities and Natural Disasters, for the period 2015/2017	Executive Decree No. 29/16, of January 1
Strategic Plan for Disaster Risk Prevention and Reduction, within the scope of the 2013/2017 National Development Plan	Executive Decree No. 30/16, of January 3

3.2 International Protocols and Agreements

In the absence of national legislation governing air quality issues, an analysis was conducted of the conventions and international protocols ratified by Angola in this area.

Table 5: International Legal Framework

Convention on the Elimination of All Forms of Discrimination Against Women – CEDAW (1981)	Resolution AN 15/84, of September 19
Convention on the Law of the Sea	Resolution No. 17/90, of October 6
Convention on the Rights of the Child	Resolution AN 20/90, of November 10
African Charter on Human and Peoples' Rights	Resolution AN 1/91, of January 19
International Covenant on Civil and Political Rights	Resolution AN 26-B/9/91, of December 27
International Covenant on Economic, Social, and Cultural Rights (1966)	Resolution AN 26-B/9/91, of December 27
African Charter on the Rights and Welfare of the Child	Resolution AN 1-B/92, of May 15
Convention on the Protection of the Underwater Cultural Heritage (UNESCO)	Adopted in 1995
Convention on Biological Diversity, 1992	Resolution No. 23/97, of July 4
Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol	Resolution No. 12/98, of April 20
Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO)	Ratified on November 7, 1991
Convention to Combat Desertification	Resolution No. 12/00, of May 5

International Legal Framework	
Convention for the Safeguarding of Intangible Cultural Heritage (UNESCO)	Approved in 2003
Convention on Migratory Species of Wild Animals (Bonn Convention)	Resolution No. 14/03, of April 15
IUCN – International Union for Conservation of Nature	Resolution No. 21/03, of May 27
Convention on the Protection and Promotion of the Diversity of Cultural Expressions (UNESCO)	Ratified on February 7, 2005
Stockholm Convention on Persistent Organic Pollutants	Resolution No. 49/05, of October 30
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Resolution No. 1/07, of February 14
United Nations Framework Convention on Climate Change, 1997	Resolution No. 14/07, of March 28
Convention on the Rights of Persons with Disabilities	Resolution AN 1/13, of June 11, 2007
Optional Protocol to the Convention on the Rights of Persons with Disabilities	Resolution AN 1/13, of June 11, 2007
Optional Protocol to the Convention on the Elimination of All Forms of Discrimination Against Women	Resolution AN 23/07, of June 23
Inquiry into the implementation of CEDAW	Resolution AN 23/07, of June 23
Benguela Current Convention	Resolution No. 15/15, of July 3
Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa	Resolution AN 25/07, of July 16
Convention on Wetlands of International Importance	Resolution No. 27/16, of July 22
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Resolution No. 29/16, of July 25
Convention on Cooperation for the Protection and Development of the Coastal Environment of the West and Central African Region	Resolution No. 32/16, of July 29,
Paris Agreement on climate change	Resolution No. 37/20, of October 12
Cartagena Protocol on Biosafety	Approved on January 29, 2000
Rotterdam Convention on Chemicals and Pesticides	Adopted on September 10, 1998, and entered into force on February 24, 2004.

3.3 African Development Bank Integrated Safeguards System

The Integrated Safeguards Framework is part of the African Development Bank's (AfDB) strategy to promote socially inclusive and environmentally sustainable growth.

Safeguards are a powerful tool for identifying risks, reducing development costs, and improving the sustainability of projects, benefiting affected communities and helping to preserve the environment.

With this Integrated Safeguards System, the AfDB is better equipped to address emerging environmental and social development challenges. The Integrated Safeguards System not only promotes best practices in these areas, but also encourages greater transparency and accountability.

The Integrated Safeguards System is designed to protect populations affected by World Bank-financed operations, especially the most vulnerable communities, by providing, for example, project-level grievance and compensation mechanisms, i.e., allowing the concerns of affected populations to be heard and addressed in a structured, systematic, and managed manner during the planning and implementation phases of the project.

The AfDB, in accordance with its mandate set out in Article 1 of the Bank Agreement and Article 2 of the Fund Agreement, and the provisions of Article 38 of the Bank Agreement and Article 21 of the Fund Agreement, considers economic and social rights to be an integral part of human rights and, consequently, affirms that it respects the principles and values of human rights as defined in the Charter of the United Nations and the African Charter on Human and Peoples' Rights. These were some of the principles that guided the development of the Integrated Safeguards System. The AfDB encourages member countries to observe international human rights norms, standards, and best practices, based on their commitments under the International Covenants on Human Rights and the African Charter on Human and Peoples' Rights.

Consideration of these values and principles places the AfDB at the forefront of multilateral development banks, with a set of clear and integrated policies and procedures for addressing safeguarding issues that arise in the course of development. With the Integrated Safeguards System, the AfDB is empowered to fulfill its mandate and help increase the effectiveness and development impact of its operations.

The Integrated Safeguards System is thus one of the most robust tools available to the AfDB to help promote the well-being of those it serves, i.e., the people of Africa.

In general, the safeguards aim to:

- Avoid adverse impacts of projects on the environment and affected people, while maximizing development benefits;
- Minimize, mitigate, and/or compensate for adverse impacts on the environment and affected people when such impacts cannot be avoided; and
- Help borrowers/clients strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

The AfDB requires borrowers/clients to comply with these safeguard requirements during project preparation and implementation. The Integrated Safeguards Policy Statement sets out the basic principles that guide and underpin the AfDB's approach to environmental safeguards.

In addition, the AfDB has adopted five operational frameworks, limiting their number to what it considers necessary to achieve the goals and optimal functioning of the Integrated Safeguards System, namely:

Integrated Safeguards System, namely:

Operational Safeguard 1: Environmental and Social Assessment - This comprehensive safeguard governs the process of determining a project's environmental and social category and the applicable environmental and social assessment requirements: scope; category; implementation of a strategic environmental assessment or an environmental and social impact assessment, where appropriate; Environmental and Social Management Plans; assessment of vulnerabilities to climate change; public consultation; impacts on the community; assessment and treatment of vulnerable groups; and grievance procedures. The Safeguard updates and consolidates the commitments set out in the AfDB's environmental policy.

Operational Safeguard 2: Acquisition of land for involuntary resettlement, displacement of populations, and compensation - This safeguard consolidates the commitments and requirements set out in the AfDB's policy on involuntary resettlement and incorporates a number of refinements designed to improve the operational effectiveness of these requirements. In particular, it comprises comprehensive and forward-looking notions of livelihoods and assets, addressing social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasizes the need to maintain social cohesion, community structures, and social interconnections that common property provides. This safeguard ensures the requirement for compensation, covering full replacement; reiterates the importance of resettlement that improves living standards, income-earning capacity, and livelihoods in general; and emphasizes the need to ensure that social considerations such as gender, age, and participation in project outcomes do not particularly disadvantage those affected by the project.

Operational Safeguard 3: Biodiversity and Ecosystem Services – This safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the AfDB's commitments in its integrated water resources management policy and the United Nations Convention on Biological Diversity into OS requirements. This safeguard reflects the importance of biodiversity on the African continent and the value of key ecosystems to the population, emphasizing the need to “*respect, conserve, and maintain the knowledge, innovations, and practices of indigenous and local communities (...) and to protect and encourage the customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.*”

Operational Safeguard 4: Pollution prevention and control, hazardous substances, and resource efficiency - This safeguard covers the range of key impacts of pollution, waste, and hazardous substances for which there are agreed international conventions, as well as specific industry and regional standards, including greenhouse gas accounting

of greenhouse gases, which other multilateral development banks adopt. This safeguard also introduces vulnerability analysis and monitoring of greenhouse gas emission levels and provides a detailed analysis of possible reduction or a framework for compensatory measures.

Operational Safeguard 5: Labor, Health, and Safety – This safeguard establishes the AfDB's requirements for its borrowers or clients regarding workers' conditions, rights, and protection against abuse or exploitation. It thus covers working conditions, workers' organizations, occupational health and safety, and the prevention of child or forced labor. It also ensures greater harmonization with most other multilateral development banks.

3.4 Differences between Angolan Legislation and AfDB and DFC Requirements

Table 6: Differences between Angolan legislation and AfDB and DFC requirements

Item	Angolan Legislation	Integrated Security System	Differences
<p>Environmental and Social Impact Assessment</p>	<p>The Annex to Presidential Decree No. 117/20 of April 22 presents the categorization of activities (A, B, C, D, E) and a list of those of those that require environmental studies.</p> <p>Article 4 of this legal document refers to "licensing of agricultural, forestry, industrial, commercial, housing, tourism, or infrastructure projects which, due to their nature, size, or location, have implications for environmental and social balance and harmony, are subject to a prior Environmental Impact Assessment process, which involves the preparation of an Environmental Impact Assessment</p> <p>(EIA) to be submitted for approval by the competent authority responsible for the environment."</p> <p>The legislation establishes the minimum content for the EIA and Terms of Reference for certain types of projects. For the water sector, this only applies to water supply systems (Decree No. 92/12 of March 1). The issuance of the Environmental Installation License for projects subject to EIA is conditional upon the approval of the EIA.</p>	<p>Operational Safeguard 1 establishes different categories of projects in relation to environmental and social impact assessment, highlighting in more detail projects with significant and/or irreversible adverse impacts, or those that significantly affect environmental and social components considered sensitive.</p> <p>It defines the content of the EIAs and establishes specific guidelines for the agriculture sector and associated infrastructure (silos), etc.</p>	<p>Angolan legislation establishes categories of activity and defines the EIA requirements for projects with environmental impacts and social impacts that are less significant and reversible.</p> <p>Angolan legislation includes agricultural infrastructure (silos) in the list of activities subject to EIA, categorized as category B projects, referred to in 38 - other projects.</p> <p>According to the AfDB, seaport and agricultural infrastructure projects, if not large, are classified as Category 2 and only require the preparation of an Environmental Management Plan.</p> <p>The DFC shares the same view, and projects of this nature fall under the category B.</p>

Item	Angolan Legislation	Integrated Security System	Differences
Environmental and Social Impact Management	The Environmental License is conditional upon the submission of an Environmental Management Plan to be presented with the Environmental Impact Study of compliance (Presidential Decree No. 117/20, of April 1). The Environmental Installation License provides for an environmental audit during the operational phase (Decree No. 1/10, of January 13).	The PGAS is a management tool and is carried out during the construction and operation phases, including, among other things, the definition of responsibilities, measures to be implemented, implementation schedule, and budget.	No are notable differences.
Public Consultations	As part of the EIA process, a public consultation lasting 5 to 10 days is planned, through a meeting conducted by MINAMB (Executive Decree No. 87/12, of February 24). The public consultation report is based on a public hearing.	Operational Safeguard 1 establishes the need to hold public consultations from the beginning of the project cycle.	Angolan legislation defines public consultation in a more limited way, without specifying the need for public consultations throughout the project cycle and not limited to the public presentation meeting to discuss the EIA.
Biodiversity	<p>The Basic Environment Law (Environment, Law No. 5/98, of June 19) includes the protection of biodiversity within its scope, and the Aquatic Biological Resources Law (Law No. 6-A/04, of October 8) establishes the principles of rules for the protection of biological and aquatic resources.</p> <p>Angola has acceded to the Convention on Biological Diversity (Resolution No. 23/97, of July 4) and the International Convention on Wetlands which protects these wetland and coastal ecosystems (Resolution No. 27/16, of July 22).</p>	It establishes the need to adopting a hierarchy to avoid impacts on the integrity of ecosystems and the conservation of biodiversity.	There are notable differences.

Item	Angolan Legislation	Integrated Security System	Differences
Pollution Prevention	<p>The Basic Environment Law includes the principle of pollution prevention. There are legal provisions relating to waste and water quality, but there are no regulations on atmospheric emission limits, noise, or vibrations.</p>	<p>The AfDB and DFC adopt the parameters established by the World Bank.</p>	<p>Angolan legislation does not establish limits for atmospheric emissions, noise, and vibrations.</p>
Resettlement	<p>There are rules, regulations, procedures, and criteria for the resettlement of groups of people (Decree No. 1/01 of January 5 and Presidential Decree No. 117/16 of May 30).</p>	<p>A Operational Safeguard 2 establishes the need to carry out of a Resettlement Resettlement Plan, with defined procedures defined, aimed at improving the living conditions of the affected populations.</p>	<p>No are notable differences.</p>
Health, Safety, and Hygiene at Work	<p>Angolan legislation regulates the Occupational Safety, Hygiene, and Health System and defines the principles aimed at preventing occupational accidents, occupational diseases, and other risks inherent to the work environment (Decree No. 31/94, of August 5).</p>	<p>Operational Safeguard 5 requires protection of workers against abuse or exploitation, and hygiene and safety at work.</p>	<p>There are notable differences.</p>

No discrepancies were identified between Angolan legislation and the Safeguard Guidelines of the African Development Bank (ADB) and **the U.S. International Development Finance Corporation (DFC)**. The distinctions noted in the table above refer to cases where Angolan regulations are more or less restrictive than the guidelines of the African Development Bank and DFC, or to circumstances where national legislation does not set specific limits for certain emissions. In this study, we have chosen to adopt the highest requirement, ensuring compliance with all requirements established by both the Angolan legal framework and the guidelines of the multilateral financial institution.

3.5 Environmental and Social Standards

As a result of the comparative analysis carried out between Angolan legislation and the African Development Bank and DFC Safeguard Guidelines, where some discrepancies were identified, this section aims to set out the Environmental and Social Standards applicable to the Project. These standards are intended to complement Angolan regulations or, in the absence of specific national legislation, serve as a reference for the adoption of widely recognized international standards, such as those of the World Bank and the World Health Organization (WHO), in addition to best environmental and social practices.

Finally, it was necessary to include in this section the guidelines relating to Public Consultation, detailing the applicable regulatory procedures. This is due to the differences between Angolan legislation and the Safeguard Policies of the AfDB and DFC, thus ensuring that the Project complies with the guidelines established by the African Development Bank and the DFC.

3.6 NATIONAL PLANS, PROGRAMS, AND STRATEGIES

3.6.1 National Development Plan 2023-2027

Angola's National Development Plan (PND) 2023-2027 is a strategic instrument that guides public policies and investments necessary to promote the country's sustainable socioeconomic development. This plan is aligned with the "**Angola 2050**" **Long-Term Strategy**, which projects the country's future for the coming decades.

General Guidelines and Goals:

The PND 2023-2027 establishes guidelines to accelerate the sustainable socioeconomic impact of public policies, targeting areas that contribute significantly to the country's development.

The main goals include:

- **Human Capital Development:** Strengthen the education and health systems to improve the quality of life of the population.
- **Economic Diversification:** Reduce dependence on the oil sector by promoting other industries and services.
- **Infrastructure and Connectivity:** Improve transportation, energy, and telecommunications infrastructure to facilitate economic growth.
- **Environmental Sustainability:** Implement policies that ensure environmental protection and the sustainable use of natural resources.

Main Axes:

The plan is structured around five priority areas for development:

1. **Human Capital:** Valuing and enhancing human capital, ensuring access to quality basic services.

2. **Economic Diversification:** Promote non-oil economic sectors to ensure inclusive and sustainable growth.
3. **Infrastructure:** Develop modern infrastructure that supports economic growth and regional integration.
4. **Environmental Sustainability:** Ensure efficient management of natural resources and protection of the environment.
5. **Governance and Institutions:** Strengthen public institutions to ensure transparency, efficiency, and citizen participation.

This plan reflects Angola's commitment to achieving balanced and sustainable development, in line with the global goals set out in **the 2030 Agenda** and the **Sustainable Development Goals (SDGs)**.

3.6.2 National Plan for the Promotion of Grain Production

The **National Plan for the Promotion of Grain Production (PLANAGRÃO)** is an initiative of the Government of Angola, approved by Presidential Decree No. 200/22 of July 23, 2022, which aims to significantly increase grain production in the country, contributing to food security, income generation, and the promotion of competitiveness in the agricultural sector.

General Guidelines and Goals:

PLANAGRÃO's main objective is to double annual grain production by 2027, reaching more than six million tons. Specific goals include:

- **Corn:** Increase production to 5,002,282 tons, cultivating 326,030 hectares.
- **Wheat:** Expand the cultivation area to 673,970 hectares.
- **Rice:** Reach 600,000 hectares of cultivation.
- **Soybeans:** Cultivate 400,000 hectares.

These goals aim to reduce dependence on imports and ensure the country's food self-sufficiency.

Main Axes:

The plan is structured around strategic actions to achieve its objectives:

1. **Financing and Investment:** Make available approximately 1.7 billion kwanzas, operated by the Development Bank of Angola (BDA) and the Angolan Venture Capital Fund (FACRA), to support companies and agricultural producers.
2. **Agricultural Infrastructure:** Develop production support infrastructure, such as irrigation, storage, and transportation systems, especially in the eastern provinces of Angola (Lunda-Norte, Lunda-Sul, Moxico, and Cuando Cubango), which have vast lands and adequate water resources for growing priority grains.
3. **Training and Technology:** Implement training programs for farmers and technicians, promoting the use of modern technologies and sustainable agricultural practices to increase productivity.
4. **Market and Marketing:** Establish mechanisms to ensure the sale of production at fair prices, including the participation of the Strategic Food Reserve (REA) in the purchase of part of domestic production and the promotion of institutional purchases by the State.

The implementation of PLANAGRÃO is essential to transform Angola into the largest grain producer in southern Africa, ensuring food sovereignty and boosting the country's socioeconomic development.

3.6.3 National Food and Nutrition Security Strategy 2024-2034 (ENSAN II)

Angola's National Food and Nutrition Security Strategy 2024-2034 (ENSAN II) is a government initiative aimed at ensuring that all citizens have access to quality food in a sustainable manner, with a view to eradicating hunger and promoting food resilience in the country.

General Guidelines and Goals:

- **Eradication of Hunger:** Ensure that all Angolans have access to adequate food, eliminating hunger throughout the national territory.
- **Sustainability of Natural Resources:** Ensure the preservation of natural resources by promoting practices that maintain environmental integrity and the productive capacity of the land.
- **Strengthening Food Resilience:** Strengthen the country's capacity to address challenges such as climate change, price fluctuations, and other factors that may affect food security.

Main Axes:

1. **Sustainable Production and Marketing:** Promote agricultural and marketing practices that ensure the continued availability of healthy and nutritious food.
2. **Access to Quality Food:** Implement policies that ensure that all citizens, regardless of their location or socioeconomic status, have access to safe and nutritious food.
3. **Food and Nutrition Education:** Promote educational programs that encourage healthy eating habits and inform about the importance of a balanced diet.
4. **Research and Innovation:** Encourage scientific research at all stages of the food and nutrition chain, with a view to improving food production, conservation, and distribution techniques.
5. **Governance and Coordination:** Establish effective governance structures, such as the National Council for Food and Nutrition Security (CONSAN), to ensure the implementation and monitoring of proposed policies and actions.

ENSAN II is aligned with the Sustainable Development Goals (SDGs) and the Angola 2050 Long-Term Strategy, reinforcing the country's commitment to building a more sustainable and resilient food system.

3.6.4 National Environmental Quality Program

Angola's National Environmental Quality Program (PNQA), approved by Presidential Decree No. 138/20 of May 19, aims to improve the quality of life of Angolans living in urban, peri-urban, and rural areas, focusing on ensuring air, water, and soil quality.

General Guidelines and Goals:

- **Air Quality:** Collect and update information on sources of atmospheric emissions and their impacts on health and the environment, with a view to reducing air pollution.
- **Water Quality:** Implement water quality monitoring systems, ensuring access to drinking water and the protection of water resources.
- **Soil Quality:** Promote sustainable land use practices, preventing degradation and encouraging the recovery of affected areas.

Main Axes:

1. **Legislative Development:** Draft and update legislation regulating the control and preservation of air, water, and soil quality, establishing national environmental quality indices.
2. **Environmental Education:** Promote environmental education at all levels of education, ensuring society's involvement in the conservation, recovery, and improvement of the environment.
3. **Monitoring and Evaluation:** Implement environmental indicators to monitor the effectiveness of policies and actions, ensuring continuous improvement in environmental quality.

3.6.5 National Water Plan

Angola's National Water Plan (PNA), approved by Presidential Decree No. 126/17 of June 13, establishes guidelines for the sustainable management of the country's water resources, aiming to ensure the availability and quality of water for current and future generations.

General Guidelines and Goals:

- **Integrated Water Resources Management:** Implement an approach that considers the technical, social, economic, and environmental dimensions of water resources management, ensuring a balance between water supply and demand.
- **Infrastructure Development:** Promote the construction and maintenance of water infrastructure, such as dams, supply and sanitation systems, to improve access to drinking water and basic sanitation.
- **Environmental Conservation and Protection:** Adopt measures to preserve aquatic and terrestrial ecosystems, ensuring water quality and the sustainability of natural resources.

Main Axes:

1. **Watershed Planning and Management:** Develop specific plans for each watershed, considering regional particularities and promoting the participation of local communities in water resource management.
2. **Institutional Strengthening:** Empower institutions responsible for water management, ensuring the effective implementation of policies and strategies defined in the NAP.
3. **Education and Awareness:** Promote educational programs and awareness campaigns to raise public awareness of the importance of water conservation and sustainable use of water resources.

The NAP also coordinates with other sectoral plans and national strategies, such as the National Irrigation Master Plan (PLANIRRIGA), which aims to develop irrigated agriculture in the country, contributing to food security and rural development.

3.6.6 National Irrigation Master Plan (PLANIRRIGA)

Angola's National Irrigation Master Plan (PLANIRRIGA) is a strategic initiative designed to promote sustainable agricultural development in the country by identifying and optimizing the irrigation potential of Angolan land.

General Guidelines and Goals:

- **Identification of Potential Areas for Irrigation:** PLANIRRIGA analyzed approximately 17.5 million hectares, of which about 7.5 million were identified as highly suitable for irrigation, with 80% of these areas classified as highly to moderately suitable.
- **Regional and National Development:** The plan aims to support regional and national development by proposing measures and actions in the agricultural hydraulics sector throughout Angola.

Main Axes:

1. **Rehabilitation and Expansion of Irrigation Infrastructure:** The plan proposes the recovery of existing irrigated areas and the construction of new infrastructure to increase the irrigated agricultural area.
2. **Technical and Institutional Capacity Building:** It is expected to strengthen the technical and institutional capacities of those involved in the management and operation of irrigation systems, ensuring the sustainability of projects.
3. **Promotion of Sustainable Technologies:** The adoption of efficient and sustainable irrigation technologies is encouraged, with a view to optimizing water use and conserving natural resources.
4. **Integration with Agricultural Policies:** PLANIRRIGA is aligned with other national agricultural policies and strategies, contributing to food security and reducing food imports.

3.6.7 National Strategy for Climate Change 2022-2035

Angola's **National Strategy for Climate Change 2022-2035 (ENAC 2022-2035)** was established by Presidential Decree No. 216/22 of August 23, 2022, with the aim of coordinating objectives, instruments, and institutions to promote sustained economic growth and sustainable development in the face of climate change.

General Guidelines and Goals:

- **Adaptation and Mitigation:** ENAC 2022-2035 aims to adapt Angola to the impacts of climate change and promote low-carbon development, contributing to the eradication of poverty and improving the quality of life of Angolans.
- **Emissions Reduction:** The plan sets targets for reducing greenhouse gas emissions, aligning with Angola's international commitments under the Paris Agreement.

Main Axes:

1. **Institutional Strengthening:** Strengthen the capacities of national institutions for the effective implementation of climate change policies and measures.
2. **Policy Integration:** Ensure that climate considerations are integrated into sectoral and national development policies, plans, and programs.
3. **Sustainable Management of Natural Resources:** Promote sustainable natural resource management practices aimed at biodiversity conservation and ecosystem resilience.
4. **Promotion of Renewable Energy:** Encourage the use of renewable energy sources to reduce dependence on fossil fuels and decrease greenhouse gas emissions.
5. **Education and Awareness:** Implement public education and awareness programs on climate change, aiming to increase society's awareness and participation in mitigation and adaptation actions.

ENAC 2022-2035 represents Angola's commitment to addressing the challenges of climate change by promoting sustainable and resilient development for future generations.

3.6.8 National Action Program to Combat Desertification (PANCD)

Angola's National Action Program to Combat Desertification (PANCD) was established by Presidential Decree No. 46/14 of February 14, 2014, with the aim of addressing the challenges of desertification and promoting sustainable land management in the country.

General Guidelines and Goals:

- **Poverty Reduction and Social Inequality:** The PANCD seeks to reduce poverty and social inequalities by sustainably increasing productivity in regions subject to drought and soil degradation.
- **Sustainable Management of Natural Resources:** The program aims to improve productive capital, including soil, water, and natural biological resources, as a way to combat desertification and promote environmental sustainability.

Main Axes:

1. **Promotion of Sustainable Agricultural Practices:** Encourage agricultural techniques that conserve soil and water, reducing erosion and improving soil fertility.
2. **Reforestation and Recovery of Degraded Areas:** Implement tree planting and land recovery programs in areas affected by desertification, with a view to restoring native vegetation and biodiversity.
3. **Capacity Building and Awareness Raising among Local Communities:** Develop environmental education and capacity building activities so that communities adopt sustainable practices and actively participate in the conservation of natural resources.
4. **Institutional and Political Strengthening:** Create a favorable institutional environment for actions to combat desertification, including the formulation of public policies and coordination between different government sectors.
5. **Continuous Monitoring and Evaluation:** Establish monitoring systems to assess the effectiveness of the actions implemented and adjust strategies as necessary.

Desertification is a significant concern in Angola, affecting about 31% of the national territory, especially in semi-arid and sub-humid regions along the coast, mining areas, and areas with intense forestry and livestock exploitation.

The PANCD represents the country's commitment to addressing these challenges and promoting sustainable and resilient rural development.

4 JUSTIFICATION OF THE EIAs

The growing demand for food and the need to ensure food security has driven infrastructure projects such as the construction of silos for grain storage. Although these projects are crucial to the efficiency of the food chain, it is imperative to consider the environmental impacts associated with their planning, construction, operation, and decommissioning phases.

The construction of the Lobito port ocean terminal is part of the expansion and diversification of the activities of the Carrinho, SA group. This group intends to expand its silo bases in various parts of the country for the storage of grain produced in the regions where these infrastructures will be built, in order to facilitate their internal distribution and export, as well as to extend the shelf life and quality of the grain.

This Environmental and Social Impact Study is intended to assess the potential environmental impacts and propose mitigation measures caused by the construction of the Carrinho, SA Group's silos.

Under the combined provisions of Article 16 of Law No. 5/98 of June (Basic Environment Law), and Article 112(d) and Article 113, both of the Constitutional Law, the Government created the Regulation on Environmental Impact Assessment and Environmental Licensing Procedure (Decree No. 117/20 of April 22).

This decree establishes a set of procedures to be followed in the preparation of Environmental Impact Studies, proceeding to the approval by the competent state body of the project subject to EIA, as well as the rules for its implementation.

These studies should focus on projects which, due to their nature, size, or location, may have implications for environmental and social balance and harmony, so that the EIA is an effective instrument for environmental protection and management, as well as for ensuring fair and balanced decisions by the public administration.

This Environmental Impact Study was prepared in accordance with the provisions of Article 4 of Decree No. 117/20 of April 22, which regulates environmental protection during

construction of agricultural infrastructure for grain storage "silos" at the Lobito ocean terminal, and requires the preparation of an Environmental Impact Assessment.

We also took into account Executive Decree No. 92/12 of March 1, which approves the Terms of Reference (TOR) for the Preparation of Environmental Impact Studies and establishes guidelines for the preparation of Environmental Impact Studies necessary for the environmental feasibility analysis of projects subject to environmental impact assessment.

According to Article 2, the Environmental Impact Study must be prepared in accordance with the legislation on Environmental Impact Assessment and strictly comply with the Terms of Reference approved by the Ministry of the Environment, which guides their preparation according to the specific nature of each project.

4.1 OBJECTIVES OF THE EIAS

The purpose of this Environmental and Social Impact Assessment is to carry out the basic studies for the construction project of the Ocean Terminal, including agricultural infrastructure for grain storage "Silos" in the municipality of Lobito, by the Carrinho, SA group. This includes gathering information and assessing the current environmental and social situation, analyzing and recording the current characteristics and dynamic behavior of its components.

The EIAS must also fully comply with the following objectives:

- **A summary description of the project;**
- **Identification of Potential Impacts:**
 - Analyze the direct and indirect effects of the construction of silos at the Lobito Port Ocean Terminal on the surrounding environment;
 - Assess impacts on soil characteristics, air quality, and water resources, etc.
- **Mitigation and Compensation:**
 - Propose mitigation measures to minimize negative impacts;
 - Identify opportunities for environmental , such as projects for reforestation or preservation of natural areas.
- **Community involvement:**
 - Include the active participation of the local community in identifying concerns and solutions;
 - Promote transparency and effective communication about construction plans and their impacts.
- **Legal Compliance:**
 - Ensure that the project complies with environmental regulations and local standards;
 - Collaborate with relevant authorities to obtain necessary permits and approvals.
- **Propose an environmental monitoring plan for the different phases of project implementation.**

4.2 SCOPE OF THE EIAS

4.2.1 Scope of the project and location

The future Lobito Ocean Terminal, owned by Carrinho S.A., is located in the province of Benguela, in the municipality of Lobito, specifically in Lobito Bay (Lobito Velho) next to the Mineiro Terminal of the Port of Lobito. It occupies an area of approximately 2,229 m², which corresponds to the total area of the concession, as shown in the location of the unit below (Figure 1).

In defining the study area, consideration was given to the area directly where these activities will be carried out, as well as the entire surrounding area that may be negatively and/or positively affected according to the analysis of each descriptor involved in the study.

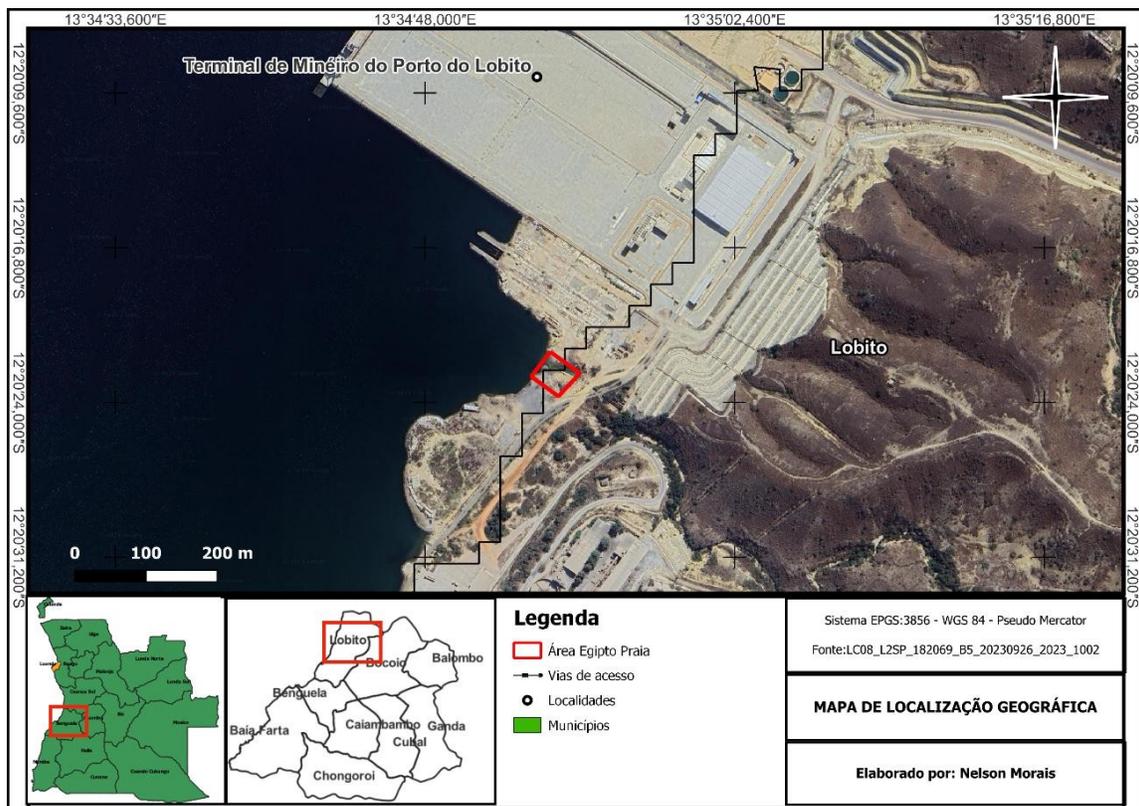


Figure 1 - Geographic location of the project implementation area

The project implementation site is bounded by the following coordinates:

Table 7: Geographic coordinates of the project area

POINTS	LATITUDE	LONGITUDE
1	12°20'21.66"S	13°34'53.85" E
2	12°20'22.66"S	13°34'55.17" E
3	12°20'23.72"S	13°34'54.21" E
4	12°20'22.82"S	13°34'52.98" E

4.2.2 Boundaries

The project is located within the following boundaries:

- North: The Atlantic Ocean;
- South: Railroad;
- East: Mineiro Terminal and;
- West: Private land, figure 2.

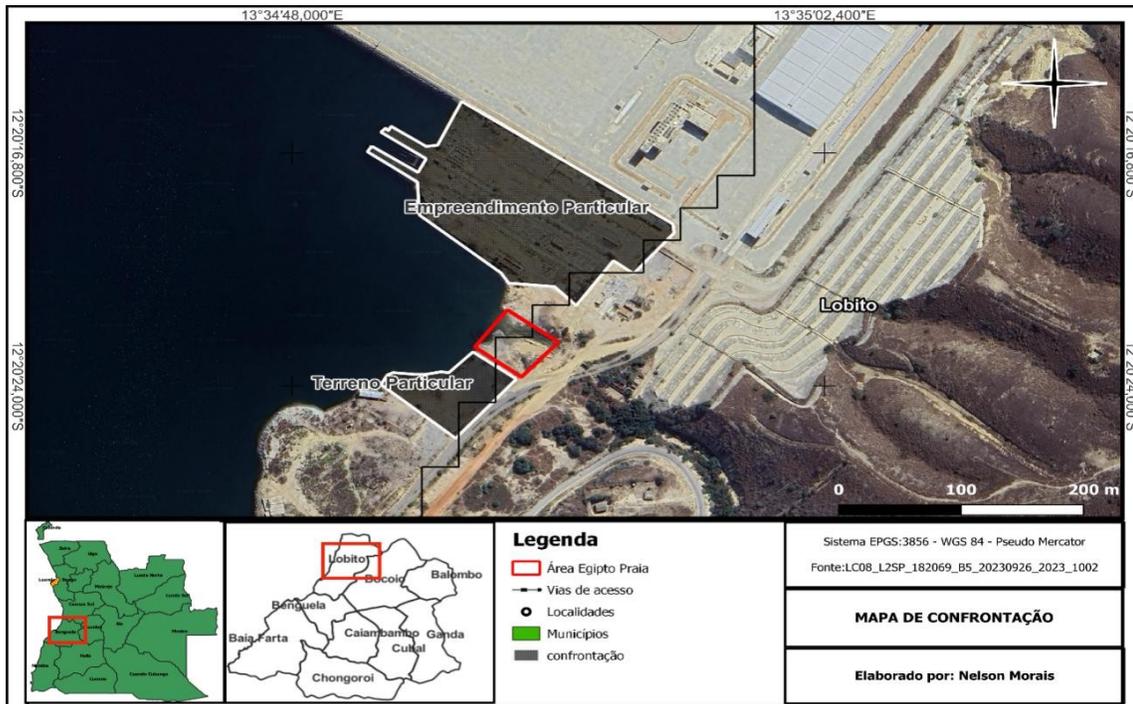


Figure 2 - Map of confrontations.

4.2.3 Access roads

The area where the project is located has a road network with infrastructure around the project area. The main access road is the EN 100, with its respective landmarks and other planned streets.

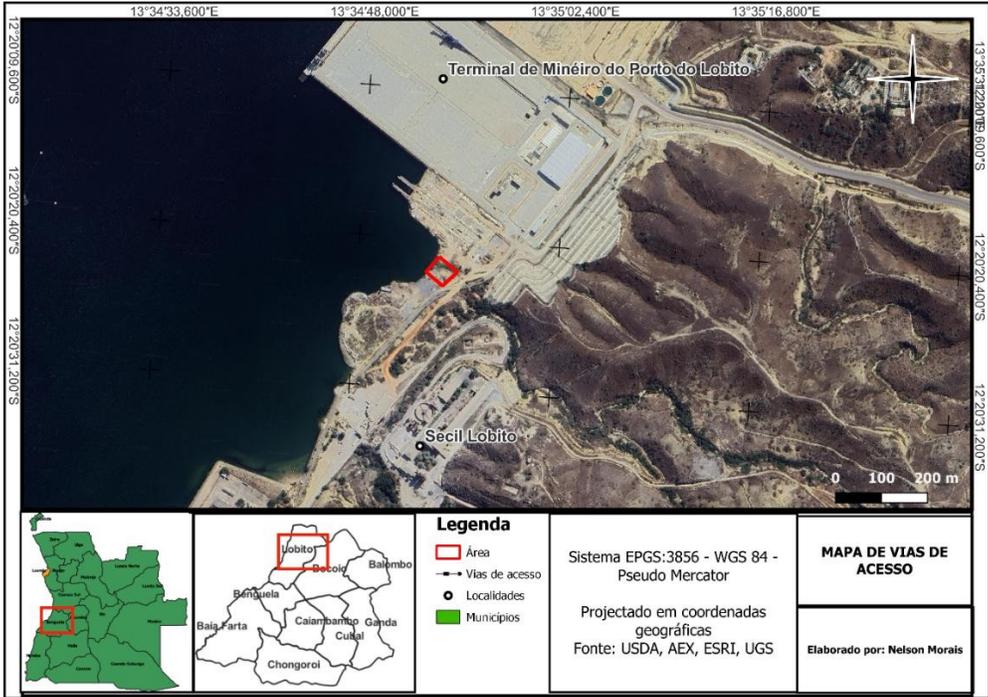


Figure 3 - Access roads map.

4.3 THEMATIC SCOPE - DESCRIPTORS UNDER ANALYSIS

Defining the thematic scope of the EIAS is an important requirement for the correct development of the study, as it allows the areas of analysis to be covered to be identified and, above all, their level of detail, depending on the type of impacts that are expected to be induced by the project and the specificity and sensitivity of the environment that will host it. Although the areas of study, as well as the aspects to be included in the analysis, may take into account the provisions of the legislation on Environmental Impact Assessment, it is important to recognize at this stage which environmental descriptors deserve particular attention and, consequently, further study.

Therefore, this EIAS will analyze the following environmental descriptors:

- Climate
- Geology and Geomorphology
- Soils and Land Use
- Surface and groundwater resources
- Flora and fauna
- Landscape
- Air quality
- Noise environment
- Socioeconomic
- Infrastructure
- Land use planning
- Historical and cultural heritage.
- Waste

4.4 EIA METHODOLOGY

The following methodology was used to prepare this environmental impact study:

- For each environmental descriptor, a characterization of the reference situation was made, which fundamentally aims to assess the current environmental situation;

- Based on the characterization of the reference situation and existing knowledge about the project components, the relevant environmental impacts on each environmental descriptor were identified and assessed;
- When impacts resulting from the Project with significant effects on a given component were identified, environmental mitigation measures were defined in order to avoid, mitigate, and compensate for the negative impacts and/or enhance the positive impacts identified;
- If there is still a degree of uncertainty about the importance of a particular environmental impact, or about the effectiveness of the proposed mitigation measures, environmental monitoring programs are proposed;
- Finally, the conclusions of the EIAS are presented, providing a summary assessment of the Project's environmental sustainability, taking into account the current state of the environment, the impacts identified, and the proposed mitigation and monitoring measures.

The structure of this EIAS reflects the general methodology adopted and comprises the following volumes and respective chapters:

Volume I, corresponding to **the Non-Technical Summary**, which summarizes in more accessible language the main aspects analyzed in the EIAS Summary Report.

Volume II, corresponding to **the EIAS Synthesis Report**, subdivided into the following chapters:

- **Chapter 1 - Executive Summary** - presents a concise summary of the EIAS Report in non-technical language, including the environmental and social reference conditions, the alternatives considered, the mitigation measures; the monitoring program, consultations with stakeholders, the technical and institutional capacity of the entities involved in the implementation of the project; and the cost implications;
- **Chapter 2 - Introduction** - this chapter presents the introductory and contextual aspects of the analyses produced in the EIAS;
- **Chapter 3 - Legal Framework** - identifies and analyzes the legal instruments and international conventions to which Angola is a signatory that have an impact on the assessment of

environmental impacts, as well as the relevant environmental, climate, and social policies of the African Development Bank;

- **Chapter 4 - Project Justification** - presents the project's objectives and justifies the need for its implementation;
- **Chapter 5 - Project Description** - describes the main characteristics of the project and the construction work, including the characteristics of the structures to be installed;
- **Chapter 6 - Characterization of the Reference Situation** - which characterizes the current state of the environment;
- **Chapter 7 - Environmental and Social Impact Assessment**, which analyzes the potential impacts of the project's implementation on the environment in terms of their value, magnitude, and significance;
- **Chapter 8 - Environmental and Social Mitigation Measures** - in which, depending on the impacts identified, environmental measures will be proposed to minimize or compensate for negative impacts and enhance positive impacts;
- **Chapter 9 - Cumulative Impacts - Residual Impacts and Environmental Risks**, identifies residual impacts, understood as negative impacts that cannot be mitigated. The environmental risks associated with the Project are also analyzed, both in the construction and operation phases;
- **Chapter 10 - Environmental and Social Monitoring and Management** - in which the environmental monitoring and environmental management programs for the various phases of the Project will be defined, when applicable;
- **Chapter 11 - Environmental and Social Management Plan** - describes the management measures, procedures, functions, responsibilities, schedule, monitoring, and implementation costs presented in the ESMP;
- **Chapter 12 – Institutional Capacity and Strengthening Plan** – describes the level of capacity of the entity responsible for the project in relation to supervising the implementation of the PGAS
- **Chapter 13 – Technical and Knowledge Gaps** – identifies all missing baseline information that, if acquired, would complement the analyses carried out;

- **Chapter 14 – Conclusions and Recommendations** – summarizing the main conclusions reached during the study;
- **Chapter 15 - Bibliography and Documentation Consulted** - lists the main sources of information and works consulted.
- **Chapter 16 - Appendices** - Contains all appendices relating to this study.

4.5 ENTITIES CONSULTED

During the course of this EIA, a number of entities were contacted in order to gather information that would allow for a better characterization of the area affected by the implementation of the Project and its environmental impacts. Information was requested from the various entities, and contacts were made in order to obtain the desired information.

- Benguela Provincial Government;
- Lobito Municipal Administration (provincial environment department);
- Lobito Mining Terminal Directorate;
- Provincial Directorate for Agriculture, Livestock, and Fisheries;
- Angolan Geodesic and Cartographic Institute (IGCA);
- Municipal Directorate of ENDE-National Electricity Distribution Company;
- Municipal Directorate of EASL-Lobito Water and Sanitation Company;
- Municipal Health Directorate;

5 PROJECT DESCRIPTION

5.1 JUSTIFICATION FOR THE PROJECT LOCATION

Carrinho is an Angolan family business committed to developing the first vertically integrated organizational structure in the food sector, managing all stages of the process: sourcing, transportation, storage, processing, and marketing.

It stands out as one of the best companies in Angola investing in agriculture and the industrial sector, with several factories distributed throughout the country. The project to build the ocean terminal and grain silos will be located in an industrial area within the urban network of the city of Lobito, with road, sea, and rail connections.

This will enable all products purchased by the Carrinho group in the provinces located in the interior of the country to be transported by road and rail (Benguela railway), and then stored and distributed quickly and efficiently at the future ocean terminal, serving domestic distribution, export, and import.

The following factors were taken into account when choosing the location of this terminal:

Economic

With the construction and operation of the ocean terminal, the economic advantages will be linked to the development of the region and the entire country. This will provide benefits such as:

- Facilitation of international trade;
- Stimulation of the local economy;
- Attraction of Investment;
- Generation of Tax Revenue;
- Stimulating regional development;
- Increased Export Competitiveness.

Social

The project is justified by the generation of jobs and income, growth in the regional economy due to the provision of services, preference for local labor, and improvement in the quality of life of the population.

Environmental

As this is a rural area with a variety of activities and agricultural fields, the project will have some impacts during its implementation. In order to minimize these impacts, it is expected that all mitigation and compensation measures will be complied with during the project's implementation, thus mitigating various impacts resulting from the project's implementation.

Location

The project will be located in an area of approximately 2,229 m², facing the ocean, with sufficient depth for loading boats and/or barges. Other location advantages include:

- Potentially industrial zone;
- Within the municipal seat;
- Proximity to the national highway connecting the provincial capital and the eastern part of the country;
- Existence of a natural barrier to prevent large waves (Lobito Bay);
- No conflict with land use and occupation;
- No urban areas very close to the project;
- Availability of adequate access routes facilitating the transport of goods, also facilitating the arrival of raw materials and necessary inputs;
- Absence of interference (transmission lines, gas pipelines, oil pipelines, etc.) that would imply restrictions and/or the need for removal for the implementation of the project;

5.2 PROJECT ALTERNATIVE

5.2.1 Location alternatives

Current option: Lobito Bay shore, industrial area near the port.

Advantages:

- Integration with existing port infrastructure;
- Proximity to logistics, road, rail, and maritime centers;

- Reduction in internal transportation costs and operating time.

Disadvantages:

- Proximity to urban areas and sensitive ecosystems (coastal zone of the bay);
- Possible pressure on marine biodiversity and water quality.

Alternative considered: Location in another less sensitive bay or further inland. **Analysis:** This option would require greater investment in access infrastructure and dredging, in addition to reducing logistical efficiency. However, it could mitigate some of the ecological impacts.

5.2.2 Technological alternative

Current option: Traditional port terminal with fixed quay, dredging, and continuous operations.

Alternatives considered:

- **Floating pier:** Less interference with the seabed, but lower load capacity.
- **Use of enclosed conveyor belts:** Reduces dust emissions and cargo spills.
- **Dredging technology with less impact** (e.g., precision dredgers, sediment curtain).

Analysis: The adoption of less invasive and more environmentally safe technologies can mitigate significant impacts, especially during the construction and ongoing operation phases.

5.2.3 Temporary alternative

- **Phased construction** over several years, with modules per stage, assessing impacts in real time.
- **Construction outside the breeding and migration season of marine species** (ecological window).

Analysis: Phased and timed construction reduces peak impacts and facilitates the timely application of corrective measures.

5.2.4 Zero alternative (non-execution of the project)

Advantages:

- Preservation of the coastal environment and marine fauna;
- No environmental or social risks.

Disadvantages:

- Loss of opportunity for regional logistical and economic development;
- Reduction in grain storage and distribution capacity in Angola;
- Lower generation of local jobs and revenues.

Analysis: Although the zero alternative has less environmental impact, not implementing it would compromise national food security and economic development objectives.

5.3 GEOGRAPHICAL CONTEXT

The proposed project will be implemented in an area corresponding to 229 m² and will be constructed using reinforced concrete, mesh, metal structures, and sheet metal, etc.

The project comprises a single facility, a silo block of 6 metal cells weighing 10,000 tons each for the storage of cereals (corn, wheat, rice, and soybeans), with a total capacity of 80,000 m³. Two horizontal silos with a total capacity of 120,000 m³ for raw sugar and three oil tanks with a capacity of 15,000 m³.

The silo block consists of:

- Reception circuit: Maritime, Road, or Rail with a capacity of 540 m³/h, with iron separation and weighing, central suction system per circuit.
- 6 storage cells with a total capacity of approximately 80,000 m³. 3 + 3 silo solution allowing two lines of 3 silos to operate.
- Shipping circuit: Maritime, Road or Rail with a capacity of 270 m³/h with weighing and central suction per circuit.

The horizontal silo consists of:

- Reception circuits: Maritime, Road, or Rail with a capacity of 540 m³/h, with iron separation and weighing, central suction system per circuit.
- 2 horizontal storage silos with a total capacity of approximately 120,000 m³. 1 + 1 silo solution allowing two lines of 1 silo to operate.
- Shipping circuit: Maritime, Road or Rail with a capacity of 270 m³/h with weighing and central suction per circuit.

The oil tanks consist of:

- Reception circuit: Maritime or Road
- 3 metal storage tanks with a total capacity of approximately 16,500 m³.
- Shipping circuit: Maritime or Road

The maritime circuit involves the unloading and loading of ships. The unloading circuit, with a capacity of 540m³/h, consists of (1) ship unloader that feeds 2 independent reception circuits, one for the 80,000m³ silo block and the second circuit for the 2 horizontal silos

The loading circuit, with a capacity of 270m³/h, consists of a ship loader that receives from a single circuit common to the silo block and the horizontal silos.

The road and rail circuit is designed for the loading and unloading of trucks (road) or wagons (rail) and consists of an independent receiving hopper for the silo block and for the horizontal silos in the case of unloading. With regard to the loading of trucks and wagons, we will also have independent loads for the silo block and the horizontal silos.

As illustrated below in the layout of the facilities (Figures 3 and 4)

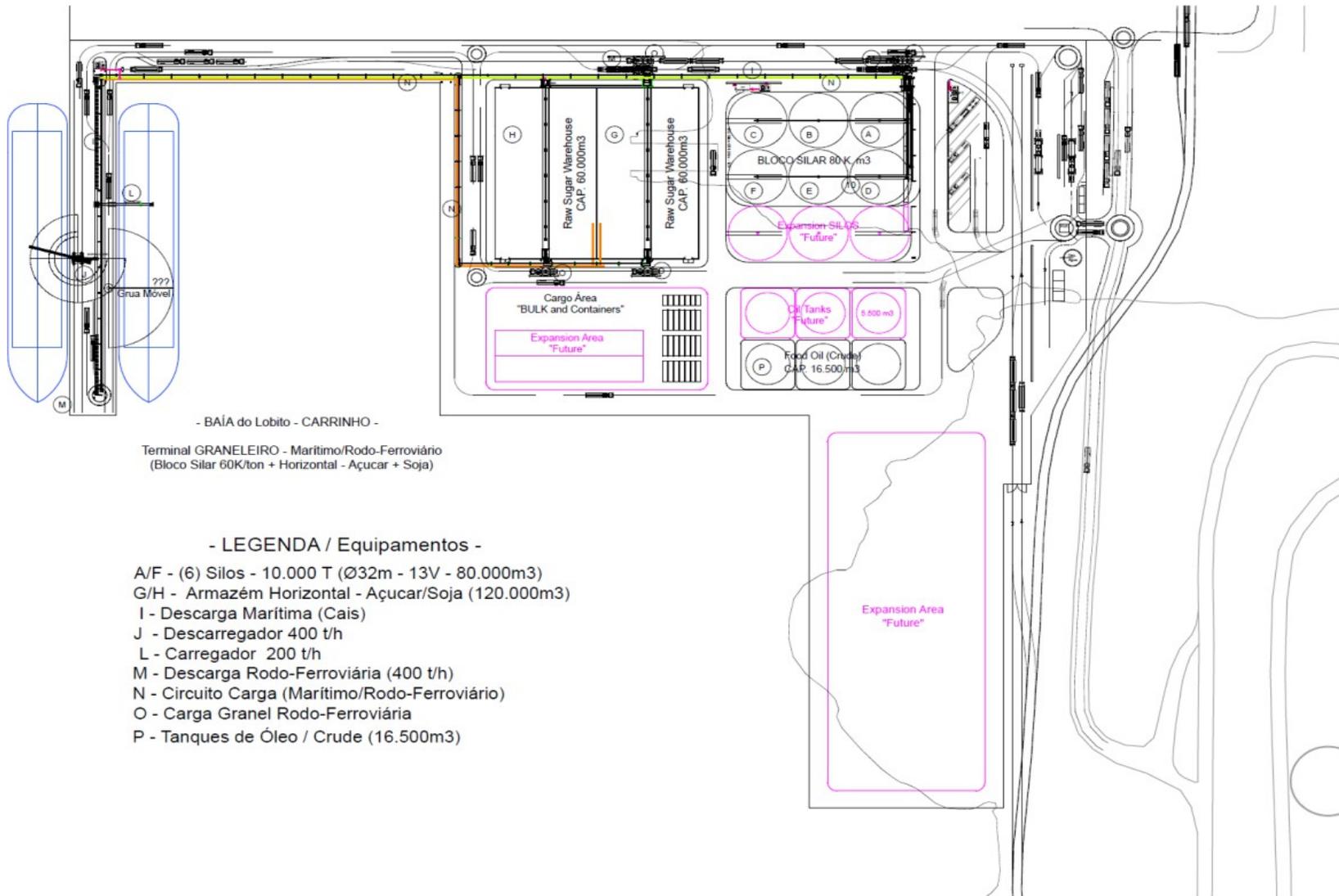


Figure 4 – Flow diagram (1)

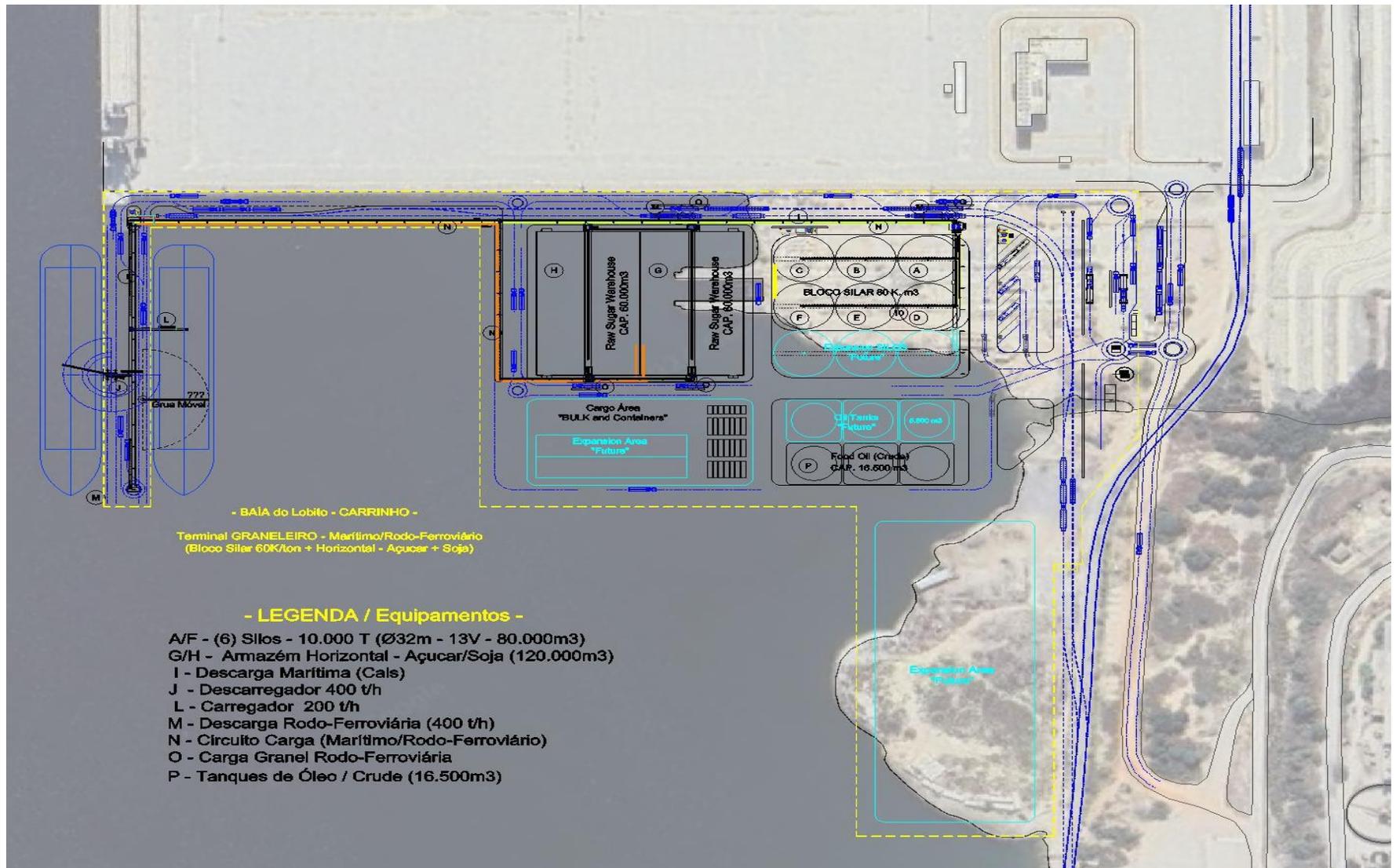


Figure 5 – Flow diagram (2)

5.4 GENERAL CHARACTERISTICS OF THE PROJECT

An ocean terminal, also known as a port terminal or maritime terminal, is a facility located in ports or coastal areas that serves as a crucial connection point between maritime and land transport. These terminals are designed to facilitate the loading, unloading, and storage of goods transported by ships.

The structure of an ocean terminal can vary depending on its size, location, and the types of cargo it handles. However, there are common main components that are generally found in modern ocean terminals. Here are the main structural elements of an ocean terminal:

5.4.1 Berthing Pier

This is the structure where ships dock to load and unload goods. The wharf can be constructed with concrete or steel pillars and is designed to support the weight and dynamic load of ships of different sizes.



Figure 6: Berthing Pier

5.4.2 Container Yard

This is the area where containers are temporarily stored before being loaded onto ships or after being unloaded. Container yards are usually paved and may include stacking areas to maximize the use of vertical space.



Figure 7: Container yard

5.4.3 Quay Cranes

Quay cranes are essential equipment for moving containers and bulk cargo between the container yard and docked ships. They are usually installed along the quay to facilitate efficient loading and unloading of goods.



Figure 8: Quay crane

5.4.4 Cargo Handling Equipment

In addition to cranes, ocean terminals may include other cargo handling equipment such as forklifts, reach stackers (equipment for stacking containers), stacker cranes (for automated warehouses), and belt conveyors.



Figure 9: Cargo handling equipment

5.4.5 Temporary Storage Facilities

Depending on requirements, there may be additional facilities for temporarily storing goods prior to shipment or after unloading. This may include warehouses or covered areas to protect goods from the elements.

5.4.6 Port Management Systems

These are computerized systems that manage all operations within the terminal, including cargo planning, space allocation, container handling, security monitoring, access control, and environmental management.

5.4.7 Land Access

Ocean terminals are connected to land transport networks via roads and, sometimes, railways. This facilitates the efficient transport of goods to and from the terminal, helping to integrate the terminal into the regional and national economy.

5.4.8 Administrative and Support Facilities

These include administrative offices to manage port operations, facilities for security and emergency personnel, maritime traffic control rooms, rest areas for port workers, and other support facilities.

5.4.9 Safety and Environmental Measures:

Ocean terminals must adhere to strict safety standards to protect human life and the environment. This may include measures such as security fencing, video surveillance systems, safety procedures for handling dangerous cargo, and environmental management practices to minimize negative impacts.

These elements combine to form the physical and operational framework of a modern ocean terminal, designed to facilitate the efficient movement of goods between ships and the land transport network.

5.5 Activities to be carried out and Materials

5.5.1 Materials

The materials to be used in the construction of the ocean terminal include reinforced concrete, wire mesh, coating materials, carpentry, masonry, paints, PVC pipes, ceramic materials, metals, and sheet metal, etc.

5.5.2 Flooring

Two types of flooring will be used, depending on their function: rigid flooring and flexible flooring.

Rigid flooring will be used in areas where water and hydrocarbon spills may occur, as it is more resistant.

Flexible flooring will be used in circulation areas.

Both types of flooring have been designed according to the type of stress to which they will be subjected, the bearing capacity of the foundation soils, and the mechanical characteristics of the constituent materials.

5.5.3 Earthworks

According to the topographical survey of the intervention area, the terrain is relatively flat, but excavation will nevertheless be necessary.

Excavation and earthworks will be necessary to secure the foundations, and in certain areas it will be necessary to replace soil for landfill and soil compaction purposes in order to improve the base.

5.5.4 Support infrastructure

To carry out the project, improvements to access roads are planned to facilitate the movement of vehicles and machinery. A construction site will also be built to support the construction of the ocean terminal, both of which will be built within the project boundaries.

5.5.5 Expected consumption

The estimated consumption for the installation and operation phase of the project is structured as follows:

a) Water supply

Water supply during the construction phase of the project will be provided by tanker trucks. The unit will have several reservoirs for water storage. For the operational phase, it is estimated that the unit will also rely on water from the public network, since the location where it will be implemented is covered by the public network.

b) Domestic Wastewater Drainage Network

The domestic wastewater drainage network comprises the conveyance of wastewater from buildings through discharge branches, which connect to manholes, giving rise to a collector that conveys wastewater by gravity to secondary treatment facilities (septic tanks).

The domestic wastewater drainage system is of the separate type, consisting of a network for the evacuation of "soapy water" and another for wastewater from toilet bowls. The treatment of wastewater from toilet bowls will be carried out in a septic tank.

c) Rainwater drainage network

During the construction phase, the unit will not have a rainwater drainage system, as rainwater will be drained and absorbed naturally by the soil.

For the operational phase, the rainwater network will have two fundamental systems: at roof level and at ground floor level.

The roofs will have slopes towards the gutters, which in turn will have slopes towards downpipes, which discharge into sand collection boxes.

At ground level, rainwater from roofs and rainwater collection grates is channeled through sand traps and discharged into the sea, with a portion being sent to storage tanks for reuse.

d) Electricity

The municipality of Lobito is supplied with electricity from the ENDE public grid, but the supply is still insufficient, requiring the use of alternative energy. For the implementation of the terminal, generators will be installed with a capacity according to the terminal's needs, powered by diesel or gasoline. The unit will also have fuel storage tanks, adequate for the needs of the project during the construction and operation phases.

e) Telecommunications

During the field visit, no public telecommunications network was found. The only resource for telecommunications in the project implementation area is private mobile telephony.

f) Air conditioning

The project will be equipped with a ventilation system that will ensure thermal comfort for users throughout the construction and operation phases.

g) Fuel

During the construction phase, the fuel to be used will be diesel and gasoline, depending on the type of equipment, capacity, and technical specifications.

5.5.6 Construction information

During the field visit, the characteristics of the surroundings near the intervention area showed that the project site has few dwellings and is a port and industrial area with cement factories, a railway line, neighboring port terminals, oil companies (Sonangol), and private enterprises. As can be seen in **the figure below**.



Figure 10: Neighboring developments (Secil Lobito and mining terminal)

The construction system to be used in this project will be completed within 24 months and will be mainly carried out in the open air with some permanent structures. The interior finish will be appropriately adapted to the spaces and their respective functions.

5.5.7 Labor

The labor will be divided into two phases: Construction Phase and Operation Phase. It will involve around 80 workers, including nationals and expatriates.

5.5.8 Schedule

The construction project for the Ocean Terminal belonging to Grupo Carrinho, SA, will last 36 months, starting in 2025 and scheduled for completion in 2028.

5.5.9 Investment Value

The total investment for the implementation of the project is estimated at **USD 4,826,250.00** (four million, eight hundred and twenty-six thousand, two hundred and fifty dollars), or the equivalent in Kwanzas according to the exchange rate on the day.

5.6 GENERAL AND OPERATIONAL CHARACTERISTICS OF THE SILOS

Silos are storage units characterized by airtight cells or compartments, which allow for minimal exchange between the external environment and the storage environment. They offer storage conditions for longer periods than ordinary warehouses, as they allow for more efficient control of sources of deterioration.

There are different types of vertical silos, depending on the material used for their construction, which can be metal, concrete, masonry, and wood (used for seed storage). The basic differences between structures built with different materials are related to:

- Initial cost, which varies greatly between them;
- Different repair needs over time; and
- Greater or lesser difficulty in eliminating infestations of organisms harmful to grain conservation.

The size of each structure depends on the amount of grain to be stored and the storage time, as well as the number of harvests per year. For large producers, it is better to have more medium-sized silos, i.e., with a capacity to store volumes of two to three thousand tons per silo.

Wooden silos: for small volumes of seeds – 60 to 80 tons;

Masonry silos: can store from 100 to 1,200 tons;

Concrete silos: from one to three thousand tons or more; and

Metal silos: can hold six thousand tons or more.

The most commonly used silos today are those made of concrete and metal.

Concrete silos

Advantages:

- Less space occupied due to vertical position;
- Thick walls, which prevent heat transfer to the grain mass; and

- Better grain preservation due to longer storage time. Disadvantages:
- High cost and long installation time;
- High maintenance cost; and
- High incidence of grain breakage due to the height of the silo.

Metal silos

Advantages:

- Simpler and lower-cost foundations;
- Lower cost per ton stored than concrete silos; and
- Medium capacity cell that allows for greater operational flexibility.

Disadvantages:

- Possibility of moisture infiltration;
- Possibility of gas leakage during the purging process;
- Heat transfer from the environment into the cell, which may cause condensation; and
- Higher installation cost than bulk storage facilities.

5.6.1 Process description

In stored grains, the most important organism is the grain itself. Although its life cycle is temporarily suspended (dormancy stage), it has all the properties of a living organism.

Grains should be harvested immediately after reaching physiological maturity, that is, when their dry matter reaches maximum weight. From that point on, if the product is not harvested, processed, and stored properly, losses will increase.

However, at the point of physiological maturity, the grains have high moisture content, both for harvesting and storage, and may be mixed with seeds from other plants that are still green (invasive or from previous crops). In this case, pre-cleaning, cleaning, and drying processes are necessary before actual storage, according to the harvest conditions, as shown in the following diagram.

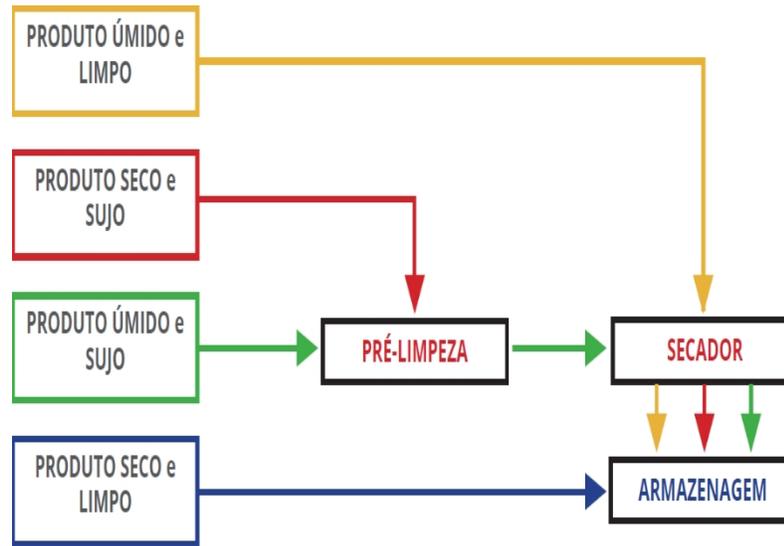


Figure 11 - Diagram of grain storage stages using a conventional system

Losses during storage can occur due to:

- Inadequate unloading of the product into the warehouse, which causes mechanical damage (broken and cracked grains);
- Grain mass with many impurities;
- Grain mass with different water contents;
- Incorrect drying of grains; and
- Poor air circulation in the storage area.

Temperature and humidity can be altered to ensure grain quality during storage. Therefore, they must be measured and controlled.



Figure 12 - Factors that most affect grain quality during storage

5.6.2 Importance of water content in stored grains

Water content is an important factor in controlling losses in stored grain. If humidity is kept at low levels, other harmful factors can be easily controlled. Table 1 shows the water content of grain in relation to harvesting and storage.

Table 8: Moisture content of some grains in relation to harvest and storage

Produto	Percentual de umidade				
	Colheita	Ideal	Armazenamento seguro		
	Máximo	Ótimo	Após secagem	1 ano	5 anos
Café	62	62	12	11	10
Milho	23	20-22	11	11	9-10
Arroz	21	17-19	11	11-12	9-10
Soja	18	16	11	11-12	9-10
Sorgo	26	23-26	9	11-12	9-10
Trigo	23	15-17	8	12-13	10-11

To determine the harvest point for grains, it is necessary to determine their moisture content under field conditions. The result indicates whether they are ready to be harvested and whether or not they will need to have their moisture content reduced through artificial drying for storage.

The recommended moisture content for manual grain harvesting is shown in Table 2. For most grains, such as rice, beans, and corn, the moisture content varies between 18 and 20%.

Produto	Teores de umidade (%)
Arroz	18 a 24
Feijão	16 a 18
Milho	18 a 24
Soja	16 a 18
Sorgo	18 a 20
Trigo	18 a 20
Café	11 a 12

Table 9: Moisture content of grains at harvest

Note: To be stored, harvested grains need to have a moisture content of 12 or 13%, a level achieved by drying in a yard or in a dryer.

5.6.3 Interference of temperature on the quality of stored grains

Increased temperature is another factor that affects grain storage and can be caused by other factors related to quality loss. Therefore, controlling temperature can prevent rapid deterioration.

The heating of stored grain is caused by fungal attack and occurs when the moisture content of the grain is above the correct level for storage, as shown in Table 1.

Note:

1. To control the temperature, it is necessary to have an environment that allows for good air circulation.
2. Grain should be stored at the correct moisture content.

5.6.4 Characteristics of stored grain mass

Grain mass has certain characteristics that can compromise or guarantee its quality and must therefore be observed.

- **Porosity of the mass:** when stored in silos, containers, or bags, grains form a porous mass consisting of themselves and the space occupied by air, which represents around 40 to 45% of the total volume.
- **Thermal conductivity:** grains exchange heat between themselves and their porous mass. Heat passes from a warmer region to a cooler one, from grain to grain, as they are in contact (conduction), and through the air flow passing through the porous mass (microconvection).
- **Grain moisture balance:** the moisture content of the grain mass remains in balance when there is a positive relationship between relative air humidity and temperature. If relative air humidity and temperature vary greatly, the grains lose or gain moisture according to the low or high relative air humidity.

Note: To store grain properly, it must be kept under conditions that hinder or prevent the growth of microorganisms and insects that cause loss or damage. To this end, water content, relative humidity, and temperature must be balanced.

5.6.5 Losses that occur during grain storage

- **Physical loss or breakage:** occurs when the product suffers weight loss due to damage caused mainly by insect attacks. Other animals, such as rodents and birds, also cause losses, but these are smaller compared to those caused by insects.



Figure 13 - Grain breakage during unloading

- **Loss of quality:** occurs when the quality of the product changes, mainly due to the action of fungi, which cause fermentation, alteration of the natural taste and smell of the product, and reduction of the nutritional value of the grains.

Contamination by foreign matter and other damage that affects the quality of grains for agribusiness are among the factors that lead to quality losses. Contamination can be biological, physical, or chemical, and can occur alone or in combination.



Figure 14 - Contamination of grains by fungi

5.6.6 Warning signs and damage in grain storage

- General appearance of mold and fermentation;
- Mixture of foreign species harmful to the use of the product; and
- Unusual odor of any kind, inappropriate for the product and harmful to consumption.

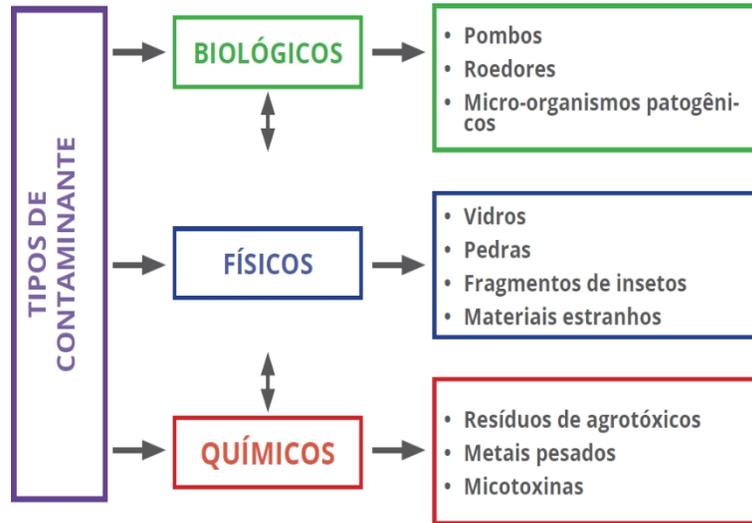


Figure 15 - Biological, physical, and chemical contaminants in stored grains

5.6.7 Contaminants in the external environment of the grain storage unit

It is necessary to identify and control possible contaminants that influence the quality and isolation of stored grains. Therefore, monitoring and control actions must be planned.

Table 10: Identification of biological hazards in post-harvest and grain storage

ÁREA DAS UNIDADES ARMAZENADORAS (Entorno do paiol, solo, galpão etc.)			
PERIGO BIOLÓGICO	<i>Salmonella</i> <i>Coccidiose*</i>	SEVERIDADE MÉDIA	RISCO ALTO
JUSTIFICATIVA - Presença de fezes de aves (pombos*)			
MEDIDAS PREVENTIVAS			
<ul style="list-style-type: none"> • Colocar telas para evitar a entrada de aves na unidade armazenadora • Evitar grãos esparramados no pátio da unidade armazenadora 			
PERIGO BIOLÓGICO	LEPTOSPIROSE	SEVERIDADE MÉDIA	RISCO ALTO
JUSTIFICATIVA - Presença de urina e fezes de ratos			
MEDIDAS PREVENTIVAS			
Controlar insetos e roedores (MIP)			

5.6.8 Insects and pests

Insects that attack grains during storage can be classified as:

- **Primary pests**

Primary pests attack and infest undamaged grains and also feed on damaged ones. Most of them can begin their infestation and attack in the field, before harvest.

- **Secondary pests**

Secondary pests attack the interior of damaged or already attacked grains.

5.6.9 Factors that contribute to insect pest attacks

High temperatures and high humidity increase infestations of primary and secondary pests.

Combined conditions of temperatures between 25 and 34°C and relative humidity of around 70% are considered risky.

While the moisture content of stored grain can be a risk for pest attack, it is also important to prevent infestation in the grain mass. Dry grain, with a moisture content of less than 12%, does not allow the development of most insect pest species, with the exception of a few, such as stem borers, which attack exceptionally dry grains with less than 8% moisture.

Table 11: Types of pests that can affect grain

PRIMARY PESTS				
TYPE OF PEST	CHARACTERISTICS	PREFERRED CROPS	DAMAGE	IMAGE
Grain weevil <i>(Sitophilus spp.)</i>	This is one of the most dangerous pests for all types of grain. It is characterized by a narrow, pointed snout (rostrum), which is an extension of the head, and has a brown body. nose (rostrum), which is an extension of the head, and has a brown bronze or dark brown body.	They attack cereals, mainly corn, sorghum, rice, and wheat. They do not They do not attack small grains such as millet, as their larvae do not develop well. They also feed on dried cassava and processed food.	Infestation usually begins in the field, when eggs are laid in undamaged grain. After harvest, the infested grain is transported to the warehouse, where the larvae emerge, leaving a characteristic hole. Both the larvae and the adult insects cause damage, but the larvae are responsible for most of the economic losses.	
Grain weevil <i>(Prostephanus truncatus)</i>	Native to Central America, this beetle is one of the most important pests that attack stored grain in tropical and subtropical regions. It is dark brown or black in color and also feeds on corn stalks, ear and wood debris, and dry foods.	It is a highly destructive primary pest for corn, especially for the product stored in cobs. Its damage has been so high that storage in cobs is no longer encouraged in some places and has been replaced by straw-free storage, previously treated. The corn borer	Infestation usually begins in the field before harvest and continues during storage, especially in corn still with straw. Both the adult beetle and the larva enter the grain and produce large amounts of dust. On average, losses can reach 30% of stored corn.	

		<p>The beetle can also feed on dried cassava and flour products.</p>		
<p>Grain beetle <i>(Rhyzopertha dominica)</i></p>	<p>Originally from South America, it is now found in all warm and humid climates around the world. This small brown or black weevil is very voracious.</p>	<p>It is a devastating pest of most cereal grains, including millet, although it is not very common in rice.</p> <p>It also feeds on cassava and other starchy products.</p>	<p>The infestation begins in the field and the larva, introduced into storage systems storage systems, attack the interior of the grains, where they develop.</p> <p>Adult insects and larvae pierce the grains and feed on the endosperm. This process causes a lot of dust, which, when present, can be an indication of high infestation. The grain beetle has a long life cycle and destroys a quantity of grains equivalent to its body weight every day.</p>	

<p>Cereal moth (<i>Sitotroga cerealella</i>)</p>	<p>This insect attacks crops after harvest and is very common in grain storage facilities, especially right after harvest. It reaches a size of 12 to 14 mm, and the larvae feed and transform inside the grains.</p>	<p>Like the grain beetle, this is a pest that attacks all major grains, including wheat, barley, corn, sorghum, and millet; it also causes great damage to rice in husk, and can cause substantial damage to its germ</p>	<p>It attacks ripening grains while still in the field and is usually transported inside them to storage facilities storage facilities.</p> <p>After incubation, the larva penetrates the grain and completes its development. Infestations produce a lot of heat and moisture, which promote the proliferation of fungi, as well as secondary pests.</p>	
<p>Bean weevil (<i>Callosobruchus maculatus</i>)</p>	<p>This is a brownish-red beetle of the dry bean weevil family. Although it is essentially a field pest, the eggs and larvae are transported inside the beans after harvest to the warehouse.</p>	<p>Legumes such as beans, soybeans, chickpeas, and string beans are susceptible to attacks by borers in general and bean weevils in particular.</p> <p>This weevil is also an important pest that infests cereal feed, animal meal, flours, and milling residues with high protein content.</p>	<p>The bean weevil generally attacks dried legumes. Infestation can begin in the field where eggs are laid in pods in the process of ripening. In the larval stage, the damage can affect 90% of stored legume grains. The infestation cycle can be broken by crop rotation, to avoid growing the same species in the same area for consecutive years.</p>	

SECONDARY PESTS

<p>Brown beetle (<i>Tribolium</i> spp.)</p>	<p>Found in the main tropical and subtropical regions.</p> <p>It is a reddish-brown beetle and the larvae are whitish-yellow.</p>	<p>It attacks corn, peanuts, rice, beans, chickpeas, sorghum, and wheat.</p> <p>It prefers damaged grains, but can also attack whole wheat grains.</p>	<p>Both adult beetles and larvae feed first on the germ and then on the endosperm. This pest spreads, generally in storage conditions with uncontrolled uncontrolled temperature and humidity, which are conducive to the proliferation of insects that increase the temperature of the grain mass.</p>	
<p>Flour moth (<i>Epehstia</i> spp.)</p>	<p>This insect is common in stored products and storage facilities in various climates. The upper half of the front is bronze, silver, or dark gray, and the upper half of the rear part is gray with a yellowish tint and a black band at the point where between the two parts.</p>	<p>It attacks all types of dry grains, such as corn, rice, and wheat.</p>	<p>The larva feeds externally on grains, but most damage is caused by contamination with massive amounts of silk threads expelled by the larva, which also accumulates feces, films, and eggshells.</p>	

<p>Termites <i>(Macrotermes sp.)</i></p>	<p>This is a common name for numerous species of social insects that can cause damage to stored grains and wooden structures, such as furniture or wood-covered parts in buildings.</p>	<p>They feed mainly on cellulose. These insects attack various crops such as corn, sorghum, sugarcane, forest plantations, among others. They attack corn crops after sowing, destroying them before germination and causing failures in this process. The roots of corn and sorghum can be attacked, causing the plants to turn yellow, wither, and die.</p>	<p>They are very large because they affect not only the stored product, but also the storage infrastructure itself.</p> <p>Although termites do not specifically seek out grain (they only eat the grain they find in their path), they can seriously damage storage structures built with grass, twigs/branches, wood, or mud, which can collapse and result in significant losses.</p>	
---	---	---	--	---

5.6.10 Integrated Pest Management (IPM) for insect control in storage facilities

IPM considers all available insect pest control techniques, which are combined to reduce the development and attack of pests. IPM reinforces the application of healthy techniques with the least possible damage to agroecosystems and encourages natural insect pest control techniques.

Pest control may include the use of predators, parasites, sterile male insects, or generating diseases in insects. Pheromones are also used for pest monitoring, to interrupt mating, or as traps.

The wide availability of insecticides often results in their excessive use and dependence on them, detracting from the importance of other pest control and management techniques, such as:

- **Pest management during pre-storage**

Pest control in storage facilities begins when the crop is still in the field. To reduce the risk of transporting primary pests from the field to storage, it is necessary to adopt certain procedures, such as grain drying and quality control, among others.

- **Cleaning and drying**

Try to clean and dry the grains whenever they come out of the fields, especially when they have to be stored for a long period.

- **Quality control of grain to be stored**

Grains must be stored in good quality and sanitary conditions, avoiding those that are infested, mixed (with other species), or damaged.

- **Storage management**

Pest development and control should be monitored by the location of storage units, the storage period, and the quality of stored products.

- **Cultivation of resistant varieties**

The use of resistant varieties generally delays infestation and damage to grains, prolonging the period during which the level of damage remains low.

Corn varieties cover the entire cob, providing good protection against weevils. The use of a particular variety needs to be carefully considered,

as high-yield varieties are more susceptible to damage by insect pests in storage units.

- **Natural insecticides**

Natural insecticides include materials such as abrasive mineral dusts, natural desiccants such as wood ash, plant materials with repellent or insecticidal properties, such as parts of the Indian neem tree (*Azadirachta indica*), or vegetable cooking oils (peanut or coconut oil).

6 CHARACTERIZATION OF ENVIRONMENT AFFECTED BY THE PROJECT

6.1 GENERAL CONSIDERATIONS

This chapter presents a description of the current environmental and social situation in the study area.

The purpose of characterizing the baseline situation is to obtain an adequate information base for assessing the environmental and social impacts caused by the Project.

The following points present analyses of the project's area of influence and characterize the baseline situation for climate, geology and geomorphology, soils and land use, surface and groundwater resources, flora and fauna, Landscape, Air Quality, Sound Environment, Socio-economic, Infrastructure, Land Use Planning, Historical and Cultural Heritage, and Waste.

6.2 DEFINITION OF THE PROJECT'S AREA OF INFLUENCE

The delimitation of the areas of influence of the project is the result of the territorial spatialization of the direct and indirect impacts resulting from its implementation and operation, considering the physical, biotic, and socioeconomic environments.

They are defined as follows:

- **Directly Affected Area (ADA)** - the Directly Affected Area (ADA) is considered to be the area of the project, including its support structures, private access roads, expanded or renovated, as well as all other unit operations associated exclusively with the project's infrastructure, i.e., for the private use of the project.
- **Directly Affected Area (DAA):** area subject to the direct impacts of the preparation and operation stages of the unit where the agricultural infrastructure (silos) will be installed. Its delimitation is based on the social, economic, physical, and biological characteristics of the systems to be studied and the particularities of the project.
- **Indirect Area of Influence (IAI):** the area that is actually or potentially threatened by the indirect impacts of the preparation and operation of the project where the

agricultural infrastructure (silos) will be installed, covering the ecosystems and socioeconomic system that may be impacted by changes occurring in the AID.

- **Regional Area of Influence (RAI):** refers to the geographical space and socioeconomic sectors that are directly or indirectly affected by the planning and management activities of the agricultural infrastructure (silos) project. This concept is fundamental to understanding the scope of the policies implemented and to ensuring an integrated and efficient approach.

The definition of geographical boundaries under the influence of a given activity is one of the requirements for assessing environmental impacts and is a determining factor for the other activities necessary for preparing the environmental diagnosis and prognosis.

The delimitation of study areas is related to the identification of spaces subject to the influences of potential impacts associated with an environmentally modifying enterprise. As a result, the task of delimiting these areas requires preliminary knowledge of the type and nature of the planned project, in order to identify the actions that significantly affect the physical, biotic, socioeconomic, and cultural environmental components during its implementation and operation.

Thus, the identification of the study areas guides, first, the environmental diagnosis phase, serving to delimit the scope of work of all disciplines involved in the Environmental Impact Assessment (EIA). Second, the areas studied allow for the investigation of the spatial extent of the adverse or beneficial effects associated with the project.

6.2.1 Directly affected area (DAA)

The Directly Affected Area (DAA) corresponds to the area that suffers the greatest impact from the activity, considering physical, biological, socioeconomic changes and the specific characteristics of the activity.

The ocean terminal construction project will be located mainly in the coastal area of the municipality of Lobito, in the province of Benguela, Angola.

6.2.2 Area of Direct Influence (ADI)

The Area of Direct Influence is the geographical area that will be affected by the impacts resulting from the project activities and corresponds to the contiguous and expanded territorial space of the ADA, and as such is likely to result in positive or negative impacts.

For physical, chemical, and ecological means, the AID is considered within a radius of 500 meters. The project covers the Lobito Port Mining Terminal to the north, Cecil Lobito to the south, vacant land to the east, and the Atlantic Ocean to the west, as illustrated in the figure below.

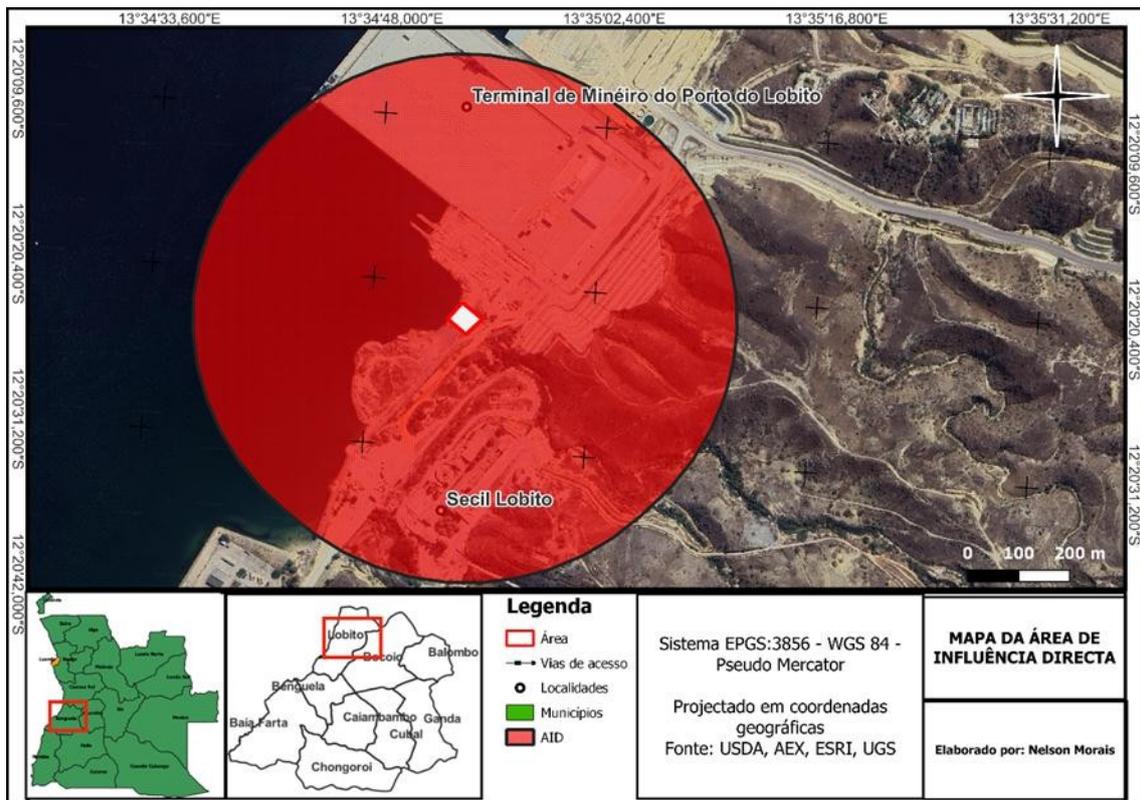


Figure 16 – Map of the direct area of influence.

6.2.3 Area of Indirect Influence (AII)

The Indirect Area of Influence (IAI) is generally a more comprehensive area where the proposed activities may have an impact, not directly, but through possible secondary effects that may result from the project.

Thus, the IIA includes the accesses to be used and, more generally, at a higher level, the area occupied by the project. Within a radius of 10 kilometers, the project covers the southwest (SW) by Catumbela and the north by the Atlantic Ocean, as shown in Figure 17.

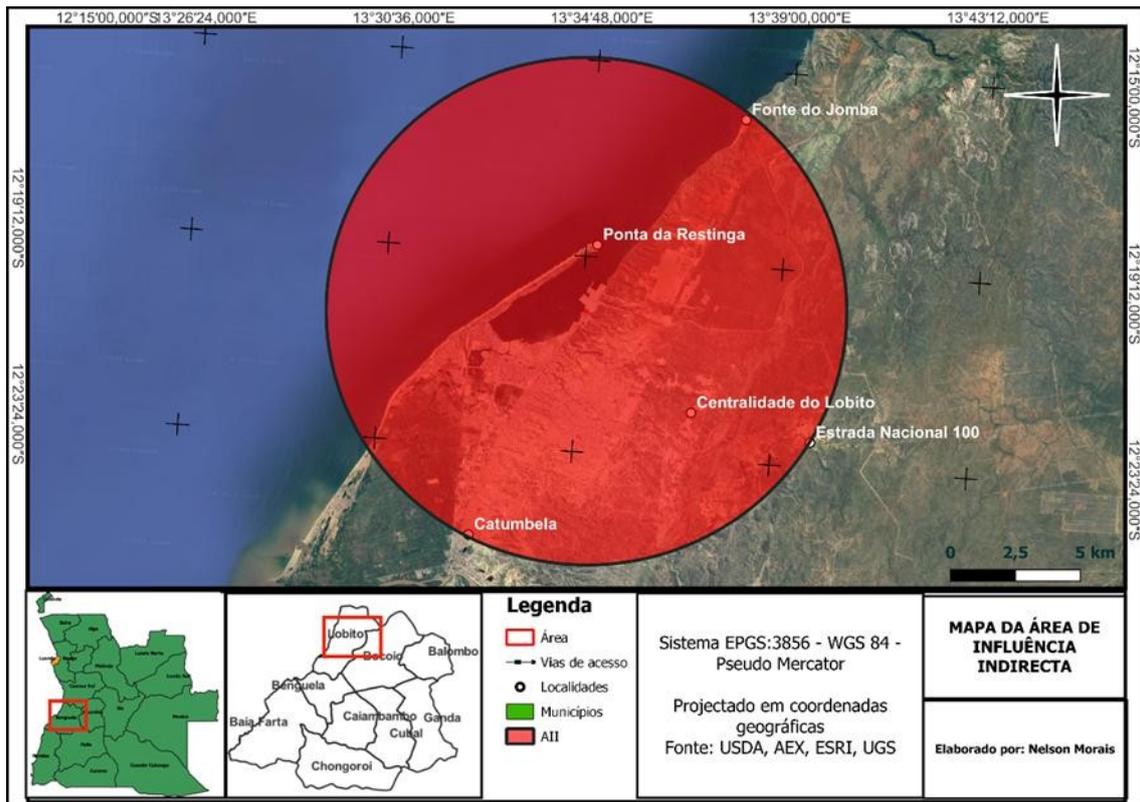


Figure 17 – Map of the area of indirect influence.

6.2.4 Regional Area of Influence (RAI)

The area of regional influence generally refers to the entire geographical area and socio-economic sectors that are directly or indirectly affected by grain storage and transport activities to and from the unit, as well as all locations that will supply this raw material, covering the entire surrounding region of Benguela Province.

6.3 CLIMATE

6.3.1 General Considerations

Angola's climate is characterized by a dry and cool season (cacimbo) from June to the end of September and a rainy season from October to the end of May (Ministry of Urbanism and Environment, 2006).

There is a clear association between rainfall in inland Angola and the southward movement of the equatorial trough from September to January, and also with its northward movement from January to May, bringing unstable air of tropical origin with strong convergence in the lower levels over much of the territory.

tropical origin with strong convergence at lower levels. This gives rise to very cloudy skies with cumulus, cumulonimbus, altocumulus, and altostratus clouds that cause rain in the form of very frequent and intense showers and thunderstorms. Local climatic factors must also be taken into account, such as the relief, which, acting in conjunction with the general conditions, determines the specific characteristics of the different areas.

The dry season, from May to August, corresponds to the action of the anticyclonic core of the African continent, transporting dry and stable continental air from the Kalahari over Angolan territory, with temperature inversions in the lower layers.

The average annual temperature varies between 15-20 °C in the central plateau and the Namibe desert, and between 25 °C-27 °C in the Congo River basin region and the sub-coastal strip in the north of the country (Ministry of Urban Planning and Environment, 2006).

6.3.2 Climate Classification

Köppen's climate classifications highlight the diversity of climates found in Angola.

According to the Köppen-Geiger climate classification, Angola has several types of climates, which can be distributed according to their representativeness, as illustrated in Table 12.

Table 12: Köppen classification: territorial distribution

CLIMATE TYPE (KÖPPEN)	AREA (km ²)	% TOTAL
Aw – Tropical rainy climate	492,660	39.5
BSh – Dry steppe climate	122,000	9.8
BSh' – Dry steppe climate	69,500	5.6
BWh – Arid desert climate	25,840	2.1
BWh' – Dry desert climate	30,200	2.4
CWa-Mesothermal, humid climate with dry winters	374,930	30.1
CWb – Temperate climate with dry winters and hot summers	131,570	10.5
TOTAL	1,246,700	100

Source: (Azevedo, 1972)

6.3.3 Characterization of the Local Climate

The climate of Benguela is characterized by arid and dry conditions typical of a desert region. Throughout the year, there is virtually no rainfall. The climate classification is BWh according to Köppen and Geiger. In Benguela, the average temperature is 24.1 °C. The average annual rainfall is 337 mm.

According to the data, Benguela is located near the equator, making summers difficult to define. The most popular time to visit is January, February, March, April, May, October, November, and December.

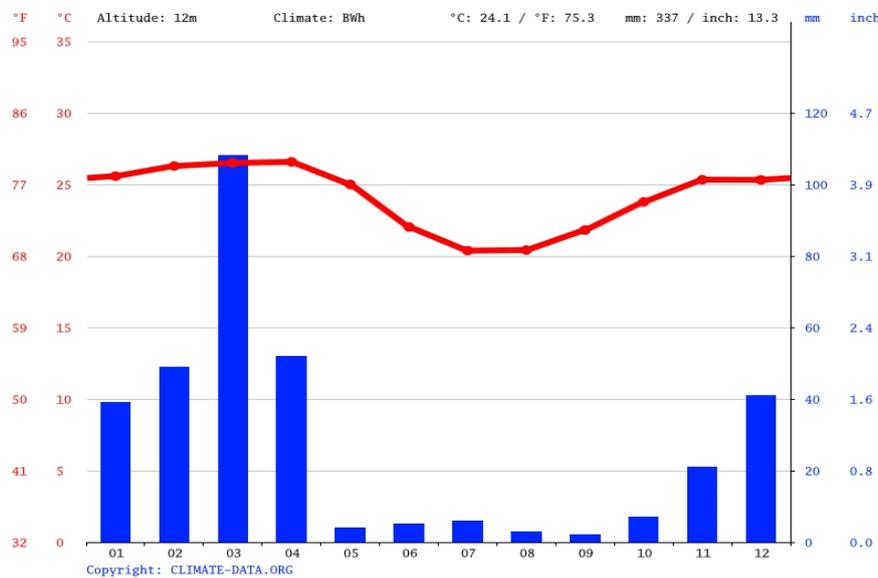


Figure 18 - Benguela climate

In September, precipitation drops to a mere 2 mm. This month holds the title of being exceptionally arid. The month with the highest precipitation is March, with an average of 108 mm. For climate analysis of the implementation area, the Köppen climate classification was used. The Köppen classification directly relates climate classes to natural vegetation cover, which allows for global climatological mapping, including regions where there are no meteorological observations. The Köppen system defines five main climate regions and several sub-regions. In the Köppen system, the different classes are defined based on the annual cycle of average monthly temperatures. The definition of sub-regions, in turn, uses the annual cycle of precipitation and monthly temperature.

In this context, according to Köppen, the municipality of Lobito has a hot semi-arid climate, which covers the project area, as shown in the figure below.

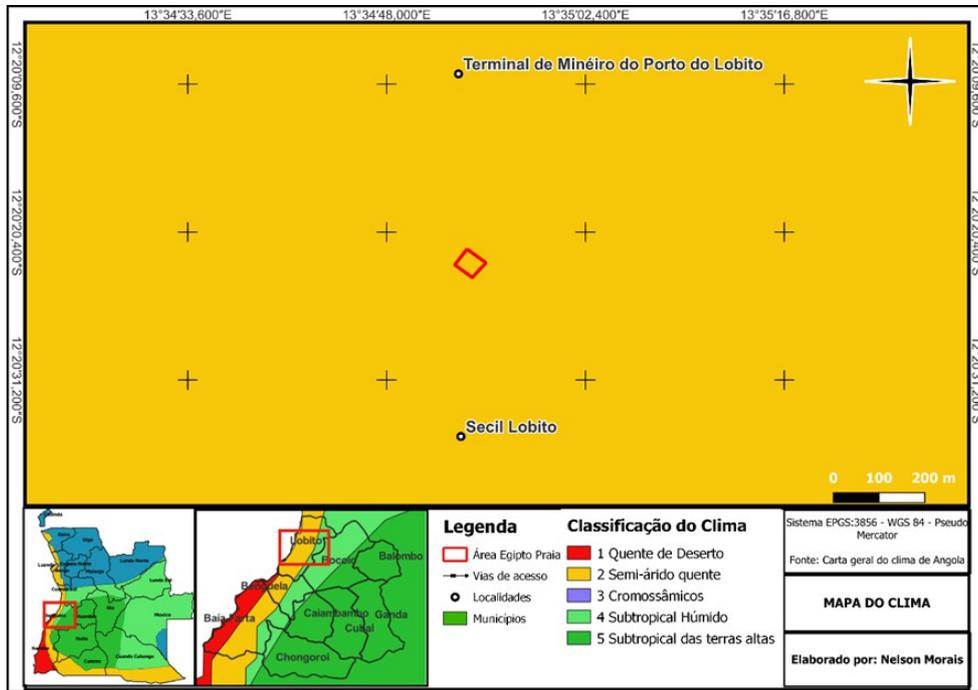


Figure 19 – Climate map.

6.3.4 Temperature

The spatial distribution of air temperature in a region is essentially conditioned by local physiographic factors, which are generally associated with aspects such as relief (altitude and exposure), soil type and cover, proximity to large bodies of water, and wind patterns.

As is characteristic of tropical climates, the months of July and August correspond to the extreme maximum temperatures and the months of December, January, and February correspond to the extreme minimum temperatures.

The project is located in a region with an average annual temperature of 26°C (Figure 20). The hottest month of the year is March and the coldest month is July, with an average temperature of 19°C.

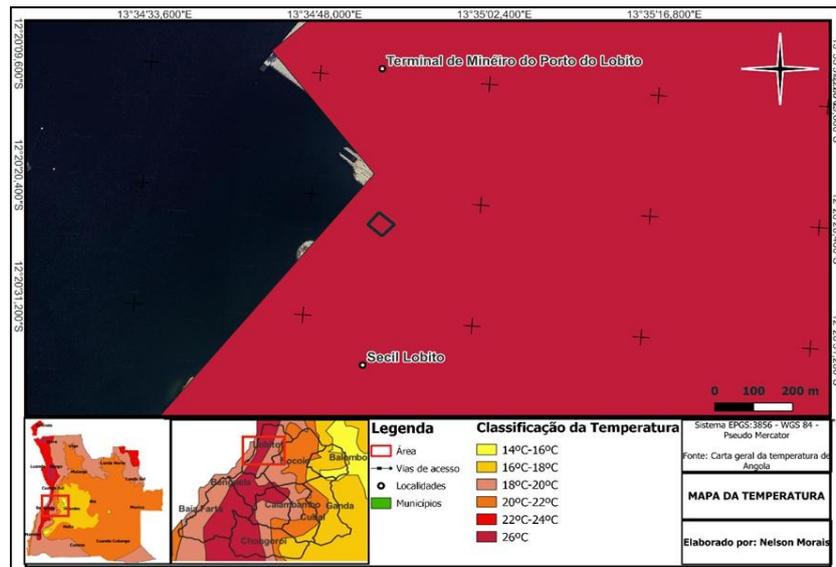


Figure 20 – Temperature map.

6.3.5 Precipitation

Precipitation is the amount of water transferred from the atmosphere to the Earth in liquid or solid form as rain, drizzle, snow, hail, or sleet, per unit area of a horizontal surface, during a given period of time. It is expressed in mm.

The area where the project is located has an average annual rainfall of 100 mm – 250 mm (Figure 21). In terms of monthly rainfall, the month with the highest rainfall is April, with an average of 159 mm, and the dry months are June, July, and August, with 0 mm of rainfall. The variation between the highest and lowest rainfall throughout the year is 159 mm.

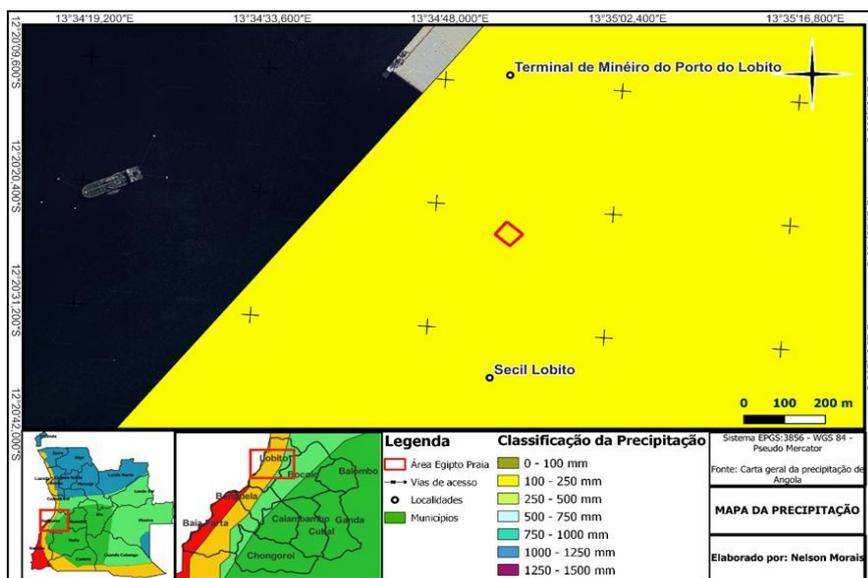


Figure 21 – Precipitation map.

6.3.6 Evaporation and Evapotranspiration

Evaporation is represented in mm, corresponding to the height of water that evaporates from an open tub exposed to the air. Average annual evaporation varies over a given period of time. Evaporation conditions local evapotranspiration, which manifests itself through the transfer of water stored in the soil or in water sources to the atmosphere through vaporization and transpiration of plants and water present in the soil.

Evapotranspiration is characterized by two different concepts: actual evapotranspiration – total water loss through evaporation from the soil and transpiration from plants; potential evapotranspiration – maximum water loss from soil with uniform green vegetation cover and assuming a uniform saturation stage.

6.3.7 Cloud cover

Cloud cover is defined as the fraction of the open sky covered by clouds. Cloud cover is expressed in tenths (as whole numbers from 0 to 10). 0 represents a clear sky and 10 represents a completely overcast sky.

The number of days with clear skies is lower than the number of days with completely cloudy skies. Except for the summer months and October, when the number of cloudy days is lower than the number of days without cloud cover, all other months have more cloudy days than clear days.

Benguela has **dry periods in May, June, July, and August. The rainiest months are October and November.** November and February end up being the months with the highest rainfall.

6.4 GEOLOGY AND GEOMORPHOLOGY

6.4.1 General considerations

The purpose of this descriptor is to present the geological and geomorphological context of the area where the Balombo grain silos are located.

The analysis in this description is based on a field survey of the site, carried out in March 2024.

6.4.2 Geological Framework

The geological framework of the AID was established based on available cartography (Geological Map of Angola at a scale of 1:1,000,000, Sheet 3), photographic records of the terrain, and bibliographic research.

The geology of Angola can generally be divided into sedimentary rocks (usually easily resistant and "soft") and crystalline rocks (usually difficult).

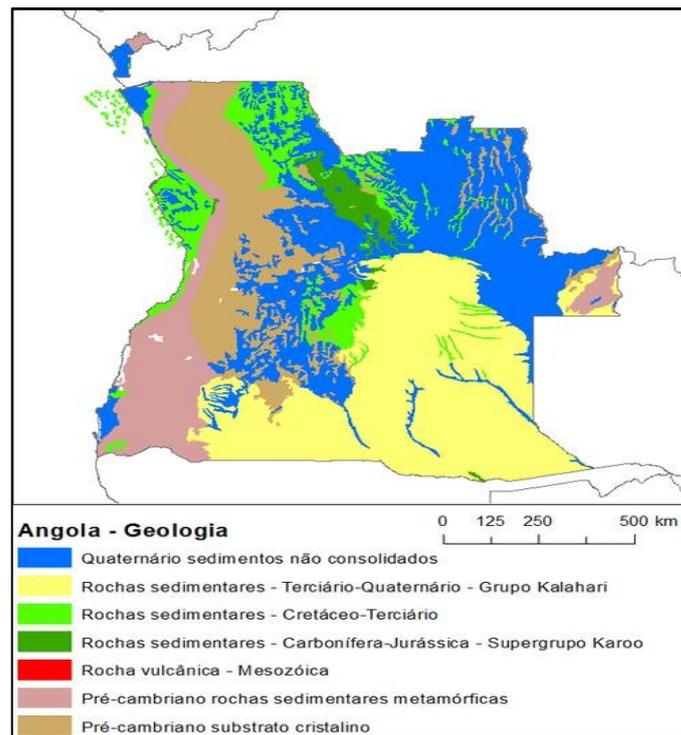


Figure 22 - Geological map of Angola

The municipality of Lobito is geologically located in the Angolan shield, on the Angolan platform, and features formations ranging from the Archean to the Phanerozoic. The Lower Archean was subdivided into two groups: Lower and Upper. The Lower Group includes rocks consisting of pyroxene plagioclases, amphibolites, eclogites, cordierite and sillimanite gneisses, quartzites, ferruginous quartzites, as well as associated plagiomigmatites, enderbites, and charnoquites.

Based on the Geological Map of Angola, the project area is covered by Cenomanian-Turonian formations, consisting of olitic, pisolitic limestones, and marls.

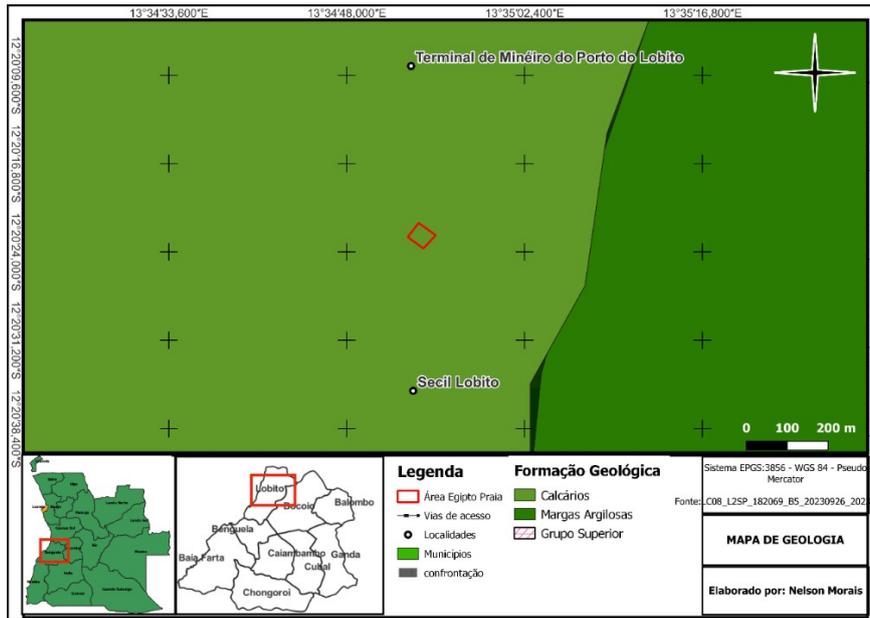


Figure 23 – Geological map.

6.4.3 Geomorphological context

According to Diniz (1998), in Angolan territory it is possible to consider geomorphological units.

consider 11

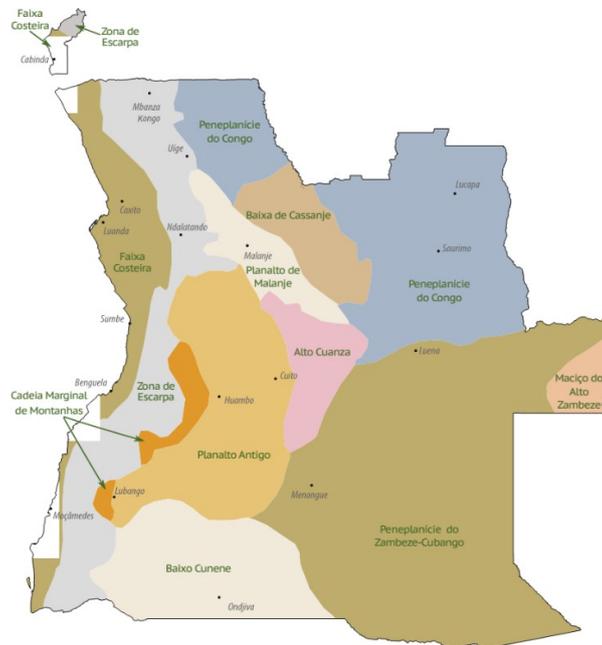


Figure 24 – Main geomorphological units of Angola (according to Diniz)

1. **Coastal Strip.** Encircling the platform, which stretches almost continuously along the coast at average altitudes of 150 m to 250 m, reaching three hundred meters or more at some points in the inner periphery, gently sloping down to the coastline where it ends, for most of its length, in a sea cliff with drops of around 100 to 150 m. The discontinuity of the platform is solely due to the action of rivers that have carved out wide, deep valleys where extensive river plains are found.
2. **Subplateau Strip.** An intermediate surface marking the transition to the plateau interior, which runs from north to south of the territory at average altitudes between 400 and 600 m, from which frequent residual landforms rise, from hill islands, protruding platforms delimited by escarpments, steps or dismantled forms, and even mountain ranges, whose names sometimes reach altitudes of 1000 m.
3. **Marginal Mountain or Marginal Mountain Range.** Marking the western limit of the Angolan interior plateau, it corresponds to a mountainous range of residual levels, whose tops, still somewhat impressive, reach 2100-2200 m, with the highest point at Morro do Môco, at an altitude of 2620 m.
4. **Ancient Plateau.** An extensive plateau reaching an altitude of 1,750-1,800 m, forming a line that defines very gentle slopes on either side, stretching for hundreds of kilometers and through which rivers meander in very wide valleys, almost at the level of flattening. The monotony of the peneplain is only interrupted by the altiplanic platforms and frequent island hills that are residual relics of other older peneplains.
5. **Lower Cunene.** A flattened or gently undulating surface that, in the continuity of the Old Plateau, slopes from 1,400 m to 1,000/1,100 m at the southern border, with the main watercourses converging on the interior basin of Etocha Pan, except for the Cunene, which, thanks to its capture in Ruacaná, has diverted to the Atlantic. Largely filled with recent sediments, the surface is generally poorly drained, with part of the water being retained in a multitude of small inland basins.
6. **Upper Cuanza.** The upper Cuanza basin stands out on the interior plateau, at average altitudes of 1,200 to 1,500 m, as it corresponds to a very slow-flowing hydrographic network, giving rise to large flooded areas during the rainy season that remain flooded for many months.

7. **Malange Plateau.** A flat or gently undulating plateau at medium altitude (1,200 to 1,250 m), which separates the Cuango river system to the east from the rivers of the Atlantic slope on the opposite side. While the Lucala, an important tributary of the Cuanza, flows across the plateau and plunges spectacularly over a hundred meters in height onto the lower sub-plateau surface (Calandula Falls).
8. **Zaire plateau.** Extensive sandy surface that slopes sharply northward, from average altitudes of 1,200 m along its edge to 500 m in Cuango, deeply dissected by deep, roughly parallel valleys, all of which flow into the Zaire basin as they converge on its tributary, the Cassai.
9. **Cassange Lowlands.** An area that is several hundred meters lower than the surrounding plateau, its boundary largely defined by a steep escarpment. On the other hand, the spectacular residual reliefs that rise from the flatness are nothing more than scattered remnants of the primitive plateau peneplain.
10. **Zambezi-Cubango peneplain.** Extensive sandy surface encompassing the Zambezi and Cubango basins, both of which are part of the same peneplain, which slopes gently southward (1,200/1,300 m – 1,000 m), where the rivers, defining very open valleys, are drawn, so to speak, at the level of the flatness, circulating very slowly in winding beds, in addition to interspersing, at times, extensive areas of difficult drainage, where the waters are retained for extended periods.
11. **Upper Zambezi Massif.** A geomorphological unit distinguished by its integration into the Calunda mountain massif, which is notable not for the differences in altitude between the flat area (1,150 m) and the highest points (around 1,612 m), which are relatively modest, but rather because it rises majestically on the horizon, after almost a thousand kilometers of flatness without any other orographic feature breaking the monotony of the landscape.

6.4.4 Local Geomorphology

The study area is located on the sedimentary coastline, characterized by marine formations consisting of more pronounced lithological materials, notably clays, limestones, marls, sandstones, and conglomerates, which were deposited in the Lower Cretaceous to

Miocene (Diniz, 1991), with observable records of carbonate and marly limestone rocks.

The regional geomorphology where the unit is located is not very rugged as it is in a transition zone. In terms of altitude, it is characterized by 0 meters being the lowest area and 500 meters being the highest area. The project area is at an altitude of 0-10, with elevation 0 being the lowest part represented by water.

There are some shallow surface water lines, as it is a low-lying area, and the seashore is likely to cause flooding through sea currents in the project area, as shown in Figure 25.

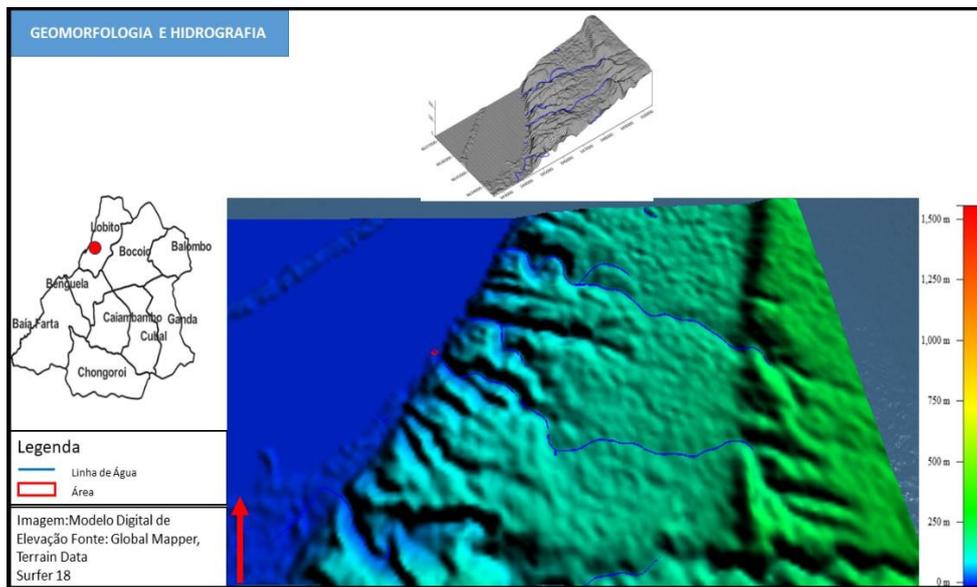


Figure 25 - Geomorphology map

6.5 SOILS AND LAND USE

6.5.1 General considerations

The purpose of this descriptor is to characterize the soil at the site where the grain silo project will be implemented, hereinafter referred to as the study area.

The analysis of this descriptor was based on a field survey of the site, carried out in August 2024.

6.5.2 Soil Characterization

Angola's soils are characterized by a high percentage (around 50%) of soils that are constantly or periodically subject to erosion processes.

Soil erosion in Angola causes a total loss of soil of around 20 million tons per year, equivalent to the loss of the possibility of feeding 50,000 people per year. According to the same source, the amount of plant nutrients lost annually is around 1,200,000 tons of organic matter, 60,000 tons of nitrogen, 4,500 tons of potassium, and 500 metric tons of phosphorus. Soil erosion causes the denudation of mountains and hilltops, reduces soil depth and alters its structure, and decreases organic matter in the soil, thus reducing water retention capacity with consequent nutrient silting and associated soil acidification. Rainfall often causes serious erosion and subsequent sedimentation of soil in streams and rivers, which eventually flow into the Indian and Atlantic oceans (Source: UNDP-AngolaLDCSIDS-SLM-draft of November 12, 2007-PORTUGUESA).

In dry regions with a desert climate, soils are generally very thin and infertile. In large sedimentary basins, climatic conditions of precipitation and temperature, and the lithology of the materials, are conducive to the development of thick soils.

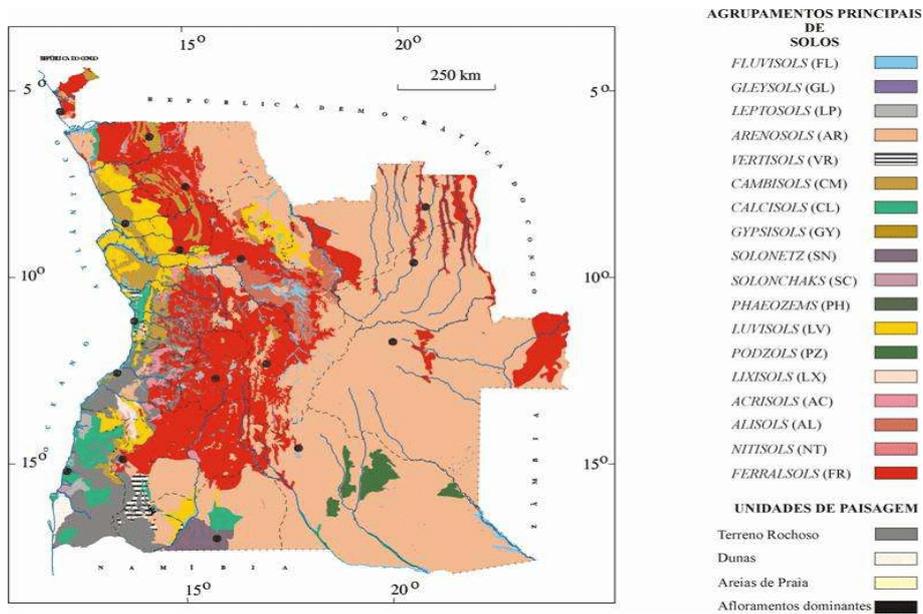


Figure 26 - Generalized map of Angola's soils

6.5.3 Characterization of local soil

Soil is the surface layer of the Earth's crust and is a complex mixture of mineral and organic matter resulting from the decomposition of rocks by physical, chemical, or biological agents that give rise to the mineral components of the soil.

The province of Benguela has a diversity of soil types that reflect its complex geology and climate. Soil characterization is essential to understand its suitability for agriculture, construction, and other uses.

The fertility of these soils has been declining due to increased agricultural activity in recent years. The destruction of vegetation cover due to intense burning, short fallow periods, and the existence of some intensive agriculture also contribute to the loss of fertility.

Knowledge of soil characteristics is fundamental to understanding, among other aspects, the suitability of each type of soil identified for its current occupation and future uses, as well as detecting the presence of areas with a greater or lesser propensity for erosion.

The predominant soils in the project implementation area are Fersialitic, as can be seen in the figure below.

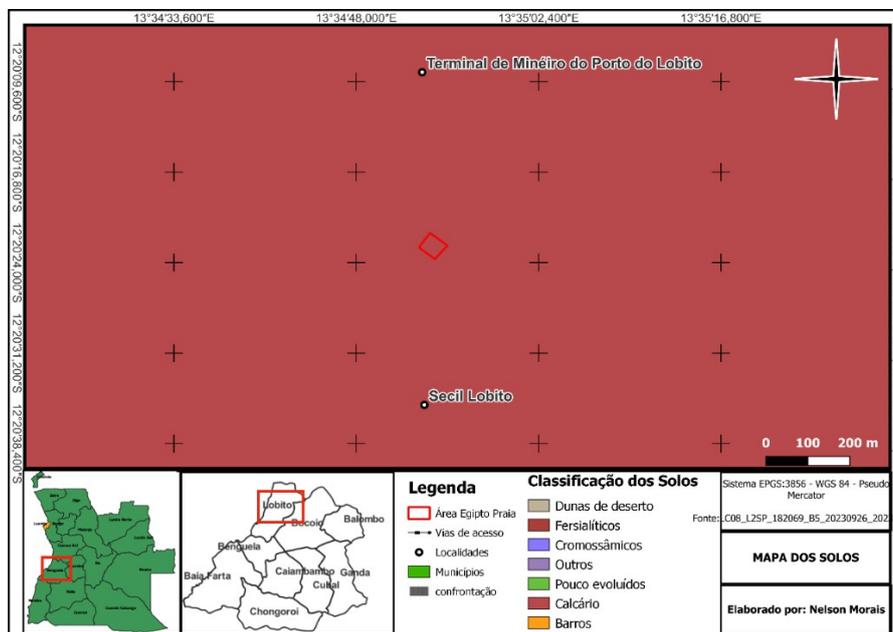


Figure 27 – Soil map.

6.5.4 Characterization of Land Occupation and Land Use

The ocean terminal covers an area of approximately 2,229 m² and is located west of the CFB railway line connecting the Lobito mining terminal. It is located exactly between the Lobito cement companies (Secil Lobito) and the mining terminal.

In terms of road access, the ocean terminal will benefit from the road that provides access to the Lobito mining terminal and is located approximately 3,700 m from the main road axes in Benguela Province, namely National Road No. 100 (EN-100), which connects Benguela Province and Luanda.

In morphological terms, the area of occupation is flat and rugged, with significant variations in natural relief. The area where the terminal will be built is relatively flat, as it has undergone earthworks in the past, while the downstream part is characterized by rugged terrain.

In terms of built-up areas, the zone is part of an industrial development hub in the area bordering the port of Lobito. The Lobito mining terminal, the Secil Lobito factory, Sonagás (Sonangol) units, etc. are located there. The front is bordered by Lobito Bay and the aforementioned Lobito sandbar. No houses were found near the area where the facilities will be built.

The remaining area is occupied by natural and semi-natural zones, whose vegetation cover consists mainly of herbaceous and shrub species and some trees and grasses. The front part is occupied by Lobito Bay, which provides a beautiful natural setting.

The nearest neighborhood is Morro Quileva, which is approximately 700 meters away. It consists of permanent masonry buildings. The neighborhood is supplied with electricity from the public grid by ENDE (National Energy Distribution Company), and water is supplied through the public network by EPASB (Benguela Provincial Water and Sanitation Company), through fountains and household connections.



Photo 1: Lobito mining terminal facilities



Photo 2: Sonangol Lobito facilities



Photo 3: Morro Quileva neighborhood

6.6 SURFACE AND GROUNDWATER RESOURCES

6.6.1 General considerations

The purpose of this descriptor is to identify and characterize the water resources existing in the area where the grain silo project is to be implemented and its surroundings.

6.6.2 Surface Water Resources

Angola has significant water potential, consisting of a dense hydrographic network directly related to the relief of the territory, as most of it descends from the plateau and mountainous areas to the lower regions.

The average surface water availability at the national level is 4,598 m³/s, equivalent to an annual mass of 145,002 Hm³. This represents an average annual surface runoff of 116,300 m³/km² of Angolan territory and 11,809 m³/inhabitant.

Angolan territory has 77 river basins, 47 of which are main basins and the rest are coastal basins that form the following five main drainage areas:

- Atlantic Slope (40.1% of the country's total area): Chiloango, Zaire or Congo, Bengo, Kwanza, Queve or Cuvo, Catumbela, Cunene rivers, among others;
- Zaire Basin (23.2% of the country's total area), which includes most of the rivers in northern Angola, such as the Cuango, Cassai and their tributaries, Cuilo, Cambo, Lui, Tchicapa, Luachimo, among others;

- Etosha-Pan watershed – Namibia (4.5% of the country's total area);
- Kalahari Basin (12.5% of the country's total area): has many intermittent rivers, notably the Cubango River, which flows into the Okavango swamp (Botswana) and has the Cuchi and Cuito as its main tributaries;
- Zambezi Watershed (19.7% of the country's total area), which includes the rivers of the east and tributaries of the Zambezi, such as the Luena, Lungué-Bungo, and Cuando, which flows into the Zambezi via the Chobe River.

The following is a list of river basins ordered according to their drainage areas:

Table 13: River basins and their respective areas

BASIN	AREA (KM ²)	BASIN	AREA (KM ²)
1-Zaire	285,206	6-Cunene	92,400
2-Cubango	156,122	7-Central West	89,496
3-Cuanza	152,520	8-Southwest	84,327
4-Zambezi	148,377	9-Northwest Angola	76,732
5-Cuando	96,360	10-Cuvelai	52,158

Angola river basins:



Figure 28 - Angola's river basins

6.6.3 Local hydrography

In hydrological terms, the study area falls within the Atlantic watershed. The province is drained by several watercourses that extend across six large basins, whose main rivers are the Cubal-Quicombo, Balombo, Cubal do Lumbo, Catumbela (the largest river and largest provincial basin), Cavaco (the largest river and basin entirely within Benguela) and Coporolo. There are also the micro-basins of the Eval, Cuula, Cucumba, Nhime, Lua, Equimina, Calongolo, Lucipo, and Catara rivers. All basins flow from east to west.

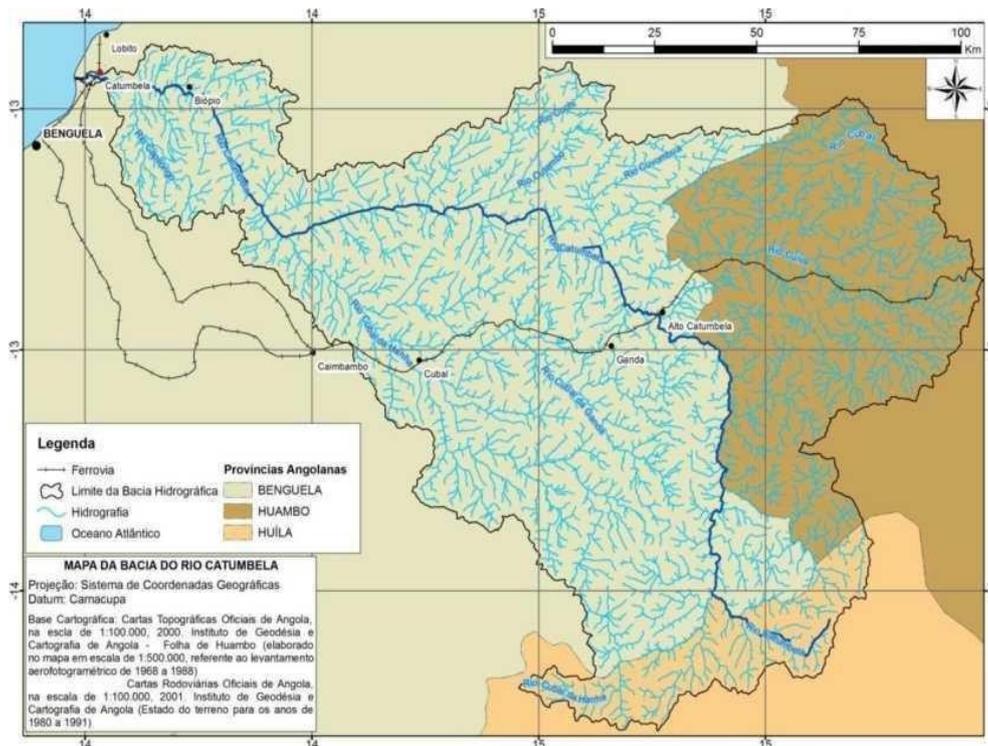


Figure 29 - Map of the Catumbela River basin (Source: IGCA 2001)

The study area, between the Tapado River and the Lobito sandbar, is defined by several river networks that flow into the sea, creating distinct physical spaces according to the river dynamics and geology of the surrounding area.

From north to south, these are the Tapado, Balombo, Kuhula, and Cubal da Hanha rivers. To the north is the Tapado River, which traces a depression that ends at the ocean, between two terraced surfaces formed by the Quissonde Formation to the north and the Catumbela Formation to the south, which are steep at the sea. It is intermittent, as it follows the seasons.

Further south is the Balombo River, one of the most voluminous rivers, notable for its permanent runoff that cuts through a carbonate cliff in the town of Kakale, ending in a delta shape on Navala beach.



Photo 4: Catumbela River

6.6.4 PHYSICAL OCEANOGRAPHY

In terms of physical oceanography, the Benguela coast is strongly influenced by the Benguela Current, a cold current of sub-Antarctic origin that flows from south to north along the southwestern African coast. This current is associated with the phenomenon of coastal upwelling, which is particularly intense in the region between southern Angola and northern Namibia, where deep, nutrient-rich waters rise to the surface, promoting high biological productivity.

Lobito Bay has the typical characteristics of a sheltered coastal cove, with dynamics strongly influenced by the regional circulation of the Benguela Current, which brings cold, nutrient-rich waters. The bay is characterized by low internal hydrodynamic energy due to the natural protection of the coast, resulting in relatively calm waters, low wave height, and predominant sedimentation of fine particles such as sand and silt.

Circulation within the bay is generally dominated by semi-diurnal tides (two cycles of high and low tide per day) and by currents induced by local winds, which can influence water renewal and the transport of sediments and nutrients. Water renewal in the bay is relatively slow compared to open sea areas, which favors the deposition of organic matter

, contributing to the fertility of the environment, but also making the system more vulnerable to pollution.

The interaction between factors such as temperature, salinity, currents, and tides creates a physical environment conducive to high biological productivity, which is especially important for the life cycle of various marine species. The physical structure of the bay, therefore, acts as a moderator of environmental conditions, essential for the reproduction, feeding, and protection of juvenile and adult marine organisms.

6.7 UNDERGROUND WATER RESOURCES

6.7.1 Hydrogeological Context

According to FAO data, groundwater availability in Angola is estimated at around 58 km³/year, of which 95% directly feeds rivers, with the remaining 5% flowing into the sea (www.fao.org, 2010).

Angola's groundwater resources are located in coastal aquifers, with an average depth of 5 to 30 m; in aquifers in the central plateau region, with an average depth of between 10 and 30 m; and in aquifers in the semi-arid regions of the south and southeast, with average depths of 200 m or more (Ministry of Urban Planning and Environment, 2006).

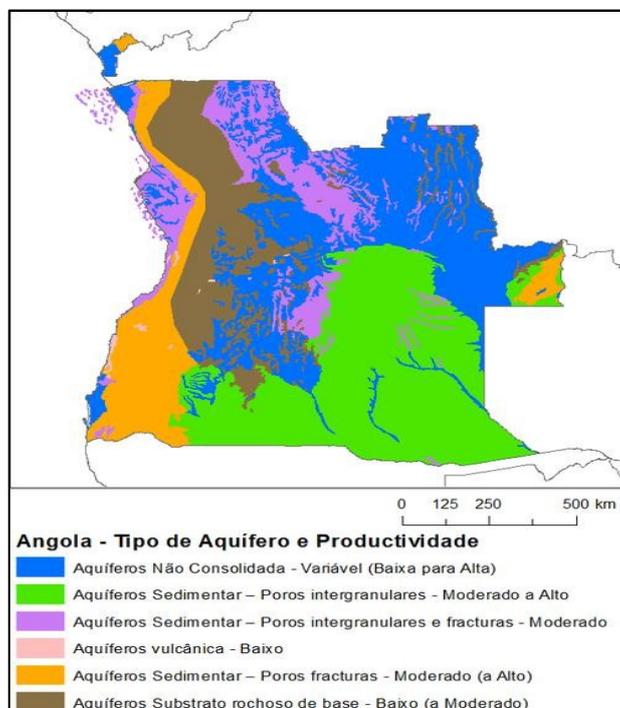


Figure 30 - Type of aquifers and productivity

As for groundwater, the system is estimated to be very productive, with existing wells between 8 and 11 meters deep.

6.7.2 Vulnerability

The vulnerability of geological formations to pollution is intrinsically linked to their lithological composition, morphology, permeability, depth of the aquifer zone, fracturing, among other characteristics.

In general, the table below shows the vulnerability indicators according to geological formation and lithological or morphological compositions.

Table 14: Aquifer vulnerability classes

AQUIFER	VULNERABILITY TO POLLUTION	INDICATOR
Aquifer in highly karstified carbonate rocks	High	V1
Aquifer in carbonate rocks with medium to high karstification high	Medium to High	V2
Aquifer in unconsolidated sediments with hydraulic connection hydraulic connection to surface water	High	V3
Aquifer in unconsolidated sediments without hydraulic connection to surface water	Average	V4
Aquifer in carbonate rocks	Medium to Low	V5
Aquifer in fractured rock	Low and variable	V6
Aquifer in consolidated sediments	Low	V7
No aquifers	Very low	V8

Due to the probable existence of an aquifer at the site with a water connection to surface waters, the degree of vulnerability is estimated to be high (V3).

6.7.3 Water uses

There is no river in the area directly affected. The nearest river is the Caporolo River. The area where the project will be implemented is facing the sea, bordered by Lobito Bay.

Among the most common uses of seawater is navigation by vessels that dock at the port of Lobito and other existing docks. It is also used for fishing, mainly artisanal fishing, and serves as a recreational element for bathers and a tourist attraction, etc.

The nearest river is the Caporolo. Common uses of fresh water are restricted to human consumption, collection for crop irrigation, and artisanal fishing using a rod and line.

6.8 FLORA AND FAUNA

6.8.1 General Considerations

Biodiversity is crucially important to the human species, since approximately 40% of the world economy and 80% of people's needs depend on biological resources.

According to the Convention on Biological Diversity, biodiversity means the richness and variety of life forms, from species to genes and habitats, encompassing terrestrial, marine, and other aquatic ecosystems.

Biodiversity is extremely vast and still largely unknown, but it is known that its balance is fundamental not only for the stability of the natural environment, but also for the social, economic, and cultural development of humanity.

It is estimated that there are between 8 and 10 million species, but only 1.7 million have been catalogued and described worldwide.

In addition to its enormous scientific, spiritual, and cultural value, biodiversity offers undeniable advantages for maintaining human well-being and ensuring health and food security, combating disease, economic growth, and providing livelihoods, among other aspects.

Angola has an extraordinarily wide range of biomes and ecosystems, associated with the diversity of climates and physiography of the territory. In total, there are seven (7) **biomes** and fifteen (15) **ecoregions**, making Angola the African country with the highest number of biomes and the second with the highest number of ecoregions.

Cataloging the species that make up a given environment is essential for assessing the risks of environmental impacts in a certain area of the country in order to

ensure a balance between human activities and the natural environment, since biodiversity (fauna and flora) plays a fundamental role that is of great importance not only for the maintenance of life, but also for the socioeconomic development of the country.

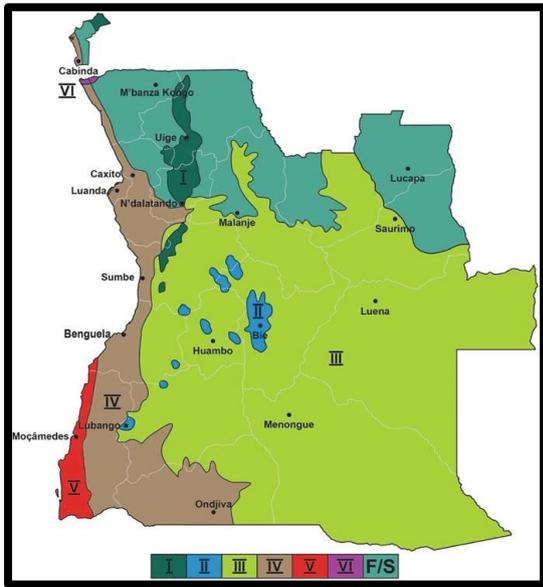
From an ecological point of view, species are the living components of ecosystems and are responsible for producing oxygen (in the case of plants and algae), maintaining water and air quality, producing and maintaining soil fertility, mitigating floods, pollinating plants, and providing food, among other services.

Economically, species have direct and indirect value, generating income and employment for the local, national, and international communities of the country, thus contributing to social and economic development.

The project construction area is located in southern Angola, in the municipality of Lobito, Benguela province, and covers the entire bay of the port of Lobito.

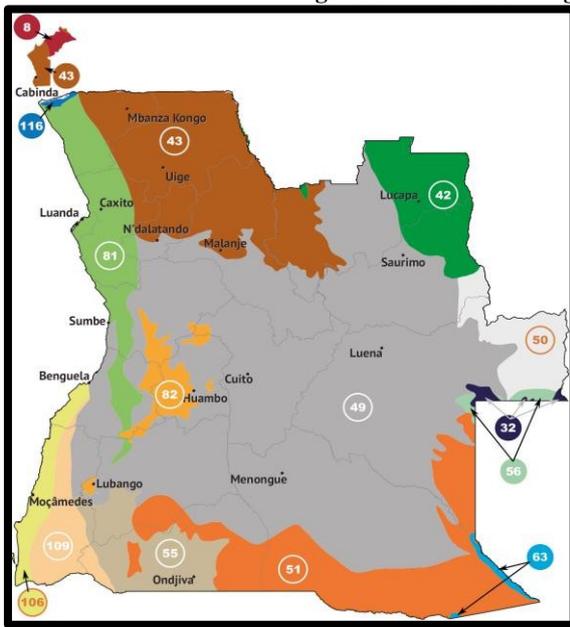
As it is part of a coastal area, the survey and description of local biodiversity and the impacts on it due to the rehabilitation works is a crucial step in maintaining the environmental sustainability of the project, as it allows for more assertive decisions to be made about management and conservation in an area rich in biological resources, providing subsistence for local communities and contributing to the national economy.

Angola's biomes and mosaics comprise the following zones: Guinean-Congolese tropical forest (I); Afromontane forests and grasslands (II); Mesic savanna (III); Arid savanna (IV); Desert (V); Mangroves (VI) and Guinean-Congolese tropical forest/mesic savanna transition mosaic (VII) (Figure 1) (HUNTLEY, 2023).



- Biomes of Angola**
- I - Guinean-Congolese rainforest
 - II - Afro-montane forests and grasslands
 - III - Mesic savanna
 - IV - Arid savanna
 - V - Desert
 - VI - Mangroves
 - VII - Guinean-Congolese tropical forest/mesic savanna transition mosaic

Figure 31 - Biomes of Angola | Source: HUNTLEY (2023)



- Ecoregions of Angola**
(According to Burgess *et al.*, 2004)
- 8 - Atlantic Equatorial Coastal Forest
 - 32 - Dry Forest of *Cryptosepalum* Zambeziana
 - 42 - Southern Congolese Forest-Savanna Mosaic
 - 43 - Western Congolese Forest-Savanna Mosaic
 - 49 - Angolan Miombo Woodland
 - 50 - Central Zambezian Miombo Woodland
 - 51 - Zambezian *Baikiaea* Forest
 - 55 - Angolan Mopane Forest
 - 56 - Western Zambezi Grassland
 - 63 - Zambezi Flooded Grasslands
 - 81 - Angola Escarpment Savanna and Forest
 - 82 - Angola Mountain Forest-Grassland Mosaic
 - 106 - Kaokoveld Desert
 - 109 - Namibian Escarpment Forests
 - 116 Central African Mangroves.

Figure 32 - Ecoregions of Angola | Source: HUNTLEY (2023)

6.8.2 Methodology

The collection of primary information focused on the Project's Area of Direct Influence (ADI), the coastal zone. Reconnaissance visits were carried out during March and August 2024, with the aim of conducting a survey of the local flora and fauna during 8.5 hours of sampling over 4 days.

The collection of secondary information (literature review) was directed at a much larger area, covering all areas of the project. One of the main objectives of the bibliographic information search was to compile a list of potential species in the study area. Information provided by *the International Union for Conservation of Nature* (IUCN), the phytogeographic map of Angola, the description of biomes for Angola provided by *the World Wide Fund for Nature* (WWF), the Red List of Angola, and the List of species included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), as well as other sources cited in this section. The potential list was supplemented by information collected in the field.

In terms of flora and fauna characterization, particular emphasis was placed on the potential presence of species that are most relevant in terms of nature conservation and biodiversity, i.e., those that are classified as threatened according to the IUCN and/or that are included in the categories of the Red List of Species of Angola, pursuant to Executive Decree No. 258/18. In this context, particular attention was also paid to any habitats with which these species may be associated.

Biotic information was sampled mainly based on the method of active search observation in potential habitats (GODOI *et al.*, 2019), although all supplementary information obtained was recorded, namely between trips to and from the study area and between sampling sites.

Secondary and primary information was further supplemented by conducting questionnaires with the population on the flora and fauna of the study area. The specific methodological details regarding the sampling of flora and vegetation and fauna are described below:

6.8.3 Flora and vegetation

The composition and description of the vegetation in the study area was based on direct *in situ* observation, data provided by the phytogeographic map of Angola, and information on Angola's ecoregions provided by the WWF.

Sampling of flora and vegetation was carried out mainly using the transect method. The transects were covered in a zigzag pattern, identifying the species present.

Specimens or population centers of note, such as invasive species or possible endangered species, were geolocated using GPS and photographed.

The vegetation units present were recorded along the transects, including the start and end points of the patch, if relevant, as well as the main species present. The floristic surveys focused on the different vegetation units identified. The results of these surveys were subjected to a phytogeographic analysis using the Phytogeographic Map of Angola. This classification analysis allowed for the segregation of the plant formations present.

6.8.4 Characterization of the Biotic Environment of the Project Area

6.8.4.1 Biogeographic and phytosociological context

The intervention area is located in the phytogeographic zone known as Meadows, savannas, shrub savannas, and tropical and subtropical forests, which is part of the Zambezian biome. This biome occupies a vast area of the national territory, covering more than 80% of its surface area, characterized by *Brachystegia* miombo woodlands, which occupy 47% of the country. Other important groups for this zone include the genera *Julbernardia*, *Guibourtia*, *Burkea*, and *Pterocarpus*.

With regard to the marine environment, the study area is located in the Tropical Atlantic region and is covered by the Southern Gulf of Guinea ecoregion.

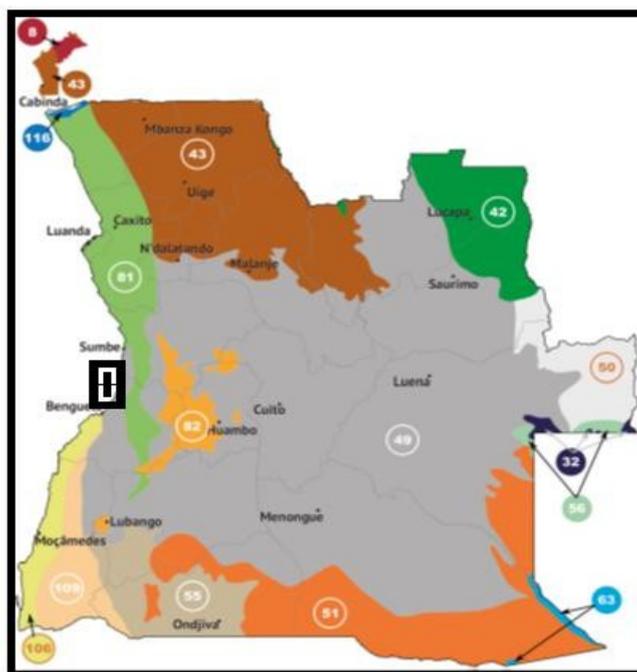


Figure 33 - Ecoregions of Angola with indication of the study area.

6.8.4.2 Description of ecosystems and habitats in the study area

According to Lobito's Municipal Development Plan (PMD), the territory has undergone changes in relation to its original and potential vegetation, with the expansion of humanized areas, both for the construction of housing, infrastructure, and industrial and commercial zones, and for other activities such as aggregate extraction and agriculture.

The ecosystems of greatest concern from a conservation point of view are the bay and mangrove area of Lobito, which are still natural environments of great biological and ecological importance, providing habitats for various marine and terrestrial species of international and economic importance to local populations.



Figure 34: Coastal zone of Lobito Bay

6.8.4.3 Marine ecosystem: Lobito Bay

Angola's coastline is 1,650 km long and includes seven coastal provinces (Cabinda, Zaire, Bengo, Luanda, Cuanza Sul, Benguela, and Namibe). It is generally characterized by high biological productivity, divided into two zones. The first is the North-Central zone, which has more tropical characteristics, with highly diverse and productive fishing resources, and is influenced by the Angola Warm Current. The second coastal region, the South zone, is dominated by the Benguela Cold Current, with temperate characteristics, less diversity, but greater abundance of fishing resources (POPA, 2018).

Along the entire coast of Angola, there are several types of ecosystems of great ecological and economic importance, notably tidal flats, estuaries, mangroves, and coastal lakes, the latter being characteristic of Lobito Bay.

Lobito Bay is a bay-type geographical structure located in the province of Benguela, about 400 km south of the capital Luanda. The bay is bordered by a sandbar that is about 10 km long, from Colina da Saudade to Farol do Ponto Final, while its opposite coastlines are 200 to 300 m apart.

This area has temperate characteristics, dominated by the Benguela Cold Current, which at certain times of the year carries nutrients that attract mammals (whales) and other species to the region, influenced by the cold currents.

The confluence of the Benguela Current and the Angola Current creates conditions for the upwelling of nutrient-rich deep waters, which occurs mainly during the dry season, between May and August.

The maritime strip of the intervention area is part of the Greater Benguela Current Marine Ecosystem, characterized by high primary production and abundant fishing resources.



Figure 35: Panorama of the port area of Lobito Bay

Lobito mangroves

Mangroves are transitional ecosystems between terrestrial and aquatic environments, comprising coastal forests of saltwater-tolerant plants (halophytes) found in tropical and subtropical zones and subject to tidal regimes. In Angola, mangroves can be found in the provinces of Cabinda, Zaire, Bengo, Luanda, Cuanza-Sul, and Benguela (Lobito).

Due to the structure and composition of their biological community, mangrove ecosystems have a biodiversity that is estimated to be of economic and ecological importance at the local, regional, and global levels.

From an ecological point of view, mangroves play a buffering role, protecting and stabilizing the coastline against terrestrial and marine aggressions, and enriching the coast with nutrients. They also support various communities of

terrestrial and aquatic flora and fauna, which are considered important transformers of nutrients into organic matter and generators of goods and services, since the large amount of matter

From an economic point of view, it is estimated that two-thirds of commercially exploited fish species depend on mangroves. These ecosystems are important for recreational and tourist activities and for scientific research, in addition to their beautiful landscape of geomorphological, ecological, and socioeconomic importance.

The formation of mangroves at the mouth of the Catumbela River, between Lobito and Benguela, marks the southern limit of their occurrence on the West African coast and constitutes a breeding ground for several marine birds of national and international conservation importance.



Figure 36: Flamingos in Lobito Bay

6.8.4.4 Characterization of flora and vegetation

The project area is located in the steppe zones of the Catumbela region, which are dominated by steppe-like, sublittoral, shrubby, and grassy formations (southern sublittoral plains), with *Acacia*, *Commiphora* (myrrh), *Colophospermum* (mopane), *Aristida*, *Schmitdia*, *Setaria*, appearing in a sublittoral strip. Further inland, the potential vegetation would consist of forests and savannas of low trees, shrubs, and tall grasses on the lower slopes of the central plateau, with *Cochlospermum*, *Terminalia*, *Albizia*, *Pterocarpus*, *Combretum*, *Hyparrhenia*, and *Panicum*. Further inland, in a narrow strip at the eastern end of the municipality, the potential vegetation would correspond to sparse "miombo" and savannah on the slopes.

with *Brachystegia spiciformis*, *Julbernardia spp.*, with localized abundance of *Brachystegia wangermeeana* and *B. bohemii*.

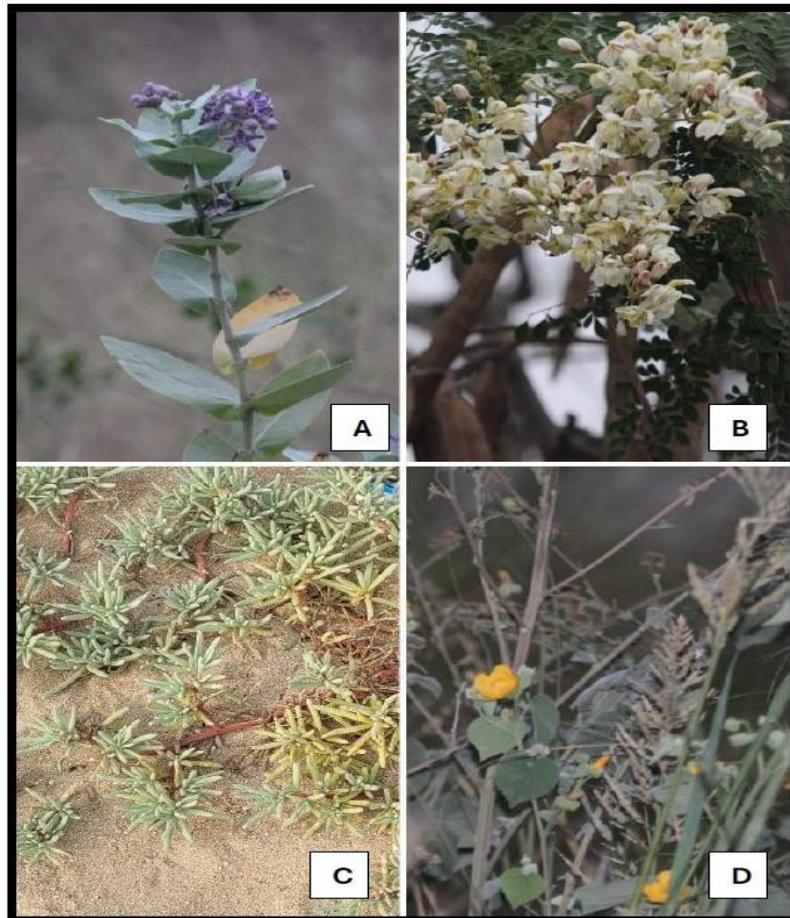


Figure 37 – Main floristic groups in the project area: *Calotropis gigantea* (A); *Moringa oleifera* (B); *Sesuvium portulacastrum* (C) and *Abutilon angulatum* (D).

COMPOSITION OF THE FLORA IN THE DIRECT PROJECT AREA - LOBITO

Taxonomic groups			Species			Conservation Status		Ecological Behavior	
Division	Class	Family	Scientific name	Common name	Size	IUCN status	Status National	Exotic	Invasive
Tracheophyta	Magnoliopsida	Apocynaceae	<i>Calotropis gigantea</i>	Madar	Shrub	LC	Category D	x	x
Tracheophyta	Magnoliopsida	Aizoaceae	<i>Sesuvium portulacastrum</i>	Purslane	Shrub	LC	NA		
Tracheophyta	Magnoliopsida	Moringaceae	<i>Moringa oleifera</i>	Moringa	Arboreal	LC	NA		
Tracheophyta	Magnoliopsida	Zygophyllaceae	<i>Tributus</i> sp.	Thistles	Shrub	LC	NA		x
Tracheophyta	Magnoliopsida	Malvaceae	<i>Abutilon angulatum</i>	Abutilon	Shrub	LC	NA		
Tracheophyta	Magnoliopsida	Rhizophoraceae	<i>Rhizophora racemosa</i>	Red mangrove	Arboreal	LC	Category C		
Tracheophyta	Magnoliopsida	Combretaceae	<i>Laguncularia racemosa</i>	White mangrove	Arboreal	LC	Category C		
Tracheophyta	Magnoliopsida	Acanthaceae	<i>Avicenia germinans</i>	Black mangrove	Arboreal	LC	Category C		
Tracheophyta	Magnoliopsida	Fabaceae	<i>Delonix regia</i>	Red acacia	Arboreal	LC	NA		

Table 15: Main botanical groups in the direct project area. LC - Least Concern, NA - Not Assessed, Category C - **Vulnerable**, Category D - **Invasive**.

6.8.5 Fauna

Fauna sampling in the study area was based on surveys in the study area, bibliographic research on the fauna composition of the area, and questionnaires conducted among the local population, focusing on the project implementation area, the sandbar beach area, and the Lobito mangrove area.

The fauna specimens observed in the field were recorded and analyzed from the point of view of endemism and conservation status, focusing on the main groups: avifauna, ichthyofauna, and benthic invertebrates.



Figure 38: Biodiversity survey area (fauna and flora) in Lobito Bay



Figure 39: Lobito mangrove biodiversity survey areas



Figure 40: Record of marine specimens inhabiting Lobito Bay



Figure 41: Photographic record of birds inhabiting the Lobito mangroves

6.8.5.1 Characterization of fauna

Fauna composition refers to all the animals that live in a given area, characterized by their adaptation to that area.

Based on the characteristics of the ecosystems and habitats that represent the study area, we can group the local fauna into terrestrial fauna and marine fauna.

6.8.5.2 Terrestrial fauna

According to Marques *et al.* (2018), in the province of Benguela there are records of around 97 species of amphibians and 355 species of reptiles, although the main groups covered by the project's AID are not included.

No species of mammals or terrestrial invertebrates of relevant conservation importance were recorded in the study area, as these groups are considered to have low representation in the area due to its high anthropization.

6.8.5.3 Marine fauna

The coastline of Benguela province has a great diversity of fauna and flora, producing a large nutrient bank, influenced by the nutrients formed in the mangroves of the river mouths in central Angola, most notably the Keve, Cubal da Hanha, Kupololo, and Catumbela rivers.

The main marine fauna groups to be taken into account for this project are: plankton, marine invertebrates, ichthyofauna, and avifauna.

6.8.5.3.1 Plankton and marine invertebrates

In the aquatic environment, primary production is dominated by phytoplankton, which contributes approximately 95% of total productivity. In tropical areas, phytoplankton species densities peak during the hottest months.

The information available on the distribution and abundance of phytoplankton species along the Angolan coast is very scarce. The main phytoplankton groups present in northern Angola are diatoms (Bacillariophyceae), dinoflagellates (Dinophyceae),

cyanobacteria (Cyanophyceae), coccolithophores (Haptophyceae), and phytoplankton (Dictyochophyceae).

As with phytoplankton, information on zooplankton communities off the coast of Angola is also quite scarce. Taking into account the *upwelling* phenomenon, the richness of the ichthyofauna, and the number of fish species found on the continental shelf that feed on plankton, zooplankton biomass should reach reasonable levels in the project area.

Benthic invertebrates are animals that depend exclusively on the aquatic environment and live attached to the substrate and mangrove roots.

These animals are also important indicators of environmental quality, as their abundance in the area is a sign of an unpolluted environment with a large amount of nutrients for macrofauna.

Benthic animals in the project area include crustaceans such as crabs, shrimp, and lobsters; marine mollusks such as the class Bivalvia and some of the class Gastropoda; cephalopods; and other groups such as Echinodermata and Annelida (class Polychaeta). These groups are widely distributed along the northern coast of Angola and are primary consumers of plankton, making them important for the ecological and sustainable balance of marine and estuarine biological resources.

Contamination of these species, from any source, spreads to all marine fauna, making marine resources sources of various diseases for their consumers.

In the project area, the main and most abundant species recorded are: rainbow crab (*Cardisoma armatum*), mud snail (*Tympanotonos fuscatus*), red crab (*Chaceon maritae*), and shrimp (*Penaeus* sp.).



Figure 42: Main benthic groups in the area: *Cardisoma armatum* (A); *Semibalanus balanoides* (B) and *Penaeus sp* (C).

6.8.5.4 Ichthyofauna

Angola's ichthyofauna is abundant and richly diverse, with around 21.8% (78) of the 358 species described for Angola being endemic. This is the highest figure in terms of national faunal endemism, making the ichthyofauna the largest representative of endemism in the country.

Due to the characteristics of the project area in terms of marine habitats, the ichthyofauna uses tidal lakes and mangroves as feeding, breeding, and sheltering areas, turning these ecosystems into nurseries and breeding grounds during the juvenile phase.

The main species in the area are of considerable commercial value, notably the white seabream (*Argyrosomus hololepidotus*), corvina (*Pseudolithus sp.*), grouper (*Epinephelus sp.*), horse mackerel (*Trachurus sp.*), and sardine (*Sardinella sp.*), *Diplodus sargus*, *Lithognathus mormyrus*, *Synodus sp.*, and *Sphoeroides sp.*

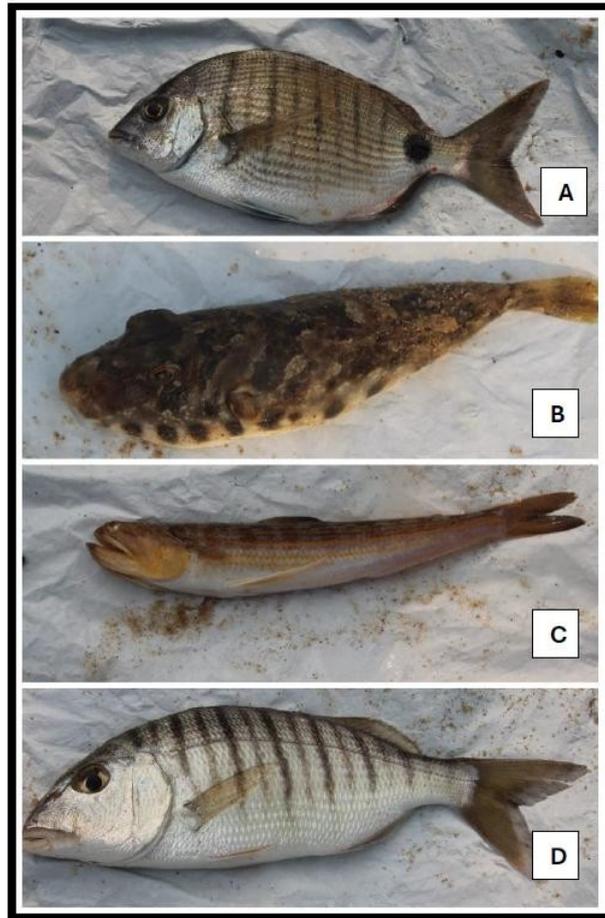


Figure 43: Some fish species that inhabit the ecosystems of the area: *Diplodus sargus* (A); *Sphoeroides sp.* (B); *Synodus sp.* (C) and *Lithognathus mormyrus* (D).

6.8.5.5 Avifauna

Coastal ecosystems also have a considerable birdlife, diversified by feeding habits, from piscivorous to insectivorous. Notable representatives include the Alcedinidae, Anhingidae, Phalacrocoracidae, Scolopacidae, Charadriidae, Pelecanidae, and Ardeidae families.

The Ardeidae, Threskiornithidae, and Pelecanidae families are the most commonly sighted in Angola's mangroves and coastal lakes, which they use as nesting, growth, and development areas. They are therefore considered groups of birds with species resident in these environments.

Lobito is mainly frequented by the lesser flamingo, also known as the African flamingo (*Phoenicopterus minor*), and the greater flamingo (*Phoenicopterus roseus*), as well as other species such as herons, sandpipers, and black ducks.

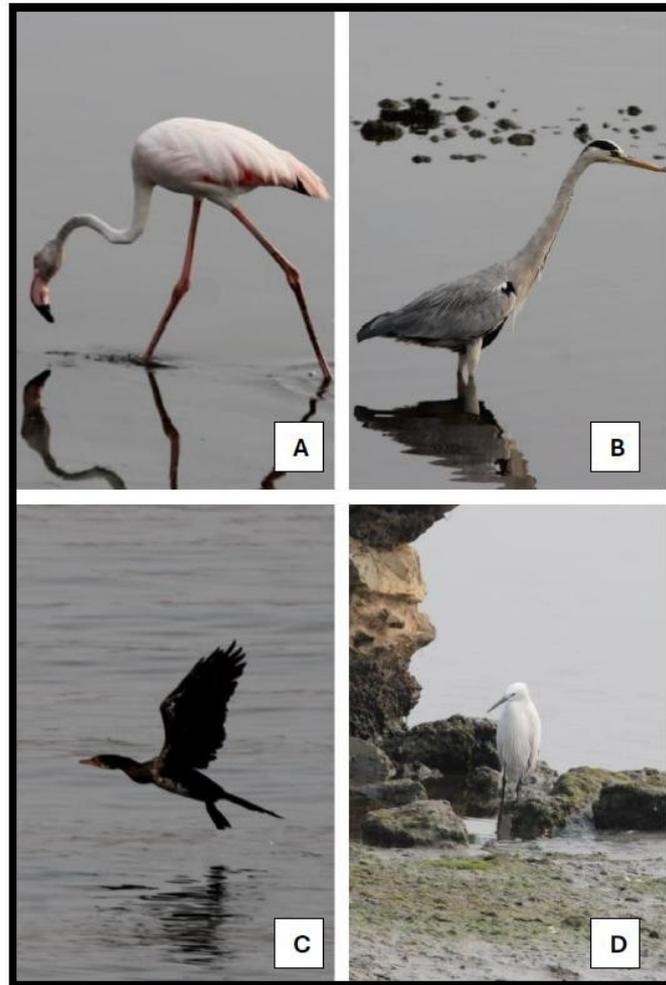


Figure 44: Some bird species in the mangrove area and Lobito Bay: *Phoenicopterus minor* (A); *Ardea cinerea* (B); *Microcarbo africanus* (C) and *Egretta garzetta* (D)

Table 16: Main fauna species in the project area: LC - Least Concern, NA-Not Assessed, Category C - Vulnerable, Category D - Invasive, CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora.

COMPOSITION OF FAUNA IN THE DIRECT PROJECT AREA - LOBITO

Taxonomic groups	Species				Conservation Status			Ecological Behavior	
	Family	Scientific Name	Common name	Confirmed	Status IUCN	Status National	CITES	Migratory	Congregator
Avifauna (Birds)	Phoenicopteridae	<i>Phoeniconaias minor</i>	Lesser Flamingo	x	LC	NA	Appendix II	x	x
	Corvidae	<i>Corvus albus</i>	White-bellied crow	x	LC	NA		x	x
	Estrildidae	<i>Estrilda astrild</i>	Waxbill	x	LC	NA			x
	Phoenicopteridae	<i>Phoenicopterus roseus</i>	Greater Flamingo	x	LC	NA	Appendix II	x	x
	Ardeidae	<i>Little Egret</i>	Little egret	x	LC	NA		x	x
	Phalacrocoracidae	<i>African cormorant</i>	African cormorant	x	LC	NA		x	x
	Kingfisher family	<i>Grey Heron</i>	Great Blue Heron	x	LC	NA		x	x
	Ardeidae	<i>Giant heron</i>	Giant heron		LC	NA		x	x
	Ardeidae	<i>Little Bittern</i>	Little Bittern		LC	NA		x	x
	Ardeidae	<i>Night Heron</i>	Goraz		LC	NA		x	
	Ardeidae	<i>Little Egret</i>	Ruffed Grebe		LC	NA		x	x
	Ardeidae	<i>Black-headed Heron</i>	Black-headed heron		LC	NA		x	x
	Threskiornithidae	<i>Bostrychia hagedash</i>	hadada ibis		LC	NA		x	x
	Ardeidae	<i>Purple Heron</i>	Purple Heron		LC	NA		x	
	Estrildidae	<i>Angolan Greenfinch</i>	Blue-breasted Roller		LC	NA			x
Ardeidae	<i>Butorides striata</i>	Little Egret	x	LC	NA		x	x	

Herpetofauna (Amphibians and Reptiles)	Cheloniidae	<i>Caretta caretta</i>	Loggerhead sea turtle	x	VU	VU	Appendix I	x	
	Cheloniidae	<i>Chelonia mydas</i>	Green sea turtle		EN	VU	Appendix I	x	
	Cheloniidae	<i>Eretmochelys imbricata</i>	Hawksbill sea turtle		CR	VU	Appendix I	x	
	Cheloniidae	<i>Lepidochelys olivacea</i>	Olive Ridley Sea Turtle	x	VU	VU	Appendix I	x	
	Dermochelyidae	<i>Dermochelys coriacea</i>	Leatherback turtle	x	VU	VU	Appendix I	x	
Benthic invertebrates	Cardisoma	<i>Cardisoma armatum</i>	Rainbow crab	x	LC	NA			x
	Geryonidae	<i>Chaceon maritae</i>	Red crab	x	LC	NA			x
	Potamididae	<i>Tympanotonos fuscatus</i>	Mud snail	x	LC	NA			x
	Balanidae	<i>Semibalanus balanoides</i>	Barnacle	x	LC	NA			x
	Rotulidae	<i>Penaeus sp</i>	Shrimp		LC	NA			
Ichthyofauna (Fish)	Sciaenidae	<i>Argyrosomus hololepidotus</i>	Pungo	x	LC	NA			
	Sciaenidae	<i>Pseudotolithus sp.</i>	Corvina	x	LC	NA			
	Epinephelidae	<i>Epinephelus sp.</i>	Grouper	x	LC	NA			x
	Carangidae	<i>Trachurus sp.</i>	Horse mackerel	x	LC	NA		x	x
	Clupeidae	<i>Sardinella sp.</i>	Sardine	x	DD	NA		x	x
	Sparidae	<i>Diplodus sargus</i>	Common white seabream	x	NA	NA			x
	Sparidae	<i>Lithognathus mormyrus</i>	Striped seabream	x	LC	NA			x
	Synodontidae	<i>Synodus sp.</i>	Lizardfish	x	DD	NA		x	
	Clupeidae	<i>Sphoeroides sp.</i>	Pufferfish	x	LC	NA		x	x
	Gobiidae	<i>Periophthalmus barbarus</i>	Mudskipper	x	LC	NA			x
	Gobiidae	Periophthalmus barbarus	Mudskipper	x	NA	NA			x
Cichlidae	<i>Tilapia sp.</i>	Cacusso	x	NA	Cat. D		x	x	

6.8.6 Conservation areas

Angola is a country with exceptional biodiversity, home to a wide range of ecosystems ranging from tropical forests and savannas to deserts and wetlands. This diversity of habitats supports a rich and varied fauna, including several endemic and endangered species, such as the giant sable antelope (*Hippotragus niger variani*), one of the country's rarest and most iconic antelope species. Other endangered species include elephants, rhinos, and big cats, whose populations have been impacted by poaching and habitat loss.

Starting in the 1930s, legally protected areas (national parks and game reserves) were created, and by the time of independence in 1975, these occupied 6% of the country's land area. As a result of prolonged war, conservation areas were exposed to severe neglect, poaching, and land encroachment. Many habitats of biogeographical importance and many rare and endemic species were put at risk. In April 1998, the Republic of Angola ratified its accession to the Convention on Biological Diversity, and in May 2006, it approved the National Biodiversity Strategy and Action Plan, committing itself before the international community and in light of the provisions of the Constitution of the Republic of Angola to "promote environmental protection and reflect strategies for the protection of the country's natural resources," a concern expressed in multiple approved documents (NBSAP, p. 3).

The recently strengthened administration is cause for optimism, signaling that a new era for biodiversity conservation is approaching. The conservation area system was greatly expanded in 2011, and more and more resources are being made available to ensure its effective management.



Figure 45: Conservation areas in Angola: • 1 Maiombe • 2 Quiçama • 3 Cangandala • 4 Cameia • 5 Iona • 6 Bicuar • 7 Mupa • 8 Luengue-Luiana • 9 Luando • 11 Chimalavera • 12 Búfalo • 13 Namibe. (Mavinga is not shown on this map due to a lack of complete data on the boundaries of its classification).

The province of Benguela is one of the richest in terms of biological diversity. The province has protected areas of significant importance, such as the *Chimalavera Regional National Park*, which covers an area of 112 km². The sub-littoral steppe predominates, with some species of acacia trees. Its fauna includes the fan-tailed goat, monkeys, jackals, and zebras.

The Búfalo Partial Reserve covers an area of 400 km². The dominant vegetation is open forest, savanna with some trees and shrubs, and steppe with sparse grass and small shrubs. This habitat is home to black buffalo, baboons, kudu, golungo, hippopotamus, African wild boar, red palanca, bambi, wild dogs, jackals, hyenas, and lions.

6.9 LANDSCAPE

6.9.1 General considerations

The purpose of this descriptor is to characterize the landscape of the area where the silo is located and its surroundings in order to determine the potential visual disturbances caused by the use of the space.

6.9.2 Landscape Units

The landscape should be understood as the visual image of the surrounding space, which always presupposes an interaction between potential observers and the observed territory.

The morphology of the territory and its occupation are the aspects that contribute most clearly and directly to the different types of landscape. These types, which include living elements, are not static but vary throughout the day and, above all, throughout the year. The landscape can therefore be defined as a complex and dynamic system.

In addition to the factors mentioned above, *"understanding the landscape involves knowledge of factors such as climate, geology, soils, flora and fauna, ecological structure, land use, and all expressions of human activity over time, as well as understanding their interrelationships, constituting a multifaceted reality."* The visual expression of these interactions at a given moment constitutes the landscape that can be seen by each observer, according to their perception and specific interests (Pinto-Correia et al., 2001).

When defining the Landscape Units present in the study area, it is important to take into account the concept of Landscape and Landscape Unit.

According to (Forman, R. T and Godron, M; 1986), Landscape is understood as the global, dynamic, and evolving image of *"a heterogeneous area of territory composed of a set of interacting ecosystems that repeat themselves throughout it in a similar way"* and that is *"the result of the combination of nature, techniques, and human culture"* (Pitte, J.R. T; 1983).

A Landscape Unit is considered to be not only *"areas limited by relief or other elements, within which all points are mutually visible,"* but also those in which the landscape presents a certain homogeneity in relation to relief, geology, and

humanization. These correspond to areas with relatively homogeneous landscape characteristics, whose interconnection creates a specific pattern that repeats itself, differentiating a given unit from the surrounding area. In addition to this pattern, there should be internal coherence and a character specific to the unit, which facilitates its identification.

Unique Landscape Elements are understood to be *“elements with a small surface area, but which stand out in the landscape unit as a whole due to their difference, their intrinsic quality (or, conversely, because they create a disqualifying dissonance) and/or the impact (sensory, cultural, or ecological) they have on the unit.”*

6.9.3 Landscape Characterization.

For the characterization of the landscape, a Visual Influence Area of the project was defined, which was considered adequate for a good perception of the surroundings, taking into account the characteristics of the territory under analysis and seeking to cover the visual basin directly influenced by the set of existing structures, based on parameters related to observation conditions, namely access roads, existing scenic points, and human occupation.

It is considered that the ocean terminal will be visible from the following observation points:

- Restinga do Lobito;
- Lobito railway line connecting to the mining terminal;
- Port of Lobito;
- Lobito Bay;
- Morro Quileva neighborhood;
- Secil Lobito manufacturing units and mining terminal

As a methodological approach for better characterization and assessment of the landscape of the study area, landscape units were considered. These are individualized by grouping relatively homogeneous landscape features, whose interconnection creates a specific pattern that repeats itself, differentiating a given unit from the surrounding area.

Taking into account the characteristics of the project's visual impact area, namely the relief, occupation, and vegetation cover, three distinct landscape units were identified and defined: UPH1 Semi-Natural Zone, UPH2 Consolidated Industrial Zone, and UHP3 Consolidated Urban Zone.

UHP1 Semi-Natural

UHP1 is characterized by the existence of dominant natural vegetation coexisting with human occupation due to industrial development. It has a relatively flat relief in the lower part and rugged in the upper part, natural vegetation, and the Lobito sandbank, elements that give it high scenic and natural value.

No rivers were observed in the immediate vicinity of the project.

The site of the ocean terminal is located within UHP1. The vegetation cover consists of herbaceous elements, shrubs, and some trees. Part of the intervention area has already been subject to deforestation and landfilling during the development of existing projects in the surrounding area.

The vegetation cover in the surrounding area is reduced in diversity and consists mainly of scattered trees on an insignificant herbaceous stratum.



Photo 5: Semi-natural area

The landscape of Lobito Bay is of high visual quality, due to the presence of elements that are rich from a landscape point of view and the fact that it has a sandbank in good condition despite human intervention.

UHP2 Consolidated industrial zone

This UHP2 is characterized by a dominant human occupation, characterized by clusters of industrial units that develop along the inaccessible part of Lobito Bay, with access to a paved road.



Photograph 6: Infrastructure in the surrounding area

UHP3 Consolidated urban area

UHP3 comprises the consolidated urban fabric in the areas bordering Lobito Bay, which has mixed occupation, characterized by a medium to high-density cluster, crossed by a network of paved and unpaved roads. This UHP includes the neighborhoods of



Photo 7: Restinga do Lobito and Africano market

6.9.4 Landscape Assessment

The characterization of the landscape included the definition of landscape units, which correspond to areas with more or less homogeneous characteristics in terms of their structural elements, their functioning, and their participation in the space (namely geology, climate, water resources, soils, vegetation, and land use).

For each landscape unit, an assessment is carried out based on an objective characterization and a subjective characterization, which results from the assessment of the following parameters:

Visual quality, which corresponds to the result of the presence of the main structural elements of the space (relief, vegetation cover, water resources, and built structures) and the dynamics between these elements;

Visual absorption, which refers to the capacity to absorb, integrate, or visually disguise human activities while maintaining its characteristics and visual quality, assessed based on its greater or lesser capacity to withstand visual impact, depending on the relief, the existence of vegetation screens, and the existence of human occupation;

Sensitivity, a parameter that indicates the degree to which a landscape is affected by the alteration/introduction of a particular external action, varies inversely with visual absorption capacity, which means that a given landscape will be more sensitive if it has high visual quality and low visual absorption capacity (integration of changes in the landscape).

Table 17: Landscape sensitivity matrix

CAPACITY FOR ABSORPTION	VISUAL QUALITY		
	High	Medium	Low
High	High	Medium	Low
Average	Very high	Average	Reduced
Reduced	Very high	High	Average

The combination of the application of the concepts of absorption and visual quality to the Landscape Units according to the matrix for landscape sensitivity resulted in the Landscape Sensitivity classification presented in the table below.

Table 18: Characteristics of landscape units

LANDSCAPE UNITS LANDSCAPE	VISUAL VISUAL	ABSORPTION SENSITIVITY	SENSITIVITY LANDSCAPING
UHP1- Semi-natural	High	High	High
UHP2- Industrial Consolidated	Reduced	High	Reduced
UHP3- Zone Urban Consolidated	Reduced	High	Reduced

Thus, with regard to UHP1, its high visual quality, combined with its high absorption capacity, results in high landscape sensitivity.

UHP2 and UHP3, which are characterized by some dominant human occupation, characterized by population clusters with consolidated and densified occupation, have reduced landscape sensitivity.

Based on a visual analysis of the landscape, situations that represent high landscape and scenic value due to their unique character, expression, and quality are identified, being preferred and/or valued by the user.

With regard to visual quality, as this is a characteristic that depends on subjective factors, its assessment is based primarily on qualitative criteria, and it is not possible to obtain an absolute estimate of this parameter.

6.10 AIR QUALITY

6.10.1 General Considerations

This descriptor was developed based on information gathered during a field visit in March 2024, a local analysis of the surrounding area and potential sources of air pollution, and bibliographic research.

6.10.2 Air Characterization

The purpose of this descriptor is to characterize the air quality of the area where the silos will be installed and its surroundings. To this end, potential sources of atmospheric emissions and sensitive receptors were identified and inventoried during a site visit in February 2024.

In the absence of an Ambient Air Quality Measurement Network, qualitative methods were used to assess air quality. Atmospheric dispersion conditions were also assessed, based on meteorological parameters that determine the transport and dispersion of pollutants and local morphological characteristics.

With the aim of providing guidelines to protect human health from harmful effects and to support national and local authorities in air quality management, the World Health Organization (WHO) recommends the guideline values for atmospheric pollutants shown in the table below.

Table 19: WHO recommended guideline values

POLLUTANT	EXPOSURE DURATION	GUIDELINE VALUE (MG/M3)
Carbon monoxide	15 min	100,000
	30 min	60,000
	1 hour	30,000
	8 hours	10,000
Lead	1 year	0.5
Nitrogen dioxide	1 hour	200
	1 year	40
Ozone	8 hours	100
Sulfur dioxide	10 min	500
	24 hours	20
PM10	24 hours	50 (value that should not be exceeded for more than 3 days per year)
PM2.5	24 hours	50 (value that should not be exceeded for more than 3 days per year)

Source: (WHO, 2006)

6.10.3 Characterization of Air Quality

The main sources of pollution in the immediate vicinity of the study area are associated with atmospheric emissions. According to observations made, air quality in the study area will be mainly affected by greenhouse gases emitted by vehicles and machinery, boats and motorboats operating in the area, as well as the use of fuel-powered generators.

In terms of sensitive receptors, the vegetation around the project area stands out as it may be affected by vehicle traffic, mainly due to the emission of particles from driving on unpaved roads. There are no other potential sensitive receptors in the vicinity of the project area, namely schools, hospitals, and recreational and leisure areas.

The atmospheric emissions characteristic of burning and fuel-powered machinery include, among other pollutants, carbon monoxide (CO), methane (CH₄), carbon dioxide (CO₂), particulate matter (PM₁₀ - particles with an aerodynamic diameter <10 µm), nitrogen oxides (NO_x/NO₂), sulfur oxides (SO_x/SO₂), nitrous oxide (N₂O), non-methane volatile organic compounds (NMVOCs), heavy metals, polycyclic aromatic hydrocarbons (PAHs), dioxins and furans (PCDD+PCDF), and benzene.

Since the surveys were conducted prior to the project and the air quality data for the study area and surrounding area are not known, it is not possible to state with certainty whether the concentration of the aforementioned pollutants exceeds the WHO recommended guideline values. However, these values may be known once the environmental monitoring plan for monitoring atmospheric emissions during the different phases of the project's implementation has been implemented.

6.11 NOISE ENVIRONMENT

6.11.1 General Considerations

This descriptor was prepared based on information gathered during the field visit carried out in March 2024, on the analysis of the local area and surrounding area for potential sources of noise pollution, and on bibliographic research.

6.11.2 Noise Levels and Effects of Noise on Health

Noise is generally defined as unwanted sound, which implies a subjective classification of sound. A sound signal may have different characteristics, but it is only classified as "noise" when it is directly or indirectly correlated with adverse physiological or psychological effects in humans or is perceived negatively (as useless, intrusive, or unpleasant).

When a sound source vibrates, it causes variations in pressure in the surrounding air, which overlap with the air pressure. Compared to air pressure (in Pascals), the variation in sound pressure is perceptible to the human ear, for an average individual in full possession of their hearing abilities, in the range of 20 mPa to 100 Pa.

It is customary to express sound pressure levels in decibels (dB). A decibel is a logarithmic ratio between the measured sound pressure and the reference value. The sound pressure level scale ranges from 0 dB (hearing threshold) to 140 dB (pain threshold). The ear is most sensitive to mid-range frequencies, which is where the human voice is expressed.

In environmental acoustics, the most commonly used descriptor for assessing discomfort is the equivalent continuous sound level, L_{Aeq} , defined as the constant sound pressure level which, integrated over the analysis time interval T , has the same sound energy as the signal under analysis, varying over time, where L_{Ap} is the sound pressure level, weighted by the A-scale.

Noise pollution is now treated as atmospheric contamination through energy (mechanical or acoustic energy), causing effects throughout the body and not just on the auditory system. Noise is now considered a serious public health problem.

Continuous exposure to high noise levels can cause serious health effects that manifest themselves primarily at the physiological, psychological, and social levels. The degree of impact depends on the characteristics of the source, frequency, and intensity of the noise, the sensitivity of the receiver, and the duration of exposure to the noise.

Some of the most common effects of noise are psychological disturbances or physiological changes associated with *stress* and fatigue, resulting in sleep disturbances and lack of concentration.

The World Health Organization (WHO) has stipulated that the annoyance threshold for continuous noise should be below 50-55 dB(A) LAeq day. At night, to avoid sleep disturbance, ambient noise should not exceed 30 dB(A) LAeq night.

Table 20: Exposure limit values (ELVs)

	LEX, 8h db (A)	LCpeak db (C)
Limit Values	87	140
Upper action level	85	137
Lower action level	80	135

6.11.3 Characterization of the Acoustic Reference Framework

The main sources of noise in the immediate vicinity of the study area are associated with road traffic on access roads, generator use, workers, and other instruments used in the execution of the works.

As mentioned above, the WHO has stipulated that the nuisance threshold for continuous noise is 50 dB (A) at the daytime LAeq level. At night, noise levels should be between 5 dB and 10 dB below daytime values to ensure a balanced sound environment.

As mentioned above, the characterization of the reference acoustic framework included the identification of noise emission sources and sensitive receivers in the study area.

Table 21: Details of the noise measurement survey

Reference of equipment used	Pulsar Model 33	
Height of equipment above ground	1.5 m	
Measurement interval	23-140 db	
Weighting	A	
Measurement duration	10 minutes	
Atmospheric conditions: Equipment: Testo 410-2	Humidity	58
	Temperature	25.5 °C
	Wind speed	1.5 m/s
	Clear skies	Cloudy
Equipment positioning surface	Dirt	

Table 22: Results obtained

Measured parameters	Results	Location	Coordinates
LAeq	47.0 db	Ocean Terminal	12°20'21.66"S 13°34'53.85" E
L95	45.1 db		
L50	46.4 db		
L5	49.0 db		
Lcpeak	86.6 db		



Photo 8: Noise measurement at the site

The sound levels obtained are 47.0 db, which does not exceed the noise limit recommended by the WHO, as it is intermittent during the daytime, corresponding to natural noise levels when no noisy activities are observed, or noise generated by distant road traffic.

The continuous noise annoyance threshold (LAeq) may be sporadically exceeded during the daytime when machines, vehicles, and/or other equipment that may cause noise are in use, estimated to be above 50 dB.

6.12 SOCIOECONOMICS

6.12.1 General Considerations

This descriptor was prepared based on information gathered during field visits in March and August 2024, local and regional analysis of the environment, potential socioeconomic development factors, and bibliographic research.

The socioeconomic characterization of the study area aims to identify and characterize the main demographic, economic, and social aspects likely to be influenced by the development of the ocean terminal associated with the grain silos, and thus highlight the potential direct and indirect impacts associated with it.

6.12.2 Administrative Framework

The province of Benguela has its headquarters in the city of Benguela, the second largest city in Angola. It was founded in 1615. The province covers an area of 39,826 km² and has approximately 2.6 million inhabitants, with a population density of approximately 67.1 inhabitants/km². It is estimated that 68.6% of the population is concentrated in the coastal municipalities of Benguela, Lobito, and Baía-Farta, with Lobito and Benguela being the most populous municipalities.

The province of Benguela is bordered to the north by the province of Cuanza Sul, to the east by the province of Huambo, to the southeast by the province of Huíla, to the southwest by the province of Namibe, and to the west by the Atlantic Ocean. Administratively, it is divided into nine municipalities, as shown in the figure below.

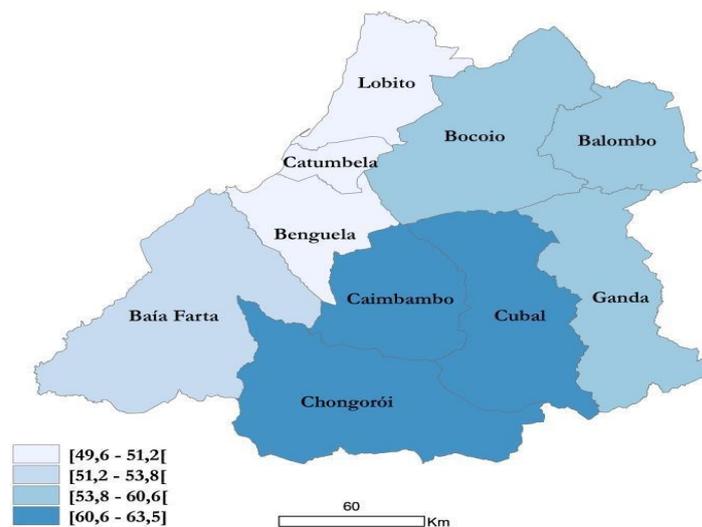


Figure 46 - Administrative division of Benguela

6.12.3 Demographics and population

According to the Final Results of the 2014 Census, the population of Benguela on the census date, May 16, 2014, was 2,231,385 people. Sixty-four percent live in urban areas and 36% in rural areas.

Table 23: Population by area of residence, by sex, 2014

Província e área de residência	Total		Homens		Mulheres	
	Nº	%	Nº	%	Nº	%
Benguela	2 231 385	100	1 055 819	100	1 175 566	100
Urbana	1 427 990	64,0	678 067	64,2	749 923	63,8
Rural	803 395	36,0	377 752	35,8	425 643	36,2

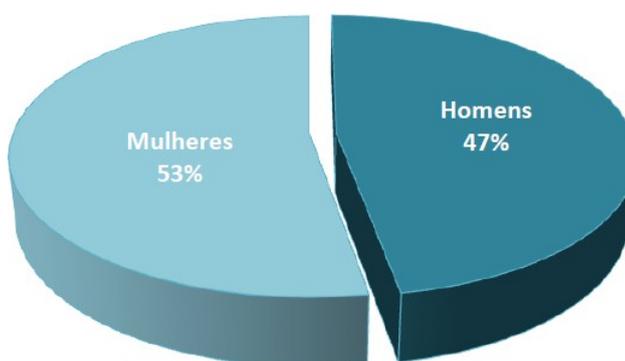
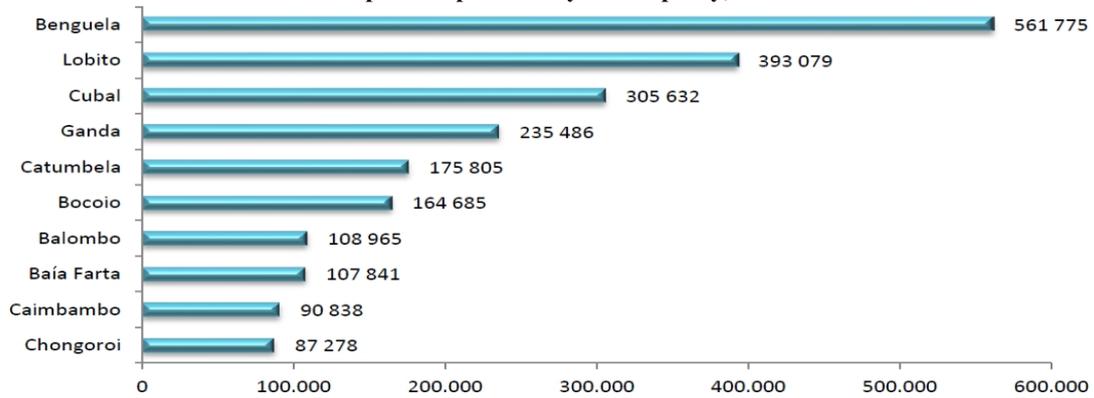


Figure 47 - Population, by sex, 2014

Among the resident population, 1,175,566 are women, corresponding to 53% of the total, while the male population is 1,055,819, representing 47% of the total resident population.

The municipality of Benguela is the most populous with 561,775 people, representing about a quarter of the province's population (25%). With fewer than 100,000 inhabitants are the municipalities of Caimbambo (90,838 inhabitants) and Chongoroi (87,278 inhabitants).

Graph 1: Population by municipality, 2014



According to the 2018 population projections prepared by the National Statistics Institute, Benguela has a population of 623,777 inhabitants and a land area of 2,100 km², making it the most populous municipality in the province and the tenth most populous in Angola.

In terms of prospects, it is anticipated that by 2025, the four main urban agglomerations in the province (Benguela, Lobito, Catumbela, and Baía Farta) will see a population increase of around 1,400,000 inhabitants.

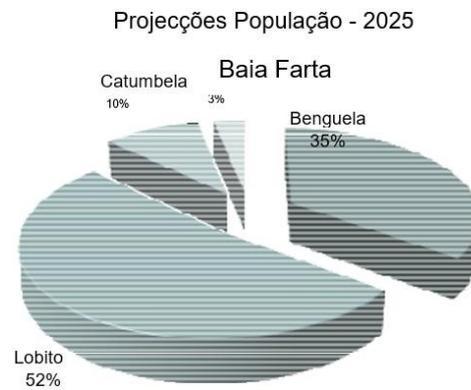


Figure 48: Benguela population projection by municipality

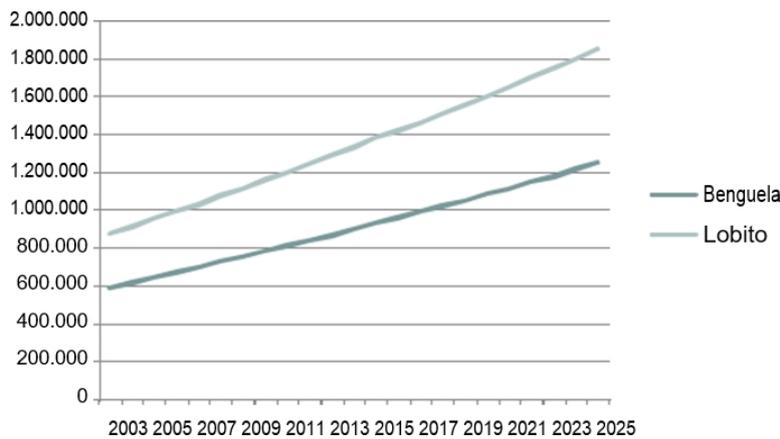


Figure 49: Population projection for Benguela and Lobito

The most significant absolute growth will occur in Lobito, where the population expansion will represent approximately 730,000 inhabitants. Benguela, in turn, will register a population expansion of around 500,000 inhabitants.

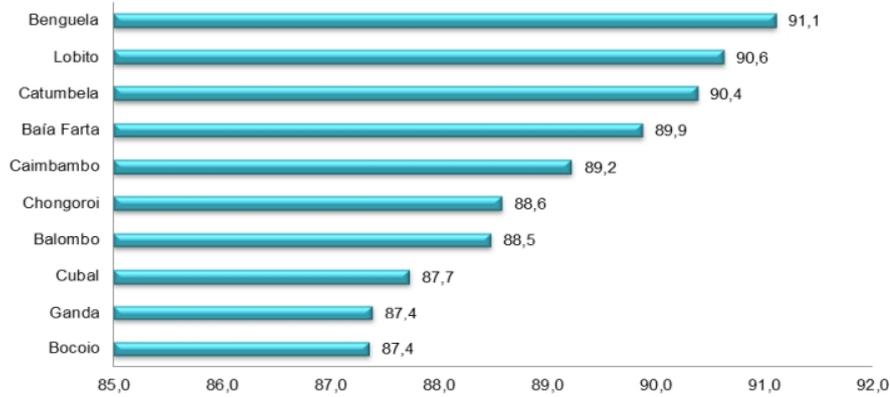
It is therefore estimated that in 2025 Benguela will have a population of approximately 1,200,000 inhabitants, while Lobito will approach 1,900,000 inhabitants. We are facing sharp population growth, which will require adequate infrastructure and heavy investment in social services. The demographic variable is fundamental in defining medium/long-term development priorities. In the case of Benguela, available estimates point to a significant increase in population over the next two decades. The challenge facing the province is therefore to create the conditions (economic, social, infrastructural, cultural, etc.) conducive to a comprehensive and equitable development project.

The 2014 Census data (INE, 2016) are not entirely clear regarding the population residing in the city of Lobito. In this context, the population to be considered is the urban population. On this basis, there are 357,950 inhabitants in Lobito (52.1% women and 47.9% men). Projections indicate a population of 448,080 inhabitants in the municipality of Lobito in 2019.

The municipality of Lobito is administratively divided into three communes, with the headquarters corresponding to the city of Lobito itself (sometimes called the commune of Lobito-Canata), and the communes of Egipto Praia and Canjala.

The province's masculinity index is 89, meaning that in Benguela there are 89 men for every 100 women, which means that Benguela's population is mostly women. The municipalities with significantly lower indices are Bocoio and Ganda.

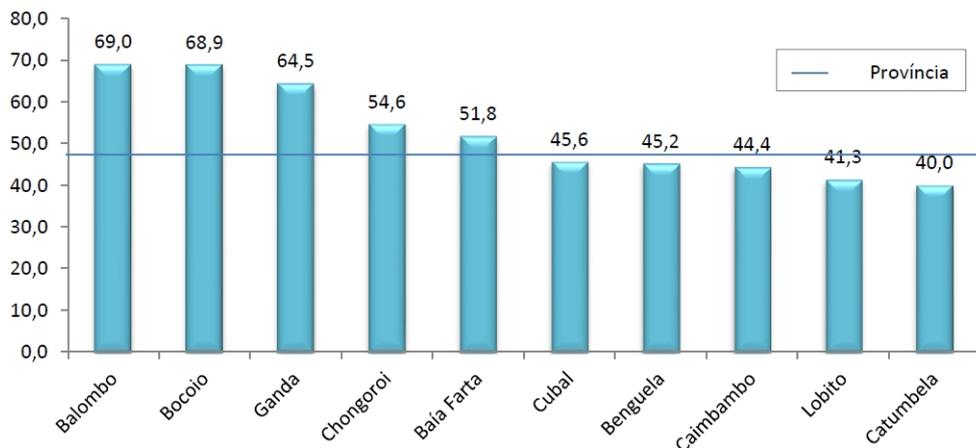
Graph 2: Masculinity index by municipality, 2014



6.12.4 Employment

The employment rate is the ratio of the employed population aged 15 or over to the total population aged 15 or over. This important indicator measures the capacity of a province's economy to provide employment for its growing population. In 2014, the employment rate in Benguela province was 49%.

Graph 3: Employment rate by municipality, 2014



The unemployment rate in Angola rose to 32.4% in the first quarter of 2024, with young people being the hardest hit by unemployment, which affects 63.5% of young people between the ages of 15 and 24.

years. According to data from Angola's National Statistics Institute (INE), the unemployment rate among the population aged 15 to 24 rose by 9.1% in the first three months of 2024 compared to the previous quarter (58.3%), while the unemployment rate among the population over 15 years of age saw a less significant increase in quarterly terms (from 31.9% to 32.4%). In the first quarter of this year, an additional 181,368 Angolans aged 15 or over (working-age population) became unemployed, for a total of 5,646,659 people (a quarterly change of 3.3%).

Among Angolans aged 15 to 24, the unemployed population increased to 3,737,150 people, with an additional 286,183 young people unemployed. Within the working-age population (17,414,877), 11,768,218 people were employed, with an estimated employment rate of 60.2%, which was slightly higher in rural areas and among the male population (61.6% compared to 59% for women).

The 35-44 and 45-54 age groups account for the largest number of employed people, from according to the Survey on Employment in Angola (IEA). Almost half of the people (47.5%) work in agriculture, hunting, and fishing, followed by trade with 22.6%. Most employed people (79.8%) are in the informal sector, of which 70.7% are men and 88.5% are women.

The IEA is a sample survey of households residing in Angola. Each quarter, a total of 10,944 households are selected, 6,036 in urban areas and 4,908 in rural areas.

In Balombo, a large part of the working population is involved in the informal sector, working in activities such as street vending, subsistence farming, small family businesses, and manual labor, where the lack of regulation and social security is a constant. Although the informal sector helps sustain the local economy, it does not offer many opportunities for improving quality of life or developing professional skills.

To combat unemployment, it is essential to create formal employment opportunities, encourage entrepreneurship and investing in professional training. Improving local infrastructure, developing sectors such as industry and tourism, and encouraging new business investment are important steps toward reducing unemployment and promoting sustainable economic growth

sustainable economic growth. In addition, promoting professional training and technical education programs can increase job prospects and reduce inequalities in the labor market.

6.12.5 Economic activities

6.12.5.1 Agriculture

In 2014, 48% of households in Benguela province were engaged in some form of agricultural activity.

Table 24: Households engaged in agriculture, 2014

Província	Nº	%
Benguela	232 339	48,0

The province of Benguela has high agricultural potential (historically proven), resulting from a unique soil structure and favorable climatic diversity, combined with an enviable hydrographic network. The province has around one million hectares of arable land, which reflects the potential for agricultural development in this area.

The province offers favorable conditions for the development of an impressive variety of crops.

Graph 4: Households, by type of agricultural activity practiced, 2014

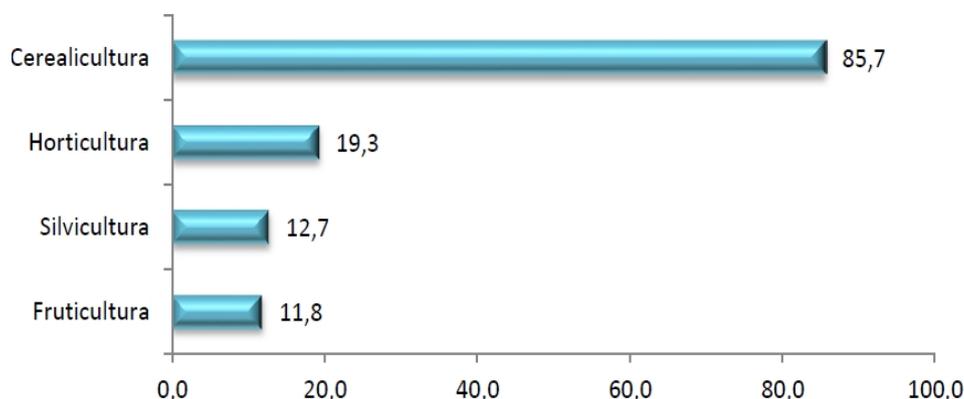


Table 25: Type of crops planted in different municipalities

Cultura	Benguela	Lobito	Baia Farta	Bocoio	Balando	Ganda	Cubal	Caimbambo	Chongoroi
Milho									
Mandioca									
Feijão Carioca									
Feijão Macunde									
Massambala									
Massango									
Amendoim									
Batata Doce									
Batata Rena									
Trigo									
Banana									
Hortícolas									
Cebola									
Gergelim									
Fruta									
Abóbora									

7

These crops are grown according to a cropping system that can be summarized according to the growing season.

With regard to agricultural practices, FAO data systematize the prevailing situation in Benguela province as follows.

Table 26: Agricultural practices

Provincia	Área Cultivada por Família	Área Cultivada com Tração Animal	Fertilizante	Rotação
Benguela	3 'ha	5 'ha	Orgânicos	Anual
Lobito	2 'ha	6 'ha	Estrume	Anual
Baia Farta	2 'ha	3 'ha	Adubos Verdes	Anual
Bocoio	1,5 'ha	4 'ha	Adubos Verdes	Anual
Balando	1,5 'ha	2,5 'ha	Adubos Verdes	Pousio
Ganda	1,5 'ha	3 'ha	Estrume	Pousio
Cubal	1 'ha	3 'ha	Estrume	Nenhuma
Caimbambo	2,5 'ha	4 'ha	Estrume	Anual
Chongoroi	1,5 'ha	3 'ha	Estrume	Pousio

Área Cultivada por Família

Área Cultivada com Tração Animal

Fertilizantes

Rotação

Source: AIP-Benguela Province market study (2010)

Corn is the staple food in the province, along with vegetables, cornmeal, and fish.

Table 27: Staple foods in the province

Município	Época Chuvosa			Época Seca		
	1º Alimento	2º Alimento	3º Alimento	1º Alimento	2º Alimento	3º Alimento
Benguela						
Lobito						
Bocoio						
Balombo						
Ganda						
Cubal						
Caimbambo						
Chongoroi						
Baia Farta						

Fuba Milho

Folhas

Peixe

Feijões

Fuba Massango

Hortícolas

Fuba Mandioca

Source: AIP market study - Benguela Province (2010)

Agriculture plays a significant role in the municipality of Lobito, especially in the communes of Egipto Praia, Canjala, and Hanha. In these areas, the Balombo River provides essential water resources for irrigation, allowing for permanent and temporary crops to be grown. The main agricultural crops include vegetables, fruits, and cereals, which not only supply the Benguela metropolitan area but also contribute to local food security.

Opportunities in Lobito's agricultural sector are linked to the availability of water resources for irrigation and proximity to the port of Lobito, which facilitates the transport of produce. In addition, the municipality's economic diversification, particularly in logistics and industry, can support agricultural development through infrastructure and services.

However, farmers face challenges such as climate variability, which can affect the availability of water for irrigation, and the need to modernize agricultural practices

to increase productivity and resilience to climate change. Investments in efficient irrigation technologies, farmer training, and market access are essential to overcome these obstacles and promote sustainable agricultural growth in the municipality.

6.12.6 Fishing

With regard to fishing, its contribution to the provincial productive structure must be separated into its industrial and artisanal aspects. Baía Farta has unique potential for industrial fishing.

Despite the scarcity of fish on the Angolan coast, shipowners in Benguela province caught 72,678 tons of fish in 2023, a slight increase of 1,639 tons compared to 2022, with pelagic species being the most prominent. This fish is processed for freezing by companies in the sector, mostly in the municipality of Baía Farta, Benguela's main fishing center.

Pelagic species such as sardines, horse mackerel, and mackerel top the list of catches and account for 75.3 percent of the total catch volume for 2023, which also includes, albeit in smaller quantities, cachucho, shrimp, alistado, crab, tilapia, and roncadour.

With more than 90 vessels, mostly for purse seine fishing and with an average capacity of 30 tons, in the industrial and semi-industrial areas, the province of Benguela has achieved average catches of over 6,000 tons of fish per month, still far from the boom of the past.

Proof of this is the company Vimar & Filhos, a modern fishery with around 600 workers, one of the largest fish capture and freezing projects in Baía Farta, with eight purse seine vessels focusing on pelagic species. Each of the eight vessels has a capacity of 60 tons. In terms of production, the installed capacity is 2,000 tons for preservation and 400 tons for freezing.

In addition to customers from the Democratic Republic of Congo, the company's priority is to supply fish to the domestic market, with priority given to the provinces of Malanje, Bié, Huambo, Lunda Sul, Cabinda, and Lunda Norte.

Although fish stocks have been declining in Benguela waters, the local fishing industry continues to weather the crisis, establishing itself as another major sector for international investment in the province, located in the south-central part of the country. Source: <https://angop.ao/noticias/economia/capturas-de-pescado-aumentaram-em-benguela-em-2023/>

Artisanal fishing is practiced by a large segment of the population living along the coast, numbering around 7,307 artisanal fishermen. All artisanal fishing activity is coordinated by the Artisanal Fishing Institute (IPA), which has representatives in the main fishing communities, namely in Cuio, Vitula, Caota, Quioche, Damba-Maria, Praia-Bebé, Lobito-Velho, and Hanha da Praia, or through the respective associations of .
Source: <https://www.aipex.gov.ao/PortalAIPEx/#!/angola/hu%C3%ADla>

Fishing is one of the most important sources of income for a section of the population, especially those living along the coast and riverbanks, contributing to regional socio-economic development and improving the nutrition of the populations in these areas.



Photo 9: Casseque fish market (artisanal fishing)



Photo 10: Artisanal fishermen in the surrounding area

6.12.7 Livestock

Livestock farming is a key sector for the subsistence of Angola's rural population and is strategically important for the economy and food and nutritional security of the population through the production and trade of animals and their products. Animal production plays a major role in the socioeconomic life of our country, not only because of the percentage of the population engaged in this activity, but mainly because of the resources it provides.

Livestock farming in the country focuses mainly on information about the agricultural and aquaculture enterprises that practice this activity, whose data is limited to the structure of the farms that raise animals, the species raised, their numbers and classes, production systems, animal vaccination, and animal health status, among other things. The RAPP (Agricultural and Fisheries Census) found that there are 773 specialized companies in the country that practice livestock farming as their main activity and 2,341 that practice livestock farming as at least one of the company's activities.

The main livestock species raised by Agricultural and Aquaculture Enterprises are cattle, goats, pigs, sheep, and poultry, particularly chickens. The results show that the number of animals in the EEs is 259,640 cattle, 136,216 goats, 69,846 pigs, and 58,951 sheep.

The table below illustrates the data on livestock numbers according to the main species raised in Angola.

Table 28: Livestock numbers by EE per province

PAÍS/PROVINCIA	BOVINOS	CAPRINOS	OVINOS	SUÍNOS
Angola	259 640	136 216	58 951	69 846
Cabinda	1 092	551	439	1 229
Zaire	1 173	2 101	640	2 814
Uige	12 623	5 386	4 598	7 423
Luanda	16 701	16 102	14 710	8 528
Cuanza Norte	13 444	4 877	2 197	1 811
Cuanza Sul	30 663	22 937	10 042	21 921
Malanje	9 633	4 518	1 504	2 558
Lunda Norte	19 370	5 089	1 489	1 577
Benguela	35 077	16 267	5 634	4 189
Huambo	10 441	10 894	4 382	6 715
Bie	4 087	4 305	1 460	1 125
Moxico	913	1 644	78	534
Cuando Cubango	968	506	60	80
Namibe	30 907	10 031	2 144	856
Huila	33 385	8 938	1 671	828
Cunene	25 178	11 705	1 764	916
Lunda Sul	6 342	3 985	1 304	1 965
Bengo	7 643	6 380	4 835	4 777

Fonte : INE-RAPP 2019-2020

Table 29: Poultry stocks raised by EEs by province (continued)

PAÍS/PROVÍNCIAS	GALINHAS		FRANGAS DE CORTE		FRANGAS POEDEIRAS		PATOS		PERUS	
	TOTAL	MÉDIA	TOTAL	MÉDIA	TOTAL	MÉDIA	TOTAL	MÉDIA	TOTAL	MÉDIA
Angola	60 986	1 799	104 254	11 043	551 219	51 529	12 796	659	544	114
Cabinda	115	12,8	7 042	320,1	1 069	213,8	567	31,5	2	2
Zaire	313	39,1	1 739	82,8	404	33,7	251	17,9		
Uige	2 355	84,1	162	23,1	5 033	2516,5	329	20,6		
Luanda	9 253	298,5	17 157	2451	99 627	9057	2 020	91,8	27	4,5
Cuanza Norte	656	46,9	894	81,3	13 576	969,7	242	22	5	2,5
Cuanza Sul	1 356	30,8	23 552	305,9	52 581	1877,9	1 443	23,3	233	14,6
Malanje	5 583	164,2	2 055	158,1	13 487	749,3	241	13,4	21	5,3
Lunda Norte	11 765	273,6	442	88,4	80	40	2 107	84,3		0
Benguela	991	17,7	11 272	150,3	71 305	5485	944	15,7	39	5,6
Huambo	7 991	44,9	253	28,1	57 143	5714,3	1 027	18,7	34	3,8
Bie	3 313	77	3 661	114,4	29 493	3277	207	13,8	10	3,3
Moxico	4 495	179,8	521	57,9	10 741	1790,2	231	19,3	1	1
Cuando Cubango	151	25,2	210	42	290	41,4	47	9,4		
Namibe	2 355	181,2	280	280	6 194	2064,7	339	48,4	12	12
Huila	749	68,1	30 450	6090	39 700	7940	312	52	47	9,4
Cunene	1 531	45	78	39			124	12,4		
Lunda Sul	6 248	63,1	400	50	5 640	705	750	30	38	12,7
Bengo	1 766	147,2	4 086	681	144 856	9053,5	1 615	134,6	75	37,5

Fonte : INE-RAPP 2019-2020

As illustrated in Tables 28 and 29, livestock farming in Benguela is practiced on a large scale by the business sector. On the other hand, local communities are also involved in raising various types of animals, which is crucial for the subsistence of these communities, as well as for the economic development of the region.

The livestock sector in Lobito has great potential for growth, but faces significant challenges in terms of infrastructure, animal health, and management techniques. With adequate investment, training for farmers, and government support, it is possible to develop a more productive and sustainable livestock sector, contributing to food security and economic development in the province.

6.12.7.1 Industry

The manufacturing sector suffers from poor promotion of raw material production (agriculture and livestock); insufficient coordination between central and provincial services; deficient mechanisms for promoting entrepreneurship (credit, guarantee funds, technical assistance); deficient inspection and supervision of activities; deficient institutional capacity of the Provincial Industry Directorate; insufficient qualified staff; incipient technical assistance activity; deficient means and facilities for production in quantitative and qualitative terms; low level of utilization of existing potential; poor accessibility to different regions of the province.

This sector is the least developed. Benguela has an industrial park whose developed and diversified structure is the second largest in the country. However, it is currently operating at less than 20% of its installed capacity. In the heavy industry group, there are 16 companies with the capacity to produce 25 types of goods and/or products and provide services in the naval, machine tool construction, metallurgical, and chemical fields. Twenty-seven companies are currently inactive.

Light industry – there are 44 companies in textiles, clothing, tanneries, footwear, tobacco, electronics, and construction. Only five production facilities are currently active.

Food industry – there are 31 companies in the sugar, fishing, pasta, vegetable oils, preserves, and various beverages sectors. Only five are operating regularly, particularly in the fishing sector.

Heavy Industry – Of the fourteen (14) existing production facilities, only seven (7) are operational. Eight (8) production facilities are at a standstill.

There are also more than 500 small businesses, including bakeries and pastry shops, mills, carpentry and joinery workshops, construction companies, wholesale and retail businesses, shoe shops, and auto repair shops, each employing between 5 and 40 people. **Source:** <https://www.aipex.gov.ao/PortalAIPEx/#!/angola/hu%C3%ADla>

The municipality of Lobito is one of Angola's main industrial hubs. Its strategic geographical position on the Atlantic coast, combined with the presence of the Port of Lobito and its connection to the Benguela Railway, favors industrial development and the movement of goods within the country and to neighboring countries. This consolidated infrastructure contributes to the establishment of several production units, boosting local and regional economic growth.

Lobito's industrial structure is diversified and includes sectors such as beverages, agro-industry, textiles, metallurgy, and shipbuilding. Also noteworthy is the storage and handling of petroleum products, as well as the construction of the future Lobito Refinery, which is expected to process up to 200,000 barrels of oil per day. These sectors make the municipality a key point in logistical support and the processing of natural resources, especially for the energy sector.

Despite its great potential, the municipality faces significant challenges. Inadequate basic infrastructure, difficulty in accessing financing, and a shortage of skilled labor are obstacles that limit the expansion and modernization of local industry. These factors can affect competitiveness and attractiveness for new investments, requiring coordinated action between the government, the private sector, and development partners.

On the other hand, Lobito offers promising opportunities, especially with investments in infrastructure, such as the Lobito Corridor, which aim to strengthen logistical connections with the interior and with countries in the region. Strengthening the industrial sector can generate employment, improve tax collection, and diversify the Angolan economy, which has traditionally been dependent on crude oil exports. With appropriate policies to support the productive sector and vocational training, the municipality has the potential to establish itself as a center of industrial excellence in Angola.

6.12.7.2 Trade

The Benguela trade sector is subdivided into rural and urban trade and has weaknesses:

In the rural trade subsector, there is no adequate system for marketing livestock and agricultural products that stimulates the supply of agricultural inputs and consumer goods; there is a lack of specific incentives for agents who may be involved in this sector; there is no functional network; central bodies have difficulties in

implementing approved rural marketing programs; a lack of technicians with the sensitivity and capacity to address the problems; a lack of interest among traders in this line of business due to the low purchasing power of rural populations; a lack of private investment; and a lack of establishments in municipalities capable of supplying agricultural equipment and tools, seeds, pesticides, livestock medicines, and other items.

In the urban trade subsector, weaknesses stem from the excessive concentration of commercial activities in the municipal capital; poor product quality and lack of control entities; poor enforcement of legislation and standards in the area of food quality; insufficient implementation of rural trade promotion programs; excessive bureaucracy and delays in the commercial licensing process; insufficient measures to protect domestic production; the exodus of traders and the rural population to urban centers and market computerization; poor information on the connection between food quality and public health; insufficient storage and preservation infrastructure; lack of regular surveys of commercial activities; municipal markets with poor hygiene and sanitation conditions; weakness in the marketing system for domestic goods; poor use of newly built markets; and the resulting weak purchasing power of the population; weak competitiveness of domestic production and constraints throughout the value chain.

The trade sector in the municipality of Lobito is dynamic and constitutes one of the main local economic activities. Its coastal location and the presence of the Port of Lobito give the municipality a strategic role in the transport and distribution of goods, both for domestic consumption and for export and import. Trade also benefits from the connection to the Benguela Railway, which facilitates the supply of goods to inland provinces and neighboring landlocked countries.

Commercial activity in Lobito is characterized by a wide variety of establishments, ranging from informal markets and small local shops to large wholesale warehouses and distribution centers. The main products traded include goods food, materials de construction, appliances, parts automobiles and

fuels. Its proximity to industrial areas and the port strengthens wholesale trade, positioning Lobito as an important commercial hub in the country.

However, the sector faces challenges such as informality, unfair competition, weak enforcement, and a lack of adequate infrastructure in markets and commercial areas. In addition, limited access to credit and low storage and preservation capacity for perishable goods negatively affect traders, especially small-scale ones. The modernization of commercial spaces and the formalization of activities remain priorities to ensure greater safety, quality, and organization in the sector.

Despite the constraints, trade in Lobito presents promising opportunities, particularly with population growth and investments in logistics infrastructure. The rehabilitation and expansion of the Port of Lobito, as well as the modernization of transport and storage systems, could further boost the sector. With public policies supporting entrepreneurship, training, and formalization, local trade could generate more jobs, boost the economy, and contribute to the sustainable development of the municipality.



Photo 11: Informal trade on the streets of Lobito



Figure 50: Port of Lobito



Figure 51: CFB Lobito railway station

6.12.7.3 Financial, Banking, and Insurance System

Banking services are already present and concentrated in coastal locations, with 15 branches. The province has branches of the following banks:

National Bank of Angola (BNA); Savings and Credit Bank (BPC); Trade and Industry Bank (BCI); Totta & Açores Bank; Development and Foreign Bank; African Investment Bank (BAI);

The Economic and Social Development Fund (FDES) has financed projects supporting the fisheries, agriculture, industry, transport, and civil construction sectors. It currently finances 29 (twenty-nine) projects worth approximately US\$7.5 million.

The banking and insurance sector in the municipality of Lobito plays a key role in supporting local economic activities, benefiting from the municipality's strategic position as one of Angola's main logistics and industrial hubs. The presence of various financial institutions and insurance companies contributes to the revitalization of the economy, offering essential services to businesses and individuals.

In the banking sector, Lobito has branches of several institutions, including Banco YETU, with a branch located on Avenida Paulo Dias de Novais, in the Industrial Zone of Bairro da Luz. Standard Bank Angola also has a branch in the municipality, located on Rua Cerveira Pereira and Avenida Salvador Correia, in Bairro Caponte. In addition, Millennium Angola offers banking services on Rua 15 de Agosto. Caixa Angola is present with the Lobito Mercado Branch, etc. The inauguration of the first Regional Branch of the Credit Guarantee Fund (FGC) in Lobito aims to facilitate access to financing for micro, small, and medium-sized enterprises, promoting entrepreneurship and local economic development.

In the insurance sector, the municipality is served by several insurance companies offering a range of products to cover personal and business risks. Sanlam Angola Seguros, a member of the South African SANLAM group, is present in the Angolan market, offering comprehensive and customized financial solutions for private clients and companies. BIC Seguros also has a presence in Benguela province, with branches in neighboring municipalities such as

Catumbela, Cubal, and Bocoio. In addition, Empresa Nacional de Seguros de Angola (ENSA) has been operating in the municipality, having signed fund management contracts with the Port of Lobito.

Despite the significant presence of financial institutions and insurance companies, the sector faces challenges such as the need to expand services to peripheral and rural areas, promote financial literacy among the population, and adapt to new digital technologies. However, the opportunities are promising, especially with investments in infrastructure and the growing demand for financial and insurance services, driven by the municipality's economic development.



Figure 52 – Bic-Lobito bank branch

6.12.7.4 Hospitality and Tourism

The tourism potential of Benguela province, exemplified by its beaches (the most famous, with the exception of Restinga do Lobito, are located south of Benguela, namely Baía de St^o. António or Baía das Vacas, Caota, Baía Azul, Caotinha), the landscape and natural heritage, transport facilities, and the dynamism evidenced by the hotel and restaurant offerings suggest that the province will, in the medium term, become an important tourist destination in the country and, if it evolves in a sustainable and consistent manner, a potential international holiday destination.

The province also boasts the Chimalavera Natural Park, located about 30 km from the city of Benguela, covering an area of 150 km² and populated by small and large animals.

Benguela therefore has natural, cultural, and socioeconomic resources that make tourism a strategically important sector for the province, as it has a multiplier effect on the region's economy by stimulating the development of a wide range of activities such as transportation, construction, trade and services, agriculture, and industry, among others. It is also a labor-intensive activity, creating many jobs. It generates significant income, brings in foreign exchange and public revenue, conserves and enhances heritage and culture, and encourages environmental preservation.

The hotel and tourism sector in the municipality of Lobito stands out as one of the most promising on the Angolan Atlantic coast. The city benefits from a privileged location, with extensive beaches, a tropical climate, and a natural bay that is ideal for water sports and leisure activities. Restinga do Lobito, a narrow peninsula jutting out into the sea, is the city's main tourist attraction, with hotels, restaurants, and entertainment venues that draw both domestic and foreign tourists.

The hotel offering in Lobito is diverse, catering to both leisure and business tourism. Notable establishments include the Hotel Terminus, recognized as one of the best beach hotels in Angola, and the Hotel Turimar, geared towards the corporate segment, with infrastructure for events and meetings. Other options include the Oceano Boutique Hotel, Hotel Restinga, Hotel Chik Chik II, and Baía da Restinga Guest House, which offer different levels of comfort and prices, expanding the range of choices for visitors.

Despite its tourism potential, the sector faces challenges such as the need to modernize infrastructure, train the workforce, and promote tourism more effectively. The informality of some services and the seasonality of demand also represent obstacles to the sustainable development of local tourism. In addition, the COVID-19 pandemic has had a negative impact on tourist flows, requiring additional efforts to recover the sector.

However, the opportunities are significant. Investments in infrastructure, such as the rehabilitation of the Port of Lobito and improvements to access roads, can boost cruise tourism and ecotourism. The promotion of cultural and sporting events, combined with the enhancement of historical and natural heritage, can diversify the tourist offer. With appropriate public policies

and partnerships between the public and private sectors, Lobito has the potential to establish itself as a leading tourist destination in Angola.



Photo 12: Hotel in Lobito



Photo 13: Tourist area of Lobito's Restinga beach

6.12.8 Social Facilities

6.12.8.1 School network

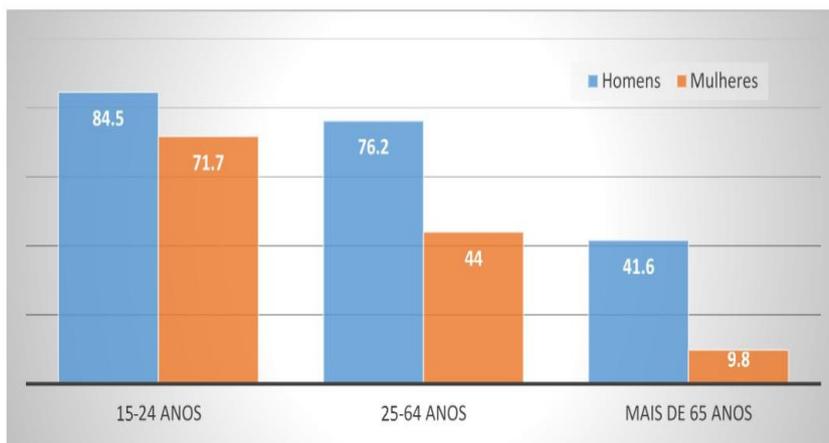
According to data from the 2014 census (INE, 2016a), the literacy rate in Benguela province is 63%, with 78% in urban areas and 36% in rural areas. In terms of gender, 78% of men can read and write, compared to 51% of women. The urban area of the municipality of Lobito has a rate of 84.3%.

The younger segments of the population (15-24 years old) are the most literate and where the ratio between men and women is most balanced, highlighting the two levels of effort in recent years: mass access to education and retention of girls in school.

Table 30: Literacy rate by area of residence, by sex, 2014

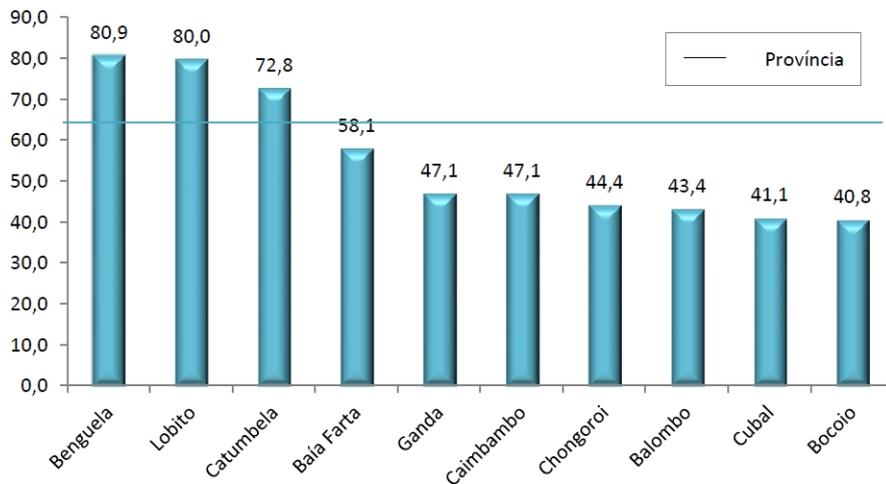
Província e área de residência	Total	Homens	Mulheres
Benguela	63,3	77,6	51,3
Urbana	77,5	89	67,8
Rural	36,3	55,2	21,3

Graph 5: Literacy rate by age group and gender



Analysis by municipality indicates that, in Benguela province, the lowest rate is found in the municipality of Bocoio, where only 4 out of 10 people can read and write (41%).

Graph 6: Literacy rate by municipality, 2014



In 2014, only 12% of the population aged 18 or over had completed the second cycle of secondary education (had completed 12th or 13th grade). On the other hand, 19% of the population aged 18 or over had completed primary education (had completed 6th grade).

Table 31: Population aged 18 or over, by level of education completed, 2014

Província	Nunca frequentou	Nenhum nível	Ensino primário	I ciclo do ensino secundário	II ciclo do ensino secundário	Ensino superior
Benguela	26,8	26,2	18,5	15,3	11,5	1,7

The school network in the city of Lobito consists of a variety of educational institutions, covering primary, secondary, and technical-vocational levels. There are public and private schools distributed throughout urban and suburban neighborhoods, with an emphasis on general education schools, technical institutes, and some institutions focused on vocational training in areas such as commerce, industry, and services. Despite advances in recent years, especially in expanding access to basic education, the system faces several challenges.

Among the main problems is the inadequacy of school infrastructure to meet the growing population demand, especially in peripheral neighborhoods. Many schools operate with overcrowded classrooms, dilapidated facilities, and a lack of teaching materials and support equipment, such as libraries and laboratories. In addition, there is a continuing need for ongoing teacher training and improvement of their teaching skills to ensure the quality of education.

In terms of improvements needed, the construction of new schools, the rehabilitation and modernization of existing ones, the provision of adequate furniture and teaching materials, and the expansion of teacher training programs are particularly noteworthy. It would also be important to strengthen technical and vocational education to align training with local economic opportunities, especially those linked to Lobito's logistics, industrial, and tourism sectors. The promotion of school inclusion programs to combat dropout and exclusion of children and adolescents is also a priority for the sustainable development of the city.

Lobito's proximity to the cities of Catumbela and Benguela makes it interdependent on the educational opportunities available in those cities.

According to local authorities, the city of Lobito has a school network comprising around 120 establishments serving just over 130,000 students taught by around 3,000 teachers.

Complete information on the school network, number of students, and teachers is presented in the following tables.

Table 32: School network in the city of Lobito

Município	Zona	Nível de Ensino	Nº de Escolas	Nº de alunos	Nº de docentes
Lobito	Baixa	Creche	2	120	30
		Primário	15	13 908	480
		Prim, 1º e 2º Ciclos	13	11 999	471
		1º e 2º Ciclos	5	6 341	365
		Primário e 1º Ciclo	1	122	7
		2º Ciclo	1	2 417	117
		2º Ciclo Técnico	1	640	19
		Formação de Professores do 2º Ciclo	1	1 472	117
	Universitário	2	4 416	210	
	Alta	Primário	25	65 565	1 479
		Prim, 1º e 2º Ciclos	13	15 388	474
		Primário e 1º Ciclo	2	587	21
		1º e 2º Ciclos	12	20 150	716
		2º Ciclo	1	479	19
		1º Ciclo Técnico	2	679	23
		2º Ciclo Técnico	6	7 827	273
Formação de Professores do 2º Ciclo		2	1 329	84	

6.12.8.2 Hospital network

According to the Multiple Indicator Cluster Survey (MICS, 2015-2016), malaria is one of the main public health problems in Angola and is the leading cause of demand for health services, absenteeism from work and school, and death. It is also one of the main causes of miscarriage, premature birth, low birth weight, anemia in pregnant women, and maternal and perinatal mortality.

It accounts for about 35% of demand for curative care, 20% of hospital admissions, 40% of perinatal deaths, and 25% of maternal mortality. The province of Benguela is at the second level of epidemiological endemicity 8: stable mesoendemic, where transmission is moderate and stable throughout the year.

Other notable diseases are diarrhea, chronic malnutrition, and acute respiratory infections, all of which are related to environmental sanitation and water supply conditions. Benguela is among the provinces with the highest prevalence of diarrhea (21%) and among those with the lowest rates of chronic malnutrition (33%).

The healthcare network is characterized by insufficient infrastructure, equipment, and specialized workforce, which translates into a low level of service provision to the population. According to provincial health authorities, Lobito has a health infrastructure network that makes it the second most covered city in the province, behind only the city of Benguela. In recent years, significant efforts have been made to expand the health network in the city, namely through the construction of new units and the expansion of existing ones, including their equipping and allocation of human resources.

According to municipal authorities, the following table presents a complete list of health facilities, while the following figure illustrates an existing health facility in the study area.

Table 33: Health network in the city of Lobito

Município	Zona	Bairro	Designação	Capacidade (n.º camas)
Lobito	Baixa	Comercial	Clínica Sagrada Esperança	(1)
		Comercial	Clínica Dentária do Lobito	(1)
		Comercial	Clínica Medicrisal	(1)
		Compão	Hospital Geral do Lobito	500
		Compão	Clínica WHO Cardio	(1)
		Kassai	Centro Médico do Kassai	(1)
		Liro	Clínica São Vicente	(1)
		Luz	Hospital Pediátrico do Lobito	101
		Restinga	Clínica do Porto do Lobito	(1)
		Restinga	Maternidade do Lobito	104
	S. Miguel	Centro Médico de S. Miguel	(1)	
	Alta	17 de Setembro	Dispensário 17 de Setembro	(1)
		27 de Março	Posto de Saúde 27 de Março	(1)
		Alto Akongo	Posto de Saúde do Alto Akongo	(1)
		Alto Liro	Centro de Saúde do Alto Liro	(1)
		Bela Vista Alta	Clínica Júlia	(1)
		Bela Vista Alta	Centro Materno Infantil da Bela Vista	71
		Boa Vista	Centro de Saúde da Boa Vista	(1)
		Golfe	Posto de Saúde do Golfe	(1)
		Mbango Mbango	Posto de Saúde da Mbango Mbango	(1)
São João		Centro de Saúde do São João	(1)	



Figure 53: Lobito regional hospital

In terms of epidemiological profile, local authorities indicate that despite the implementation and regular operation of programs such as Immunization, Reproductive Health, Epidemiological Surveillance, Nutrition, HIV/AIDS, Tuberculosis and Leprosy, Neglected Diseases, Essential Medicines, and Malaria, the main diseases causing the highest morbidity and mortality continue to be parasitic diseases, malaria, acute diarrheal diseases,

acute respiratory diseases, typhoid fever, tuberculosis, HIV/AIDS, and malnutrition. Malaria, in particular, is still considered a public health problem, with a high peak in some neighborhoods of the communes of Biopio, Praia do Bébé, Gama, as well as in the commune headquarters, which has areas where conditions favor the multiplication of disease-transmitting vectors.

Significant efforts have been made in recent years to provide the municipality with a technical health framework capable of responding to current challenges. However, the health system faces significant challenges. These include overcrowding in public hospitals, a shortage of modern medical equipment, a lack of medicines, and a shortage of health professionals in critical specialties. Infrastructure maintenance and the ability to respond to medical emergencies are also frequent concerns.

To improve the sector, actions such as the rehabilitation and expansion of existing facilities, investment in medical equipment and technology, strengthening the continuing education of health professionals, and expanding access to health care in more remote neighborhoods are necessary. Public-private partnerships and the promotion of preventive health programs can be important ways to strengthen Lobito's hospital network and ensure a more efficient and accessible health service for the population.

6.13 INFRASTRUCTURE

6.13.1 General Considerations

This descriptor comprises an analysis of the infrastructure in the project area, namely the electricity and water supply networks, road network, etc.

6.13.2 Electricity Supply Network

According to data from the 2014 Census, only 26% of households in Benguela province have access to electricity from the public grid.

Table 34: Households with access to electricity from the public grid by area of residence, 2014

Província e área de residência	Nº	%
Benguela	124848	25,8
Urbana	123340	41,1
Rural	1508	0,8

The supply of electricity from the public grid is still very poor in Benguela province. In addition to low levels of access (only 41% in urban areas), the supply is often intermittent, especially in the outlying neighborhoods where most of the city's population lives.

However, the cities under analysis have a different access situation, with levels above the provincial average. In the urban areas of Lobito, about 73% have access to electricity from the public grid. The graph below shows the main sources of lighting used by households in the urban areas of the municipalities of Lobito.

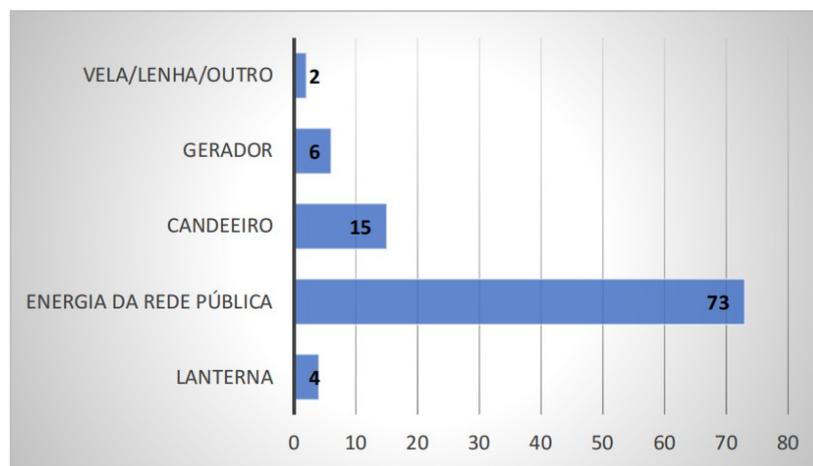


Figure 54: Main sources of lighting in the urban area of Lobito (INE, 2016)

The National Electricity Distribution Company (ENDE) is responsible for managing and operating the electricity distribution network in Balombo, as well as in other regions of Angola. ENDE is responsible for maintaining and expanding the distribution network, making new connections, and ensuring that energy is delivered continuously and with high quality.

The electricity distribution network in the city of Lobito is one of the most important in Angola's central coastal region, partially integrated into the National Electricity System. Supply is mainly provided through the National Energy Transmission Network, which transports energy from sources such as the Capanda dam in Malanje and other hydroelectric and thermal power plants.

The local distribution network consists of transformer substations, medium and low voltage lines, and distribution stations that carry power to urban and suburban neighborhoods. Despite advances in recent years, there are challenges, such as frequent power outages,

power cuts, overloads in some densely populated areas, and old infrastructure in need of modernization and maintenance.

Rapid urban growth and increased energy demand have put pressure on the capacity of the existing network. Therefore, there is a need for investment in network expansion, installation of new transformer stations, and infrastructure modernization to ensure a stable and efficient supply to the entire population, as well as to support the industrial and commercial development of Lobito. Improvements are also needed in energy loss management and in expanding access to electricity in outlying neighborhoods.

6.13.3 Water Supply Network

According to the results of the 2014 Census, in Benguela, about 59% of households have access to appropriate sources of drinking water.

Table 35: Households with access to appropriate drinking water by area of residence, 2014

Província e área de residência	Nº	%
Benguela	283 484	58,6
Urbana	249 665	83,2
Rural	33 819	18,4

The water supply network in the city of Lobito is one of the most important for ensuring the supply of drinking water to the urban and peri-urban population. The system is mainly fed by surface sources, such as the Catumbela River, and supplemented by underground wells in some specific areas.

The Lobito Water and Sanitation Company (EASL) is the agency assigned to DNA-MINEA, which manages wastewater and drinking water in the municipality of Lobito. Its corporate purpose is to provide services in the water sector, more specifically the production, treatment, supply, distribution, and marketing of drinking water, while also ensuring activities related to basic sanitation. It was established by Joint Executive Decree No. 405/13 of December 4 by the Ministries of Economy and Energy and Water.

Figure 7: Households, by main sources of drinking water supply, 2014



The quality of water for public supply in the municipality of Lobito is assessed using physical-chemical and microbiological analysis methodologies developed in the laboratory of the Water Treatment Plant (ETA-Luongo) of the Benguela Provincial Water and Sanitation Company. The aim is to monitor and guarantee the quality of water distributed to the population.

The public water supply to the city of Lobito is mainly provided from three sources:

- The Zona Velha borehole field collection system;
- Tchiúle borehole field collection system;
- Surface water intake from the Catumbela River: water is extracted from a dam located on the left bank of the river.

The intakes are located on the left and right banks of the Catumbela River, near its mouth, in areas with flat terrain, with a minimum elevation of approximately 6 meters.

Despite efforts to improve the system, the network faces significant challenges, such as water losses due to leaks and aging infrastructure, supply interruptions, and limited coverage in some outlying areas of the city.

Improvements needed include the modernization of treatment plants, the rehabilitation and expansion of the distribution network, and improvements in water quality management to meet

public health standards. It is also important to increase investments to expand coverage to unserved neighborhoods and promote education programs on efficient water use, considering the growing urban pressure and climate variations that affect local water resources. Water is used primarily for domestic use, food, personal hygiene, agricultural irrigation, animal consumption, and industrial use;

6.13.4 Basic sanitation

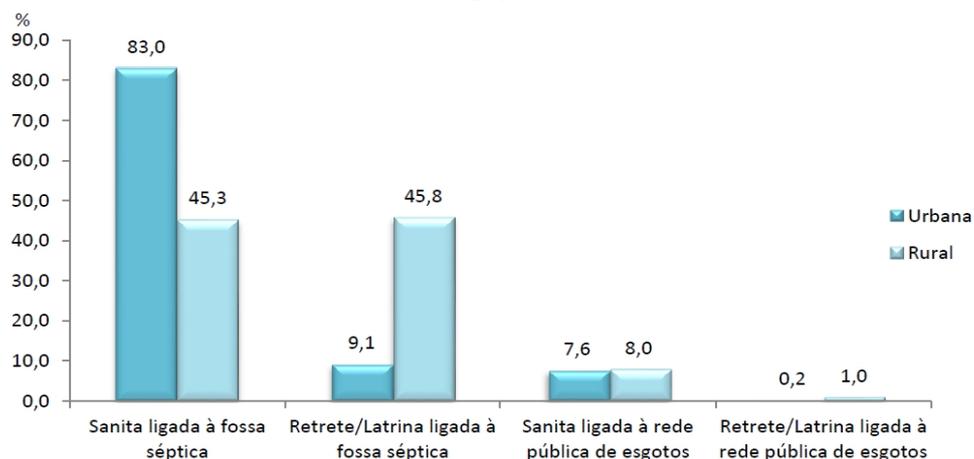
At the provincial level, only 45% of households use an appropriate place to defecate. However, this figure is only 4% in rural areas and 71% among urban residents.

Table 36: Households using appropriate facilities for defecation by area of residence, 2014

Província e área de residência	Nº	%
Benguela	219 234	45,3
Urbana	212 266	70,7
Rural	6 969	3,8

The Lobito Water and Sanitation Company (EASL) is the agency assigned to DNA-MINEA, which manages wastewater and drinking water at the municipal level in Lobito. The basic sanitation sector in the city of Lobito still faces major challenges in adequately meeting the needs of the population. Although there is some sanitation infrastructure, such as storm drainage systems and individual septic tanks in residential and commercial areas, sewerage network coverage is very limited, concentrated only in certain central areas of the city.

Figure 8: Households using appropriate sanitation facilities by area of residence, 2014



Most liquid waste is disposed of improperly, through natural runoff systems or obsolete drainage systems, which can lead to soil contamination, water pollution, and public health risks, especially during the rainy season. The cleaning and maintenance of drainage ditches is also insufficient, increasing the risk of urban flooding.

The main areas for improvement include the implementation of a public sewage system, modernization of existing infrastructure, expansion of wastewater collection and treatment services, and strengthening awareness campaigns on the importance of basic sanitation in promoting health and urban quality of life. Investments in this sector are fundamental to the sustainable development of the city and to the fulfillment of the Sustainable Development Goals (SDGs).

6.13.5 Road Network and Transport

The road and transport network of the city of Lobito is one of the most important in Angola, thanks to its strategic location next to the port of Lobito and the rail link via the Benguela Railway (CFB), which connects the coast to the interior of the country and neighboring countries.

The city has a reasonable network of paved main roads connecting urban, industrial, and port areas, as well as roads connecting it to Benguela, Catumbela, and other locations. The most important road section is the EN-100, which connects it to Luanda and Benguela. Another vital route is the Trans-African Highway 9 (or EN-250), which connects it to Balombo in the east.

The port of Lobito is open to all types of traffic without any particular type predominating. It has an important mechanical system for loading minerals, silos for corn, and serves the vast **hinterland** (manufacturer of Dragão cleaning products) through the third largest transcontinental railway line in the world and the coastal port.

The municipality also has Lobito Airport, an important air transport facility, entirely dedicated to military aviation, with civil aviation relying on **the modern Catumbela International Airport**.

However, significant difficulties remain. Many secondary roads and internal neighborhood streets have poor paving, potholes, erosion, and a lack of adequate signage, hindering traffic flow and increasing the risk of accidents. The lack of regular maintenance, especially after the rainy season, exacerbates the deterioration of the roads.

Public transportation, based mainly on motorcycle taxis and candongueiros (minibuses), is informal and lacks better organization and regulation.

Despite the challenges, there are opportunities for modernizing the sector, such as investments in rehabilitating and expanding the road network, improvements in urban public transport, and public-private partnerships to develop safer, faster, and more sustainable mobility solutions. Strengthening the transport infrastructure in Lobito is essential to boost trade, logistics, and tourism, as well as improving the quality of life of its inhabitants.

6.14 LAND USE PLANNING

6.14.1 General Considerations

The purpose of this descriptor is to identify the land use management instruments approved and/or in force in the municipality of Lobito, Benguela province, based on information gathered from local authorities and bibliographic research.

6.14.2 Municipal Master Plan

The Lobito Municipal Master Plan is ratified by Order No. 221/19 of December 4 and aims to create favorable conditions for the social and economic development of citizens, identifying in its Article 2, among other objectives:

“a) Ensure conditions for the development of economic activities, generating employment and income in order to meet the needs of the population in terms of water and electricity, basic sanitation and solid waste collection, road networks and communication systems, social facilities (education, health, social assistance, culture, recreation, and sports), and housing.”

The following classes are found in the intervention area:

- Residential space (space to be consolidated, low-density space to be renovated, space to be structured, residential tourist space);
- Equipment or structuring infrastructure space (Existing equipment, Port of Lobito, Benguela Railway Airport, Existing infrastructure);
- Economic activity space (Business area: Industrial/Warehouses, Business area: Extractive Industry);

- Space for economic activities (Business area: Industry and Warehouses, Commerce/Services and Hospitality, Reserve);
- Space for equipment or structural infrastructure (proposed equipment, planned infrastructure);
- Residential space (developable land, planned developable land) (Low-density residential space (Type II), Medium-density residential space);
- Leisure and recreation space (Green Leisure and Recreation Space (urban park));
- Space for for (Special (Environmental Protection) Environmental (Green Green areas));
- Natural space (Beaches).

6.14.3 Coastal Zone Management Plan (PNOOC)

The National Coastal Zone Management Plan was drawn up in 2010 but not published in the Official Gazette. However, it can provide some macro-level guidance on future land use, which will be detailed in the Municipal Master Plans.

The PNOOC recommends various types of land use for the intervention area in the Land Use Map, among which the following stand out: Historic City, Urban Structure to be Requalified, New Urban Structure, Urban Transition, Light Industry, Heavy Industry, Agricultural Reserve, Ecological Reserve, and Foz do Catumbela Marine Reserve.

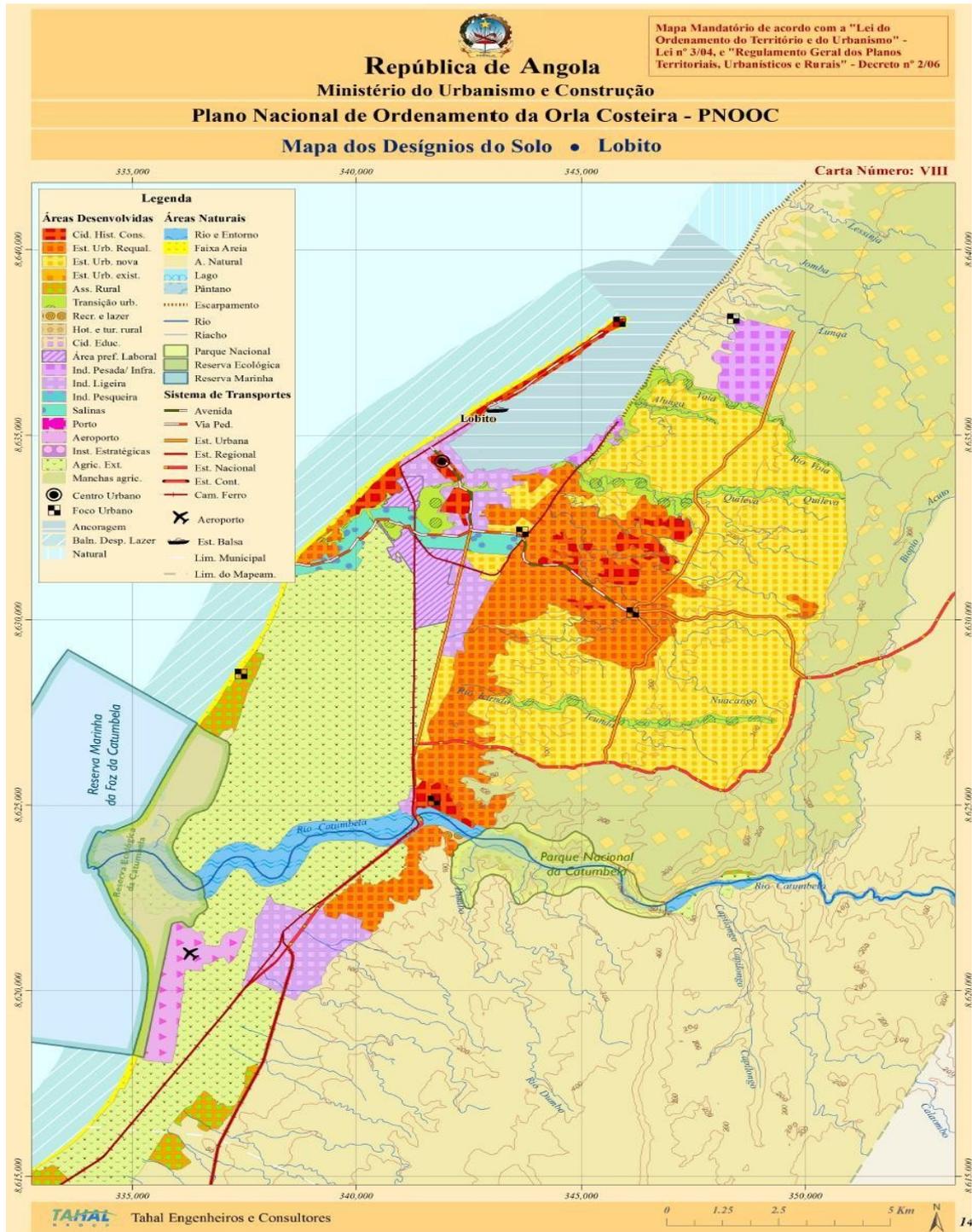


Figure 55: Land use map - Lobito

6.15 HISTORICAL AND CULTURAL HERITAGE

6.15.1 General considerations

The purpose of this descriptor is to identify and characterize the historical and cultural heritage that may exist at the project site and in its immediate surroundings.

The characterization of the heritage was based on a field survey carried out on site in March 2024 and on bibliographic research.

6.15.2 Inventory of Existing Heritage Sites

There is no classified heritage in the municipality of Lobito, and Articles 28 and 29 of the PDM state the following:

Article 28 Properties of historical and cultural interest

1. *There are no classified properties or properties in the process of being classified in the municipality of Lobito.*
2. *The properties listed in the Constraints Plan correspond to properties of cultural, social, historical, or architectural interest that are granted protection and enhancement status, namely through:*
 - a) *Preservation of characteristics and elements of identity, without prejudice to their adaptation to new uses arising from contemporary life*
 - b) *Restrictions on the occupation of areas covered by the respective protection perimeters.*
3. *For listed properties, a precautionary protection zone of 50 meters is established, measured from the outside of their boundaries, in which disposals, demolition, installation, construction, and reconstruction works, the creation or transformation of green areas, earthworks, and changes in use are subject to the opinion of the entity responsible for protecting heritage, and architectural projects must be signed by an architect.*

Article 29

Urban complexes of historical and cultural interest

1. *The urban areas marked on the Constraints Map are urban spaces of historical and cultural interest , with identifying characteristics*

that refer to a specific era and architectural style that distinguish them from the surrounding urban occupation.

- 2. The preservation of these areas as part of the collective cultural heritage enhances the city of Lobito and contributes to its rich heritage. A study should be carried out for each urban complex to determine the main architectural and urban characteristics to be maintained.*
- 3. Without prejudice to changes in use, existing buildings in these spaces should be conserved or rehabilitated in order to maintain their original architectural characteristics, and interventions in public spaces should respect the urban structure characteristic of the original urban occupation.*
- 4. The filling of empty spaces and the construction of new buildings must respect the original urban fabric that characterizes each complex, particularly with regard to occupancy and layout ratios, alignment, and building height.*

Locally, 16 monuments, sites, and historic areas are inventoried and a total of 30 are classified.

According to research, one of the city's main leisure spots is the **Lobito Lighthouse**, a historic building that serves as a guide for ships wishing to enter Lobito Bay.

Another leisure option of historical interest is the **Fort of São Sebastião do Egito**, a building that served as a refuge on the Angolan coast and controlled the slave trade.

Other important architectural constructions are the **Cine-Flamingo**, the **Post Office Building**, the **Fortress of São Sebastião**, and the **Lobito Museum of Ethnography**. There is also a historical monument, the Zaire Library Ship/Museum Ship, located in Largo 28 de Agosto.

The **Lobito Lighthouse (tower)** is an Angolan lighthouse located at the top of the cliffs on the **east** side of the entrance to the port and bay of Lobito, opposite the tip of the sandbar, north of the city of the same name, in the province of Benguela. This lighthouse was built on top of a mountain, providing a privileged view from various angles.



Figure 56: Lobito Lighthouse and Fort of São S. do Egípto



Figure 57: Historical monument of the Zaire library ship (Largo 28 de Agosto)



Figure 58: Lobito municipal administration

6.16 PROJECTION OF CURRENT SITUATION IN ABSENCE OF THE PROJECT

The identification of the evolution of the state of the environment without the Project or projection of the current situation is based on the perspective of the continuation of the characteristics and trends that are felt at the time this projection is made.

The Project under analysis is located in an area that is strategically located for the storage and distribution of grain, as it is in an industrial zone that has several docks, access roads, and the CFB railway line. These infrastructures are crucial and will facilitate the transport of grain stored in silos, whether imported or for export.

Therefore, in a scenario where the Project is not built, it is expected that the current state of the environment will evolve in the long term towards the occupation of this area by industrial activities due to the aforementioned soil characteristics.

It should also be noted that the province of Benguela has been the target of various investments and interventions in the agricultural and industrial sectors, with a view to fostering and promoting the role of the private business sector and ending regional disparities, thereby contributing to the development of the province and the country.

In view of the above, it is not expected that, from the point of view of the evolution of the current situation, there will be any substantial changes in the state of the environment that would justify a different analysis from the characterization of the current situation now carried out.

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 METHODOLOGY AND EVALUATION CRITERIA

This chapter presents the identification and assessment of the relevant environmental and social impacts resulting from the construction, operation, and decommissioning phases of the agricultural infrastructure (silos) of the Carrinho, SA ocean terminal.

The impact assessment process is a predictive exercise based on comparing the foreseeable environmental and social effects of the Project, based on knowledge of its characteristics, with the baseline situation of the environment in the study area. The identification of impacts also benefits from existing knowledge about the environmental and social impacts generated by projects similar to the Project under analysis, as well as from the technical team's previous experience in conducting environmental and social impact studies. The prediction of environmental and social impacts allows for the assessment of the environmental and social sustainability of the Project and provides a basis for proposing environmental and social mitigation measures to enhance this sustainability.

Environmental and social impact is understood to mean a change in the current state of the environment that results directly or indirectly from the Project under analysis. Each potential impact identified is assessed in terms of its value, magnitude, and significance.

In addition, and whenever necessary, the assessment of impacts can also be systematized according to the following classification criteria:

- **Signal** - negative, positive, depending on whether the impact degrades, enhances, or does not affect the current state of a given environmental component;
- **Spatial dimension (Incidence)** - local, extended, regional, according to the extent of the area in which the effects of the impact are felt;
- **Probability of occurrence** - certain, probable, improbable, and uncertain. The probability assigned to impacts took into account knowledge of the characteristics of each action and each environmental factor, as well as existing knowledge about the impacts of similar projects;
- **Duration** - temporary or permanent, depending on whether the effects of the impact occur only during a specific and identifiable period of time, or whether they persist indefinitely;

- **Reversibility** - reversible or irreversible, according to the potential for restoring the environmental component to its pre-project situation, either passively (with the cessation of the cause of the impact) or actively (through recovery measures);
- **Time dimension:** immediate, when the impact occurs during or immediately after the action that causes it; medium-term (approximately up to five years) or long-term;
- **Type of occurrence:** direct or indirect, depending on whether they are directly determined by the project or induced by related activities;
- **Magnitude:** low, moderate, or high, depending on the degree of impact on the environmental values in question;
- **Capacity for minimization or compensation:** refers to the measures and actions implemented to reduce the severity of negative impacts caused by a project on the environment;
- **Significance:** insignificant, significant, or very significant. The significance of an impact is considered to be the most important descriptive criterion of the impact, and its degree is influenced by the assessment of all other assessment criteria, with particular emphasis on the magnitude, duration, and reversibility of the impact. The degree of significance attributed to an impact is also influenced by compliance with current legal provisions. Significance thus represents an overall assessment of the importance of the environmental impact produced by the impact.

For the assessment of impacts, and in order to provide an overall picture of them, a classification scale based on the following parameters will be used to calculate the significance of the impact, as illustrated in the table below.

Table 37: Summary of criteria used for impact assessment

Classification criterion	Scale	Value (for calculating the significance of the impact)
Nature (Sign)	Positive (+) or Negative (-)	Not applicable
Incidence	Local/Direct	1
	Extended	2
	Regional/National/International	3
Probability of occurrence	Unlikely	1
	Uncertain	2
	Likely	3
	Certain	4
Duration	Temporary	1
	Permanent	2
Reversibility	Reversible	1
	Irreversible	2
Dimension	Immediate	1
	Medium term	2
	Long term	3
Type of occurrence	Direct or Indirect	Not applicable
Magnitude	Reduced	1
	Moderate	2
	High	3
Significance	Not very significant	1
	Significant	2
	Very significant	5
Minimization or compensation capacity	Minimizable and/or compensable	1
	Not minimizable or compensable	2

The classification regarding the **significance of environmental and social impacts** will be obtained by multiplying the following criteria: Probability (P), Incidence (I), Magnitude (M), and Duration (D), using the following formula.

$$S=P \times I \times M \times D$$

The significance of environmental and social impacts is assigned according to the intervals of the score values on the following scales:

- **Not significant** if the score is between 1 and 11 points;
- **Significant** if the score is higher than 12 and equal to 23 points;
- **Very significant** if the score is equal to or exceeds 24 points;

Table 38: Acronyms used in the impact assessment scale

CRITERIA	SCALE			
Duration	Temporary (T)	Permanent (P)		
Magnitude	Reduced (R)	Moderate (M)	High (H)	
Probability	Uncertain (U)	Unlikely (UNL)	Likely (LIK)	Certain (C)
Occurrence	Indirect (IN)	Direct (DIR)		
Incidence	Local (L)	Extended (E)	Regional (RE)	
Reversibility	Irreversible (IR)	Reversible (RV)		
Nature (Signal)	Positive (+)	Negative (-)		
Capacity minimization or compensation	Minimizable and/or compensable (MC)	Not minimizable or compensable (NMC)		

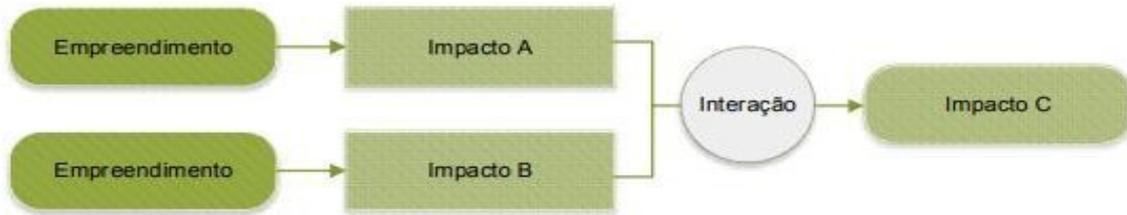
Table 39: Identification of significance according to colors

Not Significant		Negative, not very significant	
Significant		Significant Negative	
Very Significant		Very Significant Negative	

Cumulative: a cumulative environmental impact is derived from the sum of other impacts or chains of impacts that add up, generated by one or more isolated but contiguous projects in the same environmental and social system.

Synergy: refers to the ability of a specific effect to induce a new impact when interacting with another, not necessarily associated with the same project or activity.

Example:



7.2 MAIN ACTIONS AND POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

The main actions that generate negative environmental and social impacts during the construction, operation, and decommissioning phases are identified below (Tables 40, 41, and 42).

It should be noted that the project under evaluation does not involve the displacement of populations.

Table 40: Main project actions generating negative impacts during the construction phase

Main actions generating impacts	Main direct negative impacts
Setup of the construction site and other support areas, including the presence of workers, equipment, and materials	Generation of noise and dust, emission of air pollutants, disturbance to the neighborhood, and risk of work-related accidents
General circulation of vehicles, machinery, and equipment and workers involved in the construction process	Generation of noise and dust, and emission of atmospheric pollutants
Dredging for the construction of the pier	Noise and dust generation, and emission of air pollutants, disturbance of aquatic fauna and flora, risks of environmental contamination
Transport of aggregates to the construction site	Noise and dust generation, and emission of atmospheric pollutants
Cleaning, excavations for opening foundations	Generation of noise and dust, and emission of atmospheric pollutants
Construction of buildings, piers, and assembly of silos	Generation of noise and dust, emission of atmospheric pollutants, disturbance of the neighborhood, and risk of work-related accidents
Demobilization and dismantling of the construction site	Noise and dust generation, emission of pollutants emissions and production of waste
Final cleaning of the site.	Noise and dust generation, emission of pollutants emissions and production of waste

During **the operational phase**, the following actions are considered likely to generate negative impacts on the environment:

Table 41: Main project actions generating negative impacts during the operational phase

Main actions generating impacts	Main direct negative impacts
Operation of facilities and handling of silos	Generation of noise and dust, disturbance to the neighborhood, and risk of work-related accidents
Handling of cereals	Risk of pest proliferation
Circulation of light and heavy vehicles	Noise generation and pollutant emissions atmospheric conditions, and disruption to the surrounding population
Fuel supply	Risks of environmental contamination
Water and electricity consumption and effluent generation	Pressure on urban infrastructure
Operation of generators	Noise and air pollutant emissions
Cleaning, pest control, and facility maintenance	Risks of environmental contamination, waste generation, noise, and atmospheric pollutant emissions
Grain transportation	Pressure on urban infrastructure, noise generation and pollutant emissions, disturbance da population and risks of accidents
Ship traffic and mooring, maintenance dredging of the pier	Generation of noise and dust, and emission of air pollutants, disturbance of aquatic fauna and flora, risks of environmental contamination

During **the decommissioning phase**, the following actions are considered likely to have an impact on the environment:

Table 42: Main project actions generating negative impacts during the decommissioning phase

Main actions generating impacts	Main direct negative impacts
Demolition of infrastructure and removal of silos and other equipment	Generation of noise, dust, and atmospheric pollutant emissions; risks of work-related accidents
Demobilization and dismantling of support areas	Noise, dust, and air pollution, work-related accident risks, environmental contamination risks, disturbance of terrestrial and marine fauna and flora
Permanent decommissioning of facilities	Decrease in the employment rate and standard of living of the population, and decline in the local socio-economy, etc.
Final cleaning	Noise and dust generation, emission of pollutants emissions and production of waste

The actions resulting from the construction, operation, and decommissioning of agricultural silo infrastructure may have not only negative but also positive environmental and social impacts, assessed according to the classification criteria identified in section 7.1. These will have an impact on the following descriptors:

7.3 CLIMATE

7.3.1 Construction phase

Change in evapotranspiration and temperature at ground level

During the construction phase, the project is not expected to cause significant changes in the microclimate, particularly in the vicinity of the intervention area, since the project site has already undergone changes in terrain morphology and removal of existing vegetation in the area.

During the construction phase, actions related to excavation and soil waterproofing for the construction of the pier and areas for the assembly of silos may have an impact on evapotranspiration and ground temperature.

This is considered to be a negative, reduced magnitude, direct, probable, local, temporary, reversible, and insignificant.

7.3.2 Operation Phase

Increased perception of heat discomfort

During the operation phase, actions resulting from the waterproofing of surfaces and the installation of equipment and buildings will temporarily alter the conditions of solar radiation absorption and reflection, as well as air circulation, contributing to an increase in the perception of heat discomfort.

The impacts on the climate, although negative, will be of reduced magnitude and will be indirect, unlikely, local, permanent, irreversible, and insignificant.

7.3.3 Decommissioning phase

Changes in evapotranspiration and ground-level temperature

During this phase, changes may occur, mainly after the decommissioning work has been completed. However, changes in evapotranspiration and ground-level temperature may be observed.

These are positive impacts, of reduced magnitude, direct, probable, local, permanent or temporary, reversible, and insignificant.

7.4 LOCAL GEOLOGY AND GEOMORPHOLOGY

7.4.1 Construction phase

Change in local geomorphology

During the construction phase, actions likely to cause impacts on the geological and geomorphological environment are related to earthmoving, land levelling, excavation for foundations, and seabed dredging. These actions will be necessary for the construction of the pier, areas for the assembly of silos, accesses, parking lots, and other buildings. These actions will have an impact on the local geomorphology (topography).

Analysis of geological maps and local observation have shown that no geological structures of particular scientific or heritage interest will be destroyed or affected.

The impacts on this descriptor, although negative, will be of reduced magnitude, direct, irreversible, certain, local, permanent, and insignificant.

7.4.2 Operation phase

Change in local geomorphology

In general, for geology and geomorphology, the impacts that occurred during the construction phase will continue, and the impacts resulting from the artificialization of the landforms due to the presence of the ocean terminal will still be noticeable at this stage.

The impact generated is considered to be negative, direct, uncertain, local, irreversible, permanent, of reduced magnitude, and insignificant.

7.4.3 Decommissioning phase

Change in local geomorphology

During this phase, there may be changes in the artificialization of the relief and excavations in the substrate where the structural foundations are laid.

Assuming that during the decommissioning phase all equipment and infrastructure will be removed and buildings may be demolished, the activities generating environmental impacts on geology and geomorphology will be equivalent to those mentioned for the construction phase, namely, upheaval, earthworks, and other maintenance, supply, and possible repair of equipment and demolition vehicles.

However, the impact will always be less than that to date. Thus, as with the description of impacts for the construction phase, the impacts are expected to be negative, direct, temporary, local, immediate, and irreversible, but are considered to be insignificant.

7.5 SOILS

7.5.1 Construction phase

Compaction, contamination, and soil erosion

The impact on soils will occur during the construction phase, as a result of the removal or stripping of the topsoil layer, approximately 20 to 30 cm thick, as part of the preliminary ground modeling activities for the installation of the embankment.

This intervention will involve the removal of soil from the area in question, but does not necessarily mean that it will be unusable, as it can be reused in another area, including in the landfill project itself, provided that it has the necessary technical properties.

The soil in the implementation area, consisting mainly of sand, is, from an agronomic point of view, very poor in nutrients and has low moisture retention capacity. It is soil with a very simple morphological structure and very limited or no agricultural suitability, and is therefore of no interest for agricultural purposes.

During the construction phase, consideration should also be given to the possible compaction, contamination, and erosion of the soil affected by the project area, resulting from the movement of heavy machinery, maintenance of equipment and machinery, and the installation of the construction site.

In general, the impact on local soils is classified as negative, low magnitude, direct, probable (contamination, erosion) and certain (soil compaction), local, temporary (contamination, erosion) and permanent (compaction), reversible and insignificant.

7.5.2 Operation phase

Soil compaction

During the project's operational phase, the main impacts are related to the area occupied by the ocean grain terminal infrastructure, which may be subject to soil compaction due to vehicle and pedestrian traffic.

Therefore, impacts on the soil are expected during this phase and are classified as negative, direct, localized, irreversible, permanent, uncertain, of reduced magnitude, and insignificant.

Accidental contamination

During the project's operational phase, the main impacts are related to the area occupied by the grain terminal infrastructure and unpaved areas exposed to the risk of spills (fuel and oil leaks) and wastewater.

Therefore, impacts on soil are expected during this phase and are classified as negative, direct, localized, reversible, temporary, probable, of reduced magnitude, and insignificant.

7.5.3 Decommissioning phase

Soil compaction, contamination, and erosion

At this stage, erosion of exposed soils, soil compaction, and removal or alteration of soil at the site may cause an impact.

However, these are negative impacts of reduced magnitude, direct, probable, local, temporary, reversible, immediate, and insignificant.

During site restoration, the return of the soil to its undisturbed state is a positive impact, of reduced magnitude, direct, probable, local, permanent, reversible, medium and long term, and insignificant.

7.6 LAND USE

7.6.1 Construction phase

Change in land use

During the construction phase, the impacts on this descriptor stem mainly from the occupation of the land by the construction site and the installation of the ocean terminal structures and silo infrastructure. Industrial occupation will result in the disturbance, alteration, and loss of current land use.

These impacts are considered negative, of reduced magnitude, direct, temporary, certain, reversible, local, and insignificant.

7.6.2 Operation Phase

Change in land use

In this phase, it is considered that the occupation of land by the ocean terminal infrastructure will induce negative impacts that are minor in magnitude, direct, certain, local, permanent, irreversible, and significant.

7.6.3 Decommissioning Phase

Change in land use

In this phase, after the decommissioning of the infrastructure, the area may return to its natural state prior to the implementation of the terminal. However, soil compaction and removal or alteration of the soil at the site may cause an impact.

However, these are negative impacts of reduced magnitude that are direct, probable, local, temporary, reversible, and insignificant.

During site restoration, the return of the soil to its undisturbed state is a positive impact, of reduced magnitude, direct, probable, local, permanent, reversible, medium and long term, and insignificant.

7.7 WATER RESOURCES

7.7.1 Construction phase

Contamination of surface water

Given that the project area, located on the coastline, does not interfere with any permanent or intermittent watercourse, the project has no impact on surface water resources.

Groundwater contamination

Similarly, with regard to groundwater, since the project does not interfere with the subsoil, and in fact the embankment to be constructed will isolate the surface, waterproofing the local soil, no interference or risk of groundwater contamination is anticipated. Furthermore, the proximity to the coastline and the low altitude, practically at sea level, mean that there are no exploitable groundwater resources at the project site.

Change in the quality of marine waters and marine sediments

During the construction phase, this change is the result of surface drainage of rainwater that carries sediments into the sea, as well as dredging to raise the level for the construction of the pier, which will essentially result in seawater turbidity (increase in solid particles suspended in the water) and risks of contamination due to accidental spills.

This is a negative impact, ranging from minor to moderate in magnitude, but considered to be insignificant overall, given its temporary and reversible nature, uncertainty, widespread nature, and insignificance. It can also be minimized through

care taken in carrying out the work, as well as in the selection of dredging equipment.

The effluents generated at the ocean terminal will be domestic and industrial in nature. After being collected and treated, they will be discharged into the receiving environment. In the absence of *on-site* treatment conditions, they should be sent to a specialized unit for proper treatment and final disposal.

In the event of ruptures or failures in the transport and treatment of effluents, and if they are discharged into watercourses or infiltrate the underground water environment without the guarantee of minimum quality, causing its contamination, negative, uncertain, localized, temporary, reversible, immediate, direct, ranging from low to high magnitude and from insignificant to very significant, depending essentially on the duration, volume, and type of effluent discharged.

Change in coastal dynamics

The construction of buildings and dredging are not expected to cause significant changes in coastal dynamics, since the area has already undergone dredging processes during the construction of neighboring developments (mining port and cement factory) and the port of Lobito.

However, any negative impacts are likely to be minor, indirect, unlikely, local, temporary, irreversible, and insignificant.

7.7.2 Operational phase

Contamination of surface waters

Given that the project area, located on the coastline, does not interfere with any permanent or intermittent watercourse, the project has no impact on surface water resources.

Groundwater contamination

Similarly, for groundwater, since the project does not interfere with the subsoil, and in fact the embankment to be constructed will isolate the surface, waterproofing the local soil, no interference or risk of groundwater contamination is anticipated.

Furthermore, the proximity of the coastline and the low altitude, practically at sea level, mean that there are no exploitable groundwater resources at the project site.

Change in the Quality of Marine Waters and Marine Sediments

Changes in the quality of marine waters and sediments may also occur during the project's **operational phase**, due to the operation of the pier and the consequent presence of ships in the area.

The movement and mooring of ships will pose risks related to accidental spills of hazardous and polluting substances (fuels, lubricating oils, domestic and industrial effluents), including the operation of equipment assigned to the terminal.

The adoption of the necessary and appropriate environmental management measures during the works will reduce the magnitude and significance of any such impact.

On the other hand, with regard to dredging activities, the impacts of the operational phase can be described in general terms as a prolongation of the impacts generated during the construction phase, although less pronounced, given the smaller scale of the maintenance dredging required at this stage.

These impacts can be classified as negative, direct, reversible, uncertain, temporary, widespread, cumulative, moderate in magnitude, and of little significance.

Change in coastal dynamics

Maintenance dredging activities are not expected to cause significant changes in coastal dynamics, as they will be infrequent.

However, any negative impacts will be minor, indirect, unlikely, local, permanent, irreversible, and insignificant.

7.7.3 Decommissioning phase

Contamination of surface and groundwater

Given that the project area, located on the coastline, does not interfere with any permanent or intermittent watercourse, the project has no impact on surface water resources

are non-existent.

Contamination of groundwater

Similarly, with regard to groundwater, since the project does not interfere with the subsoil, and in fact the embankment to be constructed will isolate the surface, waterproofing the local soil, no interference or risk of groundwater contamination is anticipated. Furthermore, the proximity of the coastline and the low altitude, practically at sea level, mean that there are no exploitable groundwater resources at the project site.

Change in the Quality of Marine Waters and Marine Sediments

At this stage, impacts may occur due to spills of products such as fuel, oils, and wastewater effluents during the dismantling of equipment, which may affect groundwater quality. However, this is unlikely to happen, as the equipment will only be dismantled after it has been emptied. In the event of an occurrence, there will be negative impacts of reduced magnitude, direct, probable, local, temporary, reversible, and insignificant.

A gradual return to undisturbed surface water drainage patterns may also be observed.

These are positive impacts, of reduced magnitude, direct, probable, local, temporary, reversible, and insignificant.

7.8 FLORA

7.8.1 Construction phase

Disturbance and destruction of terrestrial flora

The terrestrial flora in the area where the ocean grain terminal will be built in Lobito Bay is relatively scarce and unrepresentative, as it is an area that has already been developed, with infrastructure, access roads, paved areas, and artificial surfaces. The existing vegetation is essentially ruderal or spontaneous, consisting of herbaceous and shrubby species adapted to disturbed environments, with low ecological sensitivity and reduced floristic value.

However, during the construction phase, occasional removal of this residual vegetation may occur, associated with land clearing, site installation, machine traffic, and material storage.

This impact will be negative, direct, of reduced magnitude, reversible, certain, localized, temporary, and insignificant, since the existing vegetation has no relevant ecological importance or significant functions in supporting local biodiversity.

These impacts may be offset by the creation of new green areas and tree plantations with species from the region, along road accesses and through the implementation of a landscape recovery plan for temporarily affected areas (such as construction sites and surrounding areas).

No vegetation of conservation importance (e.g., mangrove patches) was detected in the ADA coastal zone.

Disturbance and destruction of marine flora

The construction of the ocean grain terminal in Lobito Bay, involving dredging activities, could have significant impacts on **local marine flora**, especially on benthic communities and underwater vegetation such as marine phanerogams (e.g., seagrasses), macroalgae, and sedimentary microflora. Direct disturbance will occur in areas where sediment will be removed from the seabed, resulting in the physical destruction of the habitats of these species, which play an essential role in stabilizing the seabed, oxygenating the water, and supporting local biodiversity. However, the fact that the area has already been dredged as part of the construction of neighboring infrastructure (e.g., the mining port) may mitigate the significance of the impacts.

In addition to physical removal, dredging may cause increased water turbidity, reducing sunlight penetration, which impairs photosynthesis and may compromise the survival of aquatic plants in areas adjacent to the intervention zone. Suspended sedimentation may also settle on nearby vegetated areas, suffocating vegetation and negatively impacting the natural regeneration of marine flora.

This impact is generally negative, direct, certain, and of moderate magnitude, localized, temporary, and potentially irreversible in some areas if mitigation measures are not taken, and significant. Therefore, it is crucial to implement environmental management strategies

strategies, such as precise delimitation of the dredging area, monitoring of turbidity, and possible transplantation of sensitive marine vegetation, when possible.

The recovery of seagrass communities after dredging can take anywhere from 2 to 4 years, several decades, or may never occur, depending on the species present and the possibility of a return to previous environmental conditions in the seawater (Erfemeijer & Lewis, 2006).

Contamination risks

Accidental spills of hydrocarbons or effluents during the construction of the Lobito ocean grain terminal pose a significant environmental risk, especially in sensitive environments such as marine and coastal ecosystems. The release of these pollutants can cause direct contamination of water and sediments, negatively affecting the environmental quality of the bay. The presence of toxic compounds in hydrocarbons can interfere with natural biological and chemical processes, compromising the balance of aquatic habitats.

Marine flora, especially algae communities and seagrasses, can suffer immediate adverse effects, such as reduced photosynthesis due to the formation of a surface layer of oil, suffocation of roots and plant tissues, and changes in the chemical composition of the water. The degradation or death of these plant communities has cascading effects on the entire ecological chain, affecting associated fauna and compromising the ecosystem services they provide, such as shelter, food, and protection against coastal erosion.

On land, vegetation exposed to spills can also suffer soil contamination, impacting its health and development. In addition, there are indirect risks to terrestrial and marine fauna, including fish, mollusks, crustaceans, and coastal birds, which may ingest or come into contact with pollutants. The impact is considered negative, direct, of variable magnitude (depending on volume and response), potentially temporary, reversible only in the long term, uncertain, localized, and significant.

The implementation of strict preventive measures and effective contingency plans is essential to reduce the likelihood and severity of such events.

7.8.2 Operation phase

Disruption and destruction of terrestrial flora

During the operational phase, the impacts caused during the construction phase will continue, namely in terms of the destruction of vegetation cover and the emission of particulate matter from the circulation of machinery and vehicles assigned to the facilities, with effects on the surrounding flora. Given the specific and localized nature of these interventions and the type of vegetation that will be present in these locations during the operational phase, it is expected that the impacts associated with the direct destruction and degradation of habitats in the surrounding areas will be much lower than those observed during the construction phase. These impacts are considered to be negative, direct or indirect, of low magnitude, localized, permanent, probable, reversible, temporary, and insignificant.

Disturbance and destruction of marine flora

Maintenance dredging during the operational phase of the Lobito ocean grain terminal is necessary to ensure adequate depth for safe navigation of vessels. However, this operation represents a significant source of environmental impact, especially for marine flora and other ecological communities. The constant movement and removal of sediments from the seabed can cause the resuspension of fine particles and accumulated contaminants, increasing water turbidity levels and reducing light penetration, which directly affects the photosynthesis of submerged plant communities.

Marine flora, especially benthic algae and possible seagrass beds, can be impacted by burial, abrasion, and direct destruction of vegetative structures due to the mechanical action of dredging equipment. The natural recovery of these organisms can be slow or limited, depending on the frequency of dredging and the physical and chemical characteristics of the local environment. The loss of marine vegetation also compromises the stability of the substrate, which can increase erosion and negatively affect other forms of marine life that depend on these plants for shelter and food.

In addition to flora, other ecological communities, such as plankton, mollusks, crustaceans, and bottom-dwelling fish, may also be affected by changes in water quality and habitat caused by continuous dredging. The cumulative effects over time can result in changes in the composition and abundance of local species, impacting biodiversity and the balance of the ecosystem. It is therefore essential that maintenance dredging be preceded by an environmental monitoring plan and accompanied by good operational practices to minimize the ecological impacts of this essential activity.

The impacts are considered negative, uncertain, direct, permanent, widespread, irreversible, minimizable (which may involve confirming the presence of the seagrass community, mapping, avoiding impact if possible, monitoring sediment plumes, and transplants), moderate in magnitude, and significant.

The reassessment of this impact depends on the results of the seagrass habitat characterization study, which should be developed during the construction phase, allowing for a more in-depth assessment of this impact.

Contamination risks

During the operational phase of the Lobito terminal, accidental spills of hydrocarbons or effluents represent a significant risk to the environment. These events may occur during the supply of vessels or the handling of equipment and products, negatively affecting marine flora by reducing light penetration and compromising processes such as photosynthesis. Algae, phanerogams, and other aquatic organisms may suffocate or die, causing ecological imbalances that affect the entire marine food chain.

In the terrestrial environment, even though vegetation is not very significant in the project area, any spills could aggravate soil degradation and impact small remaining plant species. In addition, these contaminants can infiltrate and reach groundwater, increasing environmental and public health risks. Such impacts reinforce the need for an effective environmental management system, with contingency plans and preventive measures to minimize the effects of possible accidents.

The impact is considered negative, direct, moderate in magnitude (depending on volume and response), potentially temporary, reversible only in the long term, uncertain, widespread, and significant.

7.8.3 Decommissioning phase

Disruption and destruction of flora

In the decommissioning phase, the expected impacts are similar to those of the construction phase, in that most of the actions are similar in nature, not involving the construction or implementation of infrastructure, but rather its demolition or dismantling.

However, given that the areas to be intervened will already be devoid of vegetation, the expected impacts are assessed as less significant compared to the construction phase. Thus, the impacts on flora and vegetation at this stage are assessed as negative, direct, local, temporary, immediate, certain, reversible (if a landscape recovery plan appropriate to the area in question is implemented), of reduced magnitude, minimizable (if the limits of the intervention area are respected, without occupying surrounding areas and using existing accesses) and insignificant.

As in the construction phase, actions involving the movement of earth and other materials, and the circulation of vehicles and heavy machinery on unpaved access roads, will result in the dispersion of dust which, when deposited on the surrounding vegetation, may affect its development. This impact is assessed as negative, direct, temporary, local, immediate, probable, reversible, of reduced magnitude, minimizable, and insignificant.

Also at this stage, there may be an increased likelihood of the establishment and spread of invasive alien species, with possible adverse effects on ecosystems. If this occurs, the impact is assessed as negative, probable, indirect, permanent, regional, medium-term, reversible (but difficult to implement), minimizable, moderate in magnitude, and significant.

The last action in this phase will be the implementation of a redevelopment plan, which includes the renaturalization of the affected areas after the land has been cleared. These actions will reverse the negative effects observed in the previous phases, as their impacts are assessed as: positive, certain, direct, permanent, local, long-term, reversible, of reduced magnitude, and insignificant.

At this stage, the local flora may also recover, which translates into a gradual return to an undisturbed state after decommissioning work. These are positive impacts, of reduced magnitude, which are direct, certain, local, temporary, reversible, immediate, and insignificant.

7.9 FAUNA

7.9.1 Construction phase

Scare away terrestrial and marine fauna

During the construction phase of the Lobito grain terminal, the continuous presence of heavy machinery, intense noise, vibrations, and human movement may cause the temporary scaring away of terrestrial and marine fauna. This impact results from changes to the natural habitat, leading many species to abandon the area in search of quieter and safer environments. In the terrestrial environment, small mammals, birds, and reptiles that may still occupy the area may be forced to migrate, temporarily reducing local biodiversity.

In the marine environment, species such as fish, mollusks, and crustaceans may be driven away due to water turbidity caused by dredging, increased underwater noise, and the presence of vessels. Marine mammals and turtles, if present in the region, may also avoid the intervention area, interfering with feeding or breeding routes.

Although the impact is largely reversible and temporary in nature, it is considered negative, of reduced magnitude, direct, certain, local, reversible, temporary, immediate, and insignificant, requiring the adoption of management measures to minimize disturbances and allow for the subsequent recovery of local fauna.

Disturbance and destruction of habitats and individuals (mollusks, crustaceans, other invertebrates, and fish)

The construction of the Lobito grain terminal, especially due to dredging, excavation, and underwater foundation installation activities, as well as accidental spills, may result in the destruction of benthic habitats and the physical removal of marine organisms such as mollusks, crustaceans, echinoderms, and other sessile or reduced mobility species. These habitats, often rich in biodiversity, function as feeding, breeding, and sheltering areas and are essential for the maintenance of coastal ecosystems.

The direct destruction of these habitats leads to the death of organisms that are unable to move to safe areas, causing a local reduction in biodiversity and altering the food chain. In addition, increased water turbidity and the deposition of suspended sediments can negatively impact filter feeders and affect the quality of adjacent habitats, extending the impacts beyond the immediate intervention area.

This impact is considered negative, direct, localized, moderate to high in magnitude, and with the potential to be permanent, irreversible, probable, and very significant if

adopted. Such measures may include prior mapping of sensitive areas, relocation of species, and environmental recovery of impacted areas after completion of the works.

Disruption of fish migration patterns

The construction of the Lobito grain terminal, particularly the dredging and installation of underwater structures, may cause significant disruption to fish migration patterns, especially for species that use coastal routes for reproduction, feeding, or refuge. Increased water turbidity, continuous underwater noise, and vibrations from construction equipment interfere with fish sensory mechanisms, such as visual and auditory orientation, making navigation difficult.

In addition, temporary physical barriers formed by vessels or construction support structures can limit access to essential habitats, forcing migratory species to alter their routes, which can lead to increased energy expenditure, stress, and even reproductive failure. This impact is classified as negative, direct, temporary, uncertain, widespread, insignificant (but with significant potential, especially if it coincides with critical migration periods).

Therefore, it is recommended that the most intrusive activities be planned outside migration seasons and that fish fauna be continuously monitored to mitigate these effects and ensure the conservation of the affected species.

Roadkill and/or death of species

During the construction phase of the Lobito grain terminal infrastructure, the impact related to the running over and/or death of terrestrial fauna may occur due to regular heavy vehicle traffic, maintenance equipment, and increased human movement in the area, contributing to the ongoing risk of collisions with wild animals, especially in access zones, internal roads, and adjacent areas with little urbanization.

This impact mainly affects small and medium-sized species, such as reptiles, amphibians, and terrestrial mammals that are nocturnal or slow-moving.

These impacts are considered negative, direct, of reduced magnitude, local, probable, reversible and irreversible (in the case of species death), temporary, minimizable, and insignificant.

Barrier effect on species circulation

The barrier effect during the construction of the grain terminal in Lobito Bay refers to the physical and ecological disruption of natural flows, both marine and terrestrial, caused by temporary or permanent works and structures (bridges, shipyards, construction platforms). In the marine environment, this effect can interfere with the circulation of water masses, modify local currents, and impair habitat connectivity, especially for species that depend on regular movements for feeding, reproduction, or migration.

For aquatic fauna, particularly migratory fish, the barrier effect can mean difficulty or impediment in accessing areas essential to their life cycle. In the terrestrial environment, this impact can affect small and medium-sized species, which avoid crossing areas of intense human activity, noise, or artificial lighting, causing habitat fragmentation and possible changes in movement patterns.

This impact is classified as negative, direct, low magnitude, temporary, reversible, uncertain, localized, and insignificant, depending on the duration and intensity of the works. Its severity can be mitigated by careful planning of the construction phases, installation of ecological passages or corridors (where applicable), and minimization of physical barriers and sources of disturbance during critical periods for local fauna.

7.9.2 Operation phase

Scare away terrestrial and marine fauna

During the operational phase of the Lobito grain terminal, the displacement of terrestrial and marine fauna may occur mainly due to the continuous presence of human activities, noise, artificial night lighting, vessel traffic, and cargo handling. Marine fauna, such as turtles and some fish species, may avoid areas close to the pier

due to increased underwater noise and changes in habitat conditions. This displacement may disrupt the natural feeding, reproduction, or migration patterns of these species.

In the terrestrial environment, although fauna is less abundant due to the previous presence of infrastructure, animals such as reptiles, small mammals, and birds may continue to avoid the operational area due to constant movement, noise, and light activity. This may result in habitat fragmentation or reduced use of areas adjacent to the terminal.

This impact is generally negative, direct, permanent, moderate in magnitude, uncertain, widespread, and significant. It can be mitigated with measures such as noise control, minimization of unnecessary night lighting, creation of visual barriers, and monitoring of local fauna to evaluate and adapt mitigation actions. These measures help reduce disturbance to biodiversity and promote greater compatibility between terminal operations and the environment.

Disturbance and destruction of habitats and individuals (mollusks, crustaceans, other invertebrates, and fish)

During the operational phase of the Lobito grain terminal, the impact related to the destruction of marine habitats and individuals tends to be less pronounced than during the construction phase, but it can still occur, especially if good environmental practices are not adopted. The constant movement of vessels, mooring and maneuvering at the quay, as well as any maintenance dredging operations, may continue to disturb the seabed, causing sediment resettlement and physical changes to the benthic habitat.

In addition, accidental discharge of effluents, oily water, or solid waste can degrade water quality, affecting filter feeders, corals, sponges, mollusks, and other sessile or slow-moving organisms, resulting in direct mortality or reduced biodiversity in areas near the operation. Sensitive species may abandon the terminal's area of influence, reducing the resilience of the local ecosystem.

This impact can be classified as negative, direct, temporary and permanent, moderate in magnitude, widespread, uncertain, partially reversible, and significant, depending on the frequency and magnitude of the disturbances. Its reversibility is limited, especially for

more sensitive habitats, such as seaweed beds or breeding areas. Mitigation requires continuous environmental monitoring, strict effluent control, contingency plans for spills, and, where possible, the creation of buffer zones or artificial reefs to promote ecological recovery.

Disruption of fish migration patterns

During the operational phase of the Lobito grain terminal, significant disruption to fish migration patterns may continue to occur, particularly due to constant vessel traffic, the presence of fixed structures such as piers and jetties, and maintenance dredging activities that periodically remobilize sediments and alter the physical and chemical characteristics of the water.

These changes in the marine environment can act as physical or behavioral barriers, disorienting schools and migratory species that use coastal routes for reproduction, feeding, or growth. Underwater noise pollution generated by engines and operations can also interfere with the navigation and communication systems of sensitive species such as tuna, sardines, and some pelagic fish species.

The impact is considered negative, direct, permanent, and partially irreversible, with reduced, uncertain, widespread, and significant magnitude, depending on the frequency and intensity of operational activities. Mitigation requires ichthyological monitoring, temporary exclusion zones, noise control, and adjustment of operational windows to minimize interference during critical migration periods.

Running over and/or death of species

During the operational phase of the Lobito grain terminal infrastructure, the impact related to the running over and/or death of terrestrial fauna may continue to occur, although to a lesser extent than during the construction phase. Regular traffic of heavy vehicles, maintenance equipment, and increased human movement in the area contribute to the ongoing risk of collisions with wild animals, especially in access zones, internal roads, and adjacent areas with little urbanization.

This impact mainly affects small and medium-sized species, such as reptiles, amphibians, and terrestrial mammals that are nocturnal or slow-moving. The reduction of natural habitats and the fragmentation of remaining green areas near infrastructure also increase the likelihood of interactions between wildlife and transportation, intensifying this risk.

The impact is considered negative, direct, permanent, irreversible, and partially reversible, with reduced magnitude depending on traffic frequency and mitigation measures implemented, uncertain, local, and insignificant. Strategies such as adequate signage, physical barriers, wildlife crossings, speed control, and worker awareness are recommended to minimize these effects and contribute to the protection of local biodiversity.

Barrier effect on species movement

During the operational phase of the Lobito grain terminal infrastructure, the barrier effect continues to be a significant environmental impact. This effect results from the permanent presence of physical structures such as piers, breakwaters, moored vessels, and other port facilities, which can modify the natural flow of marine species and the ecological connectivity between different areas of the bay.

The barrier effect can hinder the movement of marine organisms, especially migratory species or those with coastal habits that depend on free movement for feeding, reproduction, or shelter. In addition, these structures can alter local currents, redirecting sediments and affecting water quality in nearby areas, which can negatively influence sensitive habitats and biological communities.

This impact is generally classified as negative, direct, permanent, and partially reversible, with reduced magnitude depending on the scale of the infrastructure and the intensity of port activities, uncertain, local, and insignificant. Mitigation measures include continuous monitoring of biodiversity, hydrodynamic assessments, and, if feasible, the ecological design of structures to allow the passage and permanence of species, contributing to the maintenance of the ecological connectivity of the coastal zone.

7.9.3 Decommissioning phase

Displacement of terrestrial and marine fauna

Decommissioning will involve the use of heavy machinery, removal of structures, and a temporary increase in noise and human activity, which may cause the temporary scaring away of local fauna. This impact is direct, short-lived, and moderate in magnitude, affecting especially species that are sensitive to human presence and noise disturbances.

Destruction of marine habitats and individuals

The removal of submerged or anchored infrastructure may cause further degradation of already fragile benthic or coastal habitats. Demobilization may also affect marine organisms present in the area. The impact is direct, localized, and of varying intensity, with the potential to cause irreversible damage to local populations if adequate containment measures are not applied.

Disruption of fish migration patterns

The movement of vessels and equipment during decommissioning may temporarily interfere with the migratory routes of fish species. Although the impact is temporary, it may coincide with critical periods of reproduction or migration, posing a moderate and indirect risk to the population dynamics of certain species.

Barrier effect on species circulation

During the removal of physical structures, there may be a momentary change in local hydrodynamics, acting as a "reverse barrier effect," i.e., the progressive elimination of obstructions may cause temporary instability in the marine environment. This impact is generally short-lived, indirect, and reversible.

Running over and/or killing of terrestrial fauna

During the demobilization phase, increased traffic of vehicles and heavy machinery may increase the risk of running over terrestrial species that inhabit or circulate in adjacent areas. The impact is direct but temporary and of low magnitude, and can be mitigated by simple traffic control and environmental surveillance measures.

During this phase, species may be scared away by the noise during demolition. In any case, the impacts generated will be negative, moderate in magnitude, direct, certain, local, temporary, reversible, immediate, but not very significant.

At this stage, after decommissioning work, there may also be a gradual return of fauna to an undisturbed state. These impacts are positive, of low magnitude, direct, probable, local, temporary, reversible, and insignificant.

7.10 LANDSCAPE

7.10.1 Construction phase

Landscape change

During the construction phase, changes resulting from construction activities (earthworks and the movement of vehicles, machinery, and workers) will have visual and landscape impacts and will be felt most significantly in nearby population centers and along transportation routes.

This phase will be characterized mainly by the spatial and functional disorganization of the intervened territory and by the visual intrusion of a new element in the landscape that will affect not only the area surrounding the ocean terminal infrastructure, but also its entire surroundings. The changes in land use in the construction site and earth storage areas, together with the modification of the morphological characteristics of the terrain, are the most important factors in altering the perception and scenic value of the landscape. Although the size and location of the construction sites are unknown, it is foreseeable that their implementation will cause visual and landscape impacts resulting mainly from the intrusion of foreign elements that stand out in the landscape.

In terms of vegetation cover and relief, there will be no major impacts, as the area has already undergone previous interventions that have affected these elements.

The movement of machinery will, in itself, constitute a factor of visual intrusion and may also contribute to reduced visibility in the area surrounding unpaved roads, as a result of increased dust concentration in the air.

The deposits of surplus soil, which are expected to result from excess land, will cause impacts that, although occurring during the construction phase, will also continue during the operational phase, albeit to a lesser extent and significance, if the planned mitigation measures are adopted.

The impacts identified will be temporary and can be mitigated. In fact, these disturbances can be mitigated through a number of preventive measures, avoiding the disturbance of unnecessary areas during the construction of the infrastructure, contributing to a rapid and effective recovery of the landscape after completion of the works.

During the construction phase, the impacts on the landscape are considered to be negative, of moderate magnitude, direct, certain, temporary, widespread, reversible, and significant.

7.10.2 Operation phase

Landscape change

During the exploration phase, the impacts felt during the construction phase relating to functional and visual changes to the landscape will continue during the operational phase, when the landscape will adapt to the new reality, i.e., to the presence of the ocean terminal infrastructure in a semi-natural, topographically flattened area with a significant visual basin due to its proximity to internal communication routes and industrial areas, as well as residential areas, namely the Lobito sandbar and the Morro Quileva neighborhood.

The visual presence of the ocean terminal infrastructure will contrast with the landscape, causing negative impacts of moderate magnitude that are direct, certain, widespread, permanent, irreversible, and insignificant.

The fact that it is located in an area that is strategically important for industrial development, and the presence of other companies in the area, will mitigate the visual impact on the landscape to a certain extent.

7.10.3 Decommissioning phase

Landscape change

During this phase, there may be a visual impact during the decommissioning of the grain terminal, a change in the character of the landscape, and if abandoned, it may result in possible misuse and vandalism of the infrastructure.

These are considered to be negative impacts on the landscape of low and high magnitude (in the case of abandonment), direct, certain, local, temporary, and permanent (in the case of abandonment), reversible, immediate, and insignificant.

However, during the recovery of the landscape, a gradual return of the landscape to its undisturbed state can be observed.

These are positive impacts, of low magnitude, direct, probable, local, temporary, reversible, and insignificant.

7.11 AIR QUALITY

7.11.1 Construction phase

Emissions of pollutants and particulate matter

During the construction of the Ocean Terminal, the following activities may have an impact on air quality: stripping and cleaning of the land; movement of materials and earth (landfills and excavations); circulation of machinery and equipment, vehicles and workers, dredging, welding, etc.

The movement of machine wheels and heavy vehicles on unpaved roads is the main factor responsible for the emission of particulate matter into the atmosphere during the construction phase. Particles with an aerodynamic diameter of less than 10 μm (PM10) are the most harmful because they penetrate the respiratory system, and the finest ones, with a diameter of less than 2.5 μm (PM2.5), can reach the pulmonary alveoli and interfere with gas exchange. Chronic exposure to particles contributes to the risk of developing respiratory and cardiovascular diseases, as well as lung cancer.

Suspended particles are also an effective transport vehicle for other atmospheric pollutants that attach themselves to their surface, especially hydrocarbons and heavy metals. These substances are often transported to the lungs where they can then be absorbed into the blood and tissues.

Short-term effects include irritation, neurophysiological dysfunction, and respiratory problems. Long-term effects can cause damage to lung tissue and ultimately lead to lung cancer.

The effects of particles on the environment also include changes in plant productivity. It should be noted, however, that the particle size of TSP is mostly greater than the fraction considered inhalable (PM with a diameter of less than 10 µm).

Particles with a diameter greater than 100 µm, with average wind speeds of 16 km/h, are deposited at distances between 6 and 9 m, while particles with a diameter between 20 and 100 µm are deposited at distances of tens of meters, depending on atmospheric conditions (USEPA, 2006).

The installation and use of the construction site, namely the operation of equipment such as concrete mixers, rollers, excavators, construction support vehicles, and generators, will cause an increase in particle and gas emissions resulting from combustion processes, such as nitrogen oxides (NOX), carbon monoxide (CO), sulfur dioxide (SO₂), non-methane volatile organic compounds (NMVOCs), heavy metals, among others.

Table 43: Main atmospheric pollutants emitted during the construction phase

Project Actions	Main Pollutants
Material Handling	Suspended Particles
Excavations	Suspended Particles
Dredging	Suspended Particles
Vehicle and Machinery Traffic	Suspended Particles, CO, NO _x , SO ₂ , and VOCs
Wind Erosion	Suspended Particles

Emissions depend on the state of repair, technical characteristics and performance, maintenance activities carried out, as well as the quantity and frequency of equipment used.

In view of the above, it can be concluded that the impacts on air quality resulting from the construction phase of the project can be classified as negative, direct, albeit temporary, reversible, moderate in magnitude, and insignificant.

7.11.2 Operational phase

Emissions of pollutants and particulate matter

During the project's operational phase, actions likely to cause changes in air quality are due to new sources of pollutants originating from the operations taking place, namely the movement of heavy vehicles accessing the infrastructure, the loading and unloading of grain, the movement of machinery associated with grain handling, heavy and light vehicle traffic, fuel supply and operation of electric generators, mooring and movement of vessels, etc.

Air pollutants are usually divided into three broad categories: greenhouse gases (GHGs), eutrophication and acidifying substances, and tropospheric ozone precursor substances.

The main eutrophication and acidifying gases resulting from anthropogenic activity are sulfur dioxide (SO₂), nitrogen oxides (NO_x), ammonia (NH₃), and particulate matter (PM).

In high concentrations, these gases can cause damage not only to human health and cultural heritage, but also to the environment, contributing to the degradation of ecosystems and the eutrophication and acidification of soil and water.

The precursor substances of tropospheric ozone include polluting gases such as nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO), and methane (CH₄). Ozone can cause health problems in humans, particularly affecting the respiratory system, even at low concentrations and after short-term exposure, with the most vulnerable groups such as children, the elderly, and people with a history of lung problems being particularly affected.

CO₂, a greenhouse gas (GHG), is a product of combustion and as such is released in exhaust gases. Consequently, both individual transport and road freight contribute to the release of greenhouse gases and contribute to climate change.

The suspended particles released contain small amounts of sulfates, nitrates, metals, and other trace elements, which are also toxic. Nitrogen oxides and suspended particles are the most relevant constituents due to their higher presence in exhaust gases.

Gaseous emissions from heavy goods vehicles powered by diesel, the fuel generally used in freight transport, include carbon dioxide (CO₂), oxygen (O₂), water vapor, nitrogen (N₂), carbon monoxide (CO), nitrogen compounds (NO_x), sulfur compounds (SO_x), and volatile organic compounds (VOCs).

During the operational phase, negative impacts on air quality are expected to be moderate in magnitude, direct, certain, local, permanent, reversible, and significant.

7.11.3 Decommissioning phase

Emissions of pollutants and particulate matter

At this stage, air quality will be negatively impacted by gas emissions (smoke) and dust from the movement of machinery, vehicles, excavations, and equipment in general during decommissioning, as well as possible unpleasant odors. These impacts are considered negative at this stage, but are of low magnitude, direct, probable, local, temporary, reversible, and insignificant.

Once decommissioned, the impacts caused by the infrastructure in terms of this descriptor are reduced. This is a positive impact, of reduced magnitude, direct, certain, local, temporary, reversible, and insignificant.

7.12 SOUND ENVIRONMENT

7.12.1 Construction phase

Increase in noise levels.

The impact on the sound environment during the construction phase of the project will be mainly due to construction works, such as foundation excavations, dredging, equipment assembly, civil construction works, and the movement of heavy vehicles for the transport of materials and equipment.

Some construction operations involve the production of high noise levels, such as the use of certain pneumatic equipment and the noise generated by dredgers in

operation, while others generate lower noise levels, such as the transport of materials.

However, the most significant disturbances will be relatively isolated, limited in time and space, since the work will take place at a minimum distance of 500 m from sensitive receivers.

The noisiest equipment used occasionally in this type of work is expected to produce continuous sound levels in terms of LAeq of around 80 to 90 dB(A) at a distance of approximately 10 to 15 meters from the emission sources.

Taking into account the propagation of noise over distance, this value is expected to decrease to a range of 62 to 65 dB(A) at a distance of 100 meters and not to exceed 55 dB(A) at a distance of 200 meters. which, given the distance to the nearest sensitive receivers (500 m in the vicinity of the project site), does not constitute a significant impact.

The transport of materials and equipment will also have a possible noise impact on homes located along the roads used by heavy vehicles, particularly on the access road to the project site.

In view of the above, and given that there are sensitive receptors in the immediate vicinity of the project area, it appears that the most significant potential noise impact during the construction phase will be felt in homes close to the project and those located along the roads used by heavy vehicles to transport equipment and materials for construction.

In general, it can be concluded that the impacts can be classified as **negative, direct**, albeit **moderate** in **magnitude** and **temporary** in nature, certain, widespread, **reversible, and insignificant**.

7.12.2 Operational phase

Increase in noise levels.

During the terminal's operational phase, the main actions likely to generate impacts on the sound environment stem from the activities and operations of the aforementioned facilities,

namely grain logistics, transport and distribution, maintenance, generator operation, mooring and movement of vessels, etc.

The noise levels emitted by road transport are essentially composed of emissions from the propulsion system and the movement of vehicles on the road surface. Factors contributing to noise levels include, in addition to driving speed, vehicle type, tire type, pavement type, vehicle maintenance, vehicle age, road gradient, the presence or absence of noise barriers, and driving patterns.

The impacts on the sound environment will be felt to a greater extent during the night and are mainly associated with road traffic and boats, the operation of generators, etc.

The noise impact becomes part of the new acoustic profile of the area, with a permanent character, especially in the vicinity of residential areas or areas of environmental sensitivity. The impact is considered negative, of moderate magnitude, direct, probable, local, permanent, reversible, immediate, and insignificant if mitigation measures are adopted.

On the other hand, at the start of normal operation, promote a campaign to monitor noise levels in order to assess the significance of the impact generated and/or the need to apply mitigation measures (e.g., noise barriers).

7.12.3 Decommissioning phase

Increase in noise levels.

During this phase, the movement of vehicles, machinery, and workers, as well as the noise caused during demolition, will have an impact. These impacts are considered negative, moderate in magnitude, direct, certain, local, temporary, reversible, and significant during this phase of the work.

Once decommissioned, the impacts caused by this descriptor are reduced. This is a positive impact, of reduced magnitude, direct, certain, local, temporary, reversible, and insignificant.

7.13 SOCIOECONOMICS

7.13.1 Construction phase

Job creation

During this phase, there will be a significant increase in demand for labor, especially in civil construction, material handling, support services, security, and environmental management. This will provide temporary employment for local workers, contributing to improved household income and boosting the local economy.

To carry out the work, it will be necessary to resort to external and internal labor, which will constitute the workforce for the terminal's construction. Although the risk is very low, all situations of labor exploitation, discrimination at work, or the use of child labor must be prevented in order to avoid serious violations of the provisions of international conventions on the protection of the rights of children and workers to which Angola is a signatory through the International Labor Organization (ILO).

In this context, it is important to comply with the provisions of the AfDB's Integrated Safeguard System, namely Operational Safeguard 5.

In a peripheral area of Benguela province, the impacts on the local social structure are evident, given the problems of unemployment and scarcity of income sources faced by neighboring/rural populations. The positive impact resulting from job creation can therefore be classified as direct and indirect, widespread, certain, temporary, moderate in magnitude, reversible, and significant.

Boosting related sectors

Construction activity will boost sectors such as civil construction, supply of construction materials, freight transport, accommodation, food, and security services. Demand for local suppliers and service providers will grow, increasing the circulation of capital and promoting income generation in existing businesses, as well as stimulating the emergence of new small businesses.

The positive impacts are considered to be of high magnitude, direct (job creation) and indirect (boosting of associated sectors), certain, widespread, temporary and permanent, and very significant.

Disruption for the population

During the construction phase, increased heavy vehicle traffic, movement of large equipment, excessive noise, dust, and vibrations from the works are sources of nuisance for nearby residents.

This impact can be classified as negative, of moderate magnitude, direct, probable, widespread, temporary, reversible, and insignificant.

Risks of accidents involving the population

Vehicle traffic during the construction of the terminal and assembly of the silos may increase the risk of accidents involving the population living in the surrounding area, including workers.

This impact can be classified as negative, moderate, direct, probable, widespread, temporary, reversible, and irreversible (in the event of death), and insignificant.

7.13.2 Operation phase

Job creation

The main positive impacts of the project will be felt with the start of the operation phase and, given the nature of the investment in the region's infrastructure, will have a supra-communal and provincial scope. One of the main positive effects of the construction of the project is the creation of jobs. In a peripheral area of the province of Benguela, the impacts on the local social structure are evident, given the problems of unemployment and scarcity of sources of income faced by the neighboring/rural populations. Given the impact that job creation, even if temporary, has on the group of workers who see their employment and economic situation improve, the impact is still classified as significant. The contractor's priority in hiring local labor maximizes the positive effect of this impact.

The terminal will require external and internal labor to operate, which will constitute the workforce. Although the probability of this occurring is very low, precautions must be taken against all situations of labor exploitation, discrimination in the workplace, or

use of child labor should be taken into account so as not to seriously violate the provisions of international conventions on the protection of the rights of children and workers to which Angola is a signatory through the International Labor Organization (ILO).

In this context, it is important to comply with the provisions of the AfDB's Integrated Safeguard System, namely Operational Safeguard 5.

Thus, it is expected that the hiring of labor will create a positive, direct, certain, widespread, permanent, moderate, irreversible, and significant impact (due to the lack of local employment).

Boosting of associated sectors

During the terminal's operation, there will be continuous revitalization of sectors such as logistics and transportation, supply of locally and nationally produced foodstuffs, port services, industrial maintenance, supply of parts and equipment, information technology, professional training, hospitality, catering, and commerce. This phase generates stable, long-term business opportunities, promoting economic diversification and increasing the municipality's ability to attract investment.

The positive impacts are considered to be of moderate magnitude, direct (job creation) and indirect (boosting of associated sectors), certain, regional/national and international (grain distribution and export), temporary and permanent, and very significant.

Nuisance to local residents

The constant traffic of trucks and light vehicles, loading and unloading of cargo, operational noise emissions, and possible accidental spills of materials can cause discomfort to the community, in addition to posing occupational **and** environmental accident risks if safety measures are not strictly enforced.

This impact can be classified as negative, of reduced magnitude, direct, probable, widespread, temporary, reversible, and insignificant.

Risks of accidents involving the population

The movement of vehicles and ships during the transport and distribution of various products and inputs may cause some inconvenience to the population living in the surrounding areas where these means of transport circulate, also increasing the risk of associated accidents.

This impact can be classified as negative, moderate in magnitude, direct and indirect, probable, local and widespread, permanent, reversible, and significant.

7.13.3 Decommissioning phase

Reduction in the dynamism of associated sectors and unemployment

Although decommissioning reduces overall dynamism, sectors such as civil construction, waste management, environmental remediation, **and** demobilization logistics will be temporarily boosted. It will be necessary to plan to minimize the loss of dynamism, promoting actions to requalify and reuse infrastructure for new economic uses.

At this stage, there may be an increase in unemployment and a decrease in income for the community and all those who depended on these facilities to develop their businesses.

This is a negative impact of moderate magnitude, direct and indirect, certain, local and regional, permanent, reversible, and significant.

Job creation

The decommissioning of the terminal may require labor for the dismantling of structures, environmental remediation, and rehabilitation of the site. Although the volume of jobs will be smaller and for a limited time, it will continue to generate temporary employment opportunities for the local population. However, the permanent closure could lead to the loss of permanent jobs, which requires mitigation plans to support the professional retraining of affected workers.

Although it is a very low probability risk, all situations of labor exploitation, discrimination at work, or the use of child labor should be guarded against so as not to incur serious violations of the provisions of international conventions on the protection of the rights of children and workers to which Angola is a signatory through the International Labor Organization (ILO).

In this context, it is important to comply with the provisions of the AfDB's Integrated Safeguard System, namely Operational Safeguard 5.

Decommissioning will create job opportunities, resulting in a positive impact that is small in magnitude, direct, certain, local, temporary, reversible, and insignificant.

Risks of accidents involving the population

Vehicle traffic during the decommissioning and dismantling of the silos may cause inconvenience and increase the risk of accidents involving the population living in the surrounding area.

This impact can be classified as negative, moderate, direct, probable, local and regional, temporary, reversible and irreversible (in the event of death), and significant.

7.14 URBAN INFRASTRUCTURES

7.14.1 Construction phase

Pressure on the road network

During the construction phase, impacts on the road network are expected, specifically on national road no. 100 due to the transport of construction support equipment, and on tertiary roads due to the movement of machinery, vehicles, and workers.

However, it is considered that this impact, although negative, is of low magnitude, direct, certain, regional and local, temporary, reversible, immediate, and insignificant, depending on the number of vehicles required for the work.

Pressure on the energy, water, and sanitation supply network

At this stage, it is considered that there will be no impact on these sectors, since the facilities will have their own autonomous systems.

7.14.2 Operational phase

Pressure on the road network

Due to the transport of inputs and distribution of stored and produced grain, it is considered that there will be impacts due to the use of the national road network EN-100, EN-250 and tertiary roads, and the CFB railways, etc.

The impacts are considered to be negative, of low magnitude, direct, probable, widespread, permanent, reversible, and insignificant. As for the railway and road infrastructure, it is not considered that the normal operation of the terminal will generate significant traffic on the access roads, and as such, no significant impacts are expected.

Pressure on the energy, water, and sanitation supply network

Similarly, during the operational phase, activities related to electricity and water consumption and the generation of solid waste and liquid effluents may place pressure on public infrastructure (if the terminal is connected to the grid). However, even if connected, the production of liquid effluents and the consumption of drinking water and electricity are not expected to put significant pressure on public infrastructure, because the facilities will have their own autonomous systems for storing effluents and drinking water and supplying electricity during critical phases, thereby reducing the overload.

Negative impacts are considered to be of low magnitude, direct, uncertain, widespread, permanent, reversible, and insignificant.

Reduction in grain drainage time

The start of operations at the Lobito Ocean Grain Terminal will have a very positive impact on grain import and export logistics, significantly reducing transport times across three main modes: land, rail (CFB - Benguela Railway), and sea.

By land, improvements in the logistics infrastructure associated with the terminal will relieve congestion on routes and reduce grain transport times from agricultural production centers to the port, reducing post-harvest losses and increasing producer competitiveness.

By rail, the intensive use of the CFB will facilitate the transport of large volumes of grain more efficiently and at lower logistics costs, strengthening the transport capacity from inland agricultural regions (such as Bié, Huambo, and Moxico) to Lobito. This will bring important benefits to the regional and national economy, encouraging agricultural production.

By sea, the terminal will enable faster and more efficient loading and unloading of large ships, optimizing grain import and export operations. The reduction

in waiting times at the port and the speed of operations will increase the attractiveness of the Lobito corridor as a strategic international trade route, strengthening Angola's trade relations with markets in Southern Africa, Europe, and America.

Overall, the reduction in transit time will have positive economic effects, promoting increased agricultural productivity, reduced logistics costs, improved export competitiveness, and boosting the socioeconomic development of Angola's south-central region.

The impact is considered to be positive, direct, certain, permanent, high magnitude, reversible, with regional and national effects, and very significant.

7.14.3 Decommissioning phase

Pressure on the road network

During this phase, there will be an increase in traffic intensity on the roads serving the area where the grain terminal is located, with a consequent increase in the likelihood of road accidents and road degradation during decommissioning due to the transport of equipment and waste resulting from demolition and excavation.

This is considered a negative impact of low magnitude, direct, certain, local, permanent, reversible, and insignificant.

Once decommissioned, it reduces the impacts caused by the grain terminal in terms of this descriptor. It is a positive impact, of low magnitude, direct, certain, local, temporary, reversible, and insignificant.

7.15 WASTE PRODUCTION, CONTROL, AND MANAGEMENT

7.15.1 Construction phase

Waste production

It is considered that during the construction of the metal silos, various types of waste will be generated, including inert waste such as rubble and scrap metal, hazardous waste such as oils, greases, paints, and solvents, organic waste from workers' food scraps, and recyclable waste such as plastics, cardboard, and packaging.

There may also be liquid waste resulting from the use of changing rooms and the maintenance and cleaning of the facilities. At this stage, these are considered negative, moderate in magnitude, direct, certain, local, temporary, reversible, and insignificant.

Risks of environmental contamination

It is considered that the incorrect storage and disposal of solid and liquid waste may cause a risk of environmental contamination. At this stage, these risks are considered to be negative, of reduced magnitude, direct and indirect, uncertain, widespread, temporary, reversible, and insignificant.

Proper management of this waste will be essential to minimize environmental impact during construction.

7.15.2 Operation phase

Waste production

During this phase, various types of waste will be produced as a result of grain deterioration, office waste, cafeteria waste, maintenance area waste, facility cleaning waste, etc.

This will mainly consist of cardboard, plastic packaging, cans, plastic bottles, food scraps, PETs, lubricating oils, damaged parts, effluents from the changing rooms, etc.

The impacts considered in this phase are negative, moderate in magnitude, direct, certain, local, permanent, irreversible, and very significant. They have the potential to be significant if mitigation measures are adopted.

Risks of environmental contamination

It is considered that the incorrect storage and disposal of solid and liquid waste may cause a risk of environmental contamination. At this stage, these risks are considered negative, moderate in magnitude, direct and indirect, uncertain, widespread, temporary, reversible, and insignificant.

The development and implementation of a Waste Management Plan is essential to prevent incidents.

7.15.3 Decommissioning phase

Waste production

During this phase, large quantities of waste may be produced, whether solid, liquid, etc. Therefore, very specific measures must be taken regarding its collection and final destination. At this stage, the impacts are considered to be moderate in magnitude, direct, probable, local, temporary, reversible, immediate, and significant.

Once decommissioned, the terminal's impact in terms of waste production is reduced. This is a positive impact, of reduced magnitude, which is direct, certain, local, temporary, reversible, and insignificant.

Risks of environmental contamination

It is considered that the incorrect storage and disposal of solid and liquid waste may cause a risk of environmental contamination. At this stage, they are considered negative, of reduced magnitude, direct and indirect, probable, local, temporary, reversible, and insignificant.

Proper management of this waste will be essential to minimize environmental impact during construction.

7.15.4 LAND USE PLANNING

7.15.5 Construction phase

The actions necessary for the construction of the silos are compatible with the provisions of the Spatial Planning and Urban Development Law (Law No. 3/2004 of June 25), namely with the provisions of Article 42(b). They are also compatible with the provisions of the Land Law (Law No. 9/04 of November 9), namely in its Article 68, paragraph a.

Similarly, they are compatible with the provisions of Decree No. 4/01 of February 2 on the Coastal Zone Management Plan (POOC), as well as the Master Plan for the municipality of Lobito.

7.15.6 Operational phase

The project ensures compliance with the various territorial management instruments in force in the implementation area.

However, there will only be a negative impact if authorization has not been requested from the municipal or communal administration regarding its framework.

7.15.7 Decommissioning phase

The actions necessary for the decommissioning of the terminal must comply with the provisions of the Law on Territorial Planning and Urban Development (Law No. 3/2004 of June 25), as well as other related laws.

Similarly, they must comply with the provisions of Decree No. 4/01 of February 2 on the Coastal Zone Management Plan (POOC), as well as the Master Plan of the municipality of Lobito.

7.16 HISTORICAL AND CULTURAL HERITAGE

Given that no classified heritage sites have been identified in the area directly affected and in the immediate vicinity of the site, no impacts are expected to directly affect this descriptor, either during the construction, operation, or decommissioning phases.

7.17 VULNERABILITY ANALYSIS OF THE "SILOS" PROJECT IN THE FACE OF THE EFFECTS OF CLIMATE CHANGE

The project falls under Category 2 according to the Bank's Climate Safeguards system. This indicates that the project has moderate vulnerability to climate change, requiring an analysis of the risks associated with climate change and the implementation of adaptation measures.

Climate change has been a global concern, with significant effects on food security, water availability, and increased frequency of extreme weather events. Angola, due to its geographical location and dependence on agriculture, is particularly vulnerable to these impacts. Among the main challenges facing the country are prolonged drought, soil erosion, changes in rainfall patterns, and rising temperatures, factors that directly affect agricultural production and the food security of the population.

Angola, despite its low contribution to global warming, is among the nations most impacted by climate change due to the vulnerability of its ecosystems. The effects include increased aridity and recurrence of droughts, intensification of saline intrusion and deterioration of underground water reserves, soil degradation and loss of biodiversity, as well as an increase in the frequency and intensity of tropical storms, among others.

The project to install silos at the ocean terminal aims to improve the conservation and storage of cereals, reducing post-harvest losses and ensuring greater stability in food supply. However, to ensure its effectiveness and sustainability, it is essential to analyze its vulnerability to climate change:

- **Water security:** Water scarcity can affect the grain drying process and storage efficiency, especially during prolonged periods of drought.
- **Impact on infrastructure:** High temperatures and heavy rains can compromise the structure of silos, accelerating the degradation of materials and increasing maintenance costs.

- **Effects on agricultural production:** The reduction in the production of corn, rice, beans, soybeans, and other types of grains due to climate change may impact the use of silos, reducing the operational efficiency of the project.
- **Need for adaptation:** Measures such as the construction of rainwater harvesting systems, the use of heat-resistant materials, and the adoption of climate monitoring systems are essential to mitigate the impacts.

To address these challenges, Angola is committed to several international agreements on climate change, including:

- Paris Agreement (2015): Angola has made commitments to reduce greenhouse gas emissions and adapt to climate change by promoting the resilience of agricultural systems.
- United Nations Framework Convention on Climate Change (UNFCCC): The country has developed national climate adaptation plans to mitigate negative impacts.
- United Nations Environment Programme (UNEP): Angola participates in initiatives for the sustainable use of natural resources and protection of biodiversity.

Regarding the occurrence of other extreme weather events, such as temperature variations, heat islands, heavy rains, tropical storms, landslides, and periods of severe drought, there are still no studies that allow for concrete predictions, and there is great uncertainty about these projections.

All efforts to build sustainable infrastructure were a fundamental requirement to ensure the absorption, reduction, or prevention of emissions that this project seeks to achieve in the operational phase.

The ocean grain terminal project is key to ensuring food security, but it faces risks due to climate change. To ensure its viability and longevity, it is crucial to integrate climate adaptation measures, such as infrastructure improvements, flood control, water harvesting, wastewater treatment and reuse, and constant monitoring of environmental and social impacts. Adherence to international commitments reinforces the need for sustainable strategies that ensure the project's resilience in the face of climate challenges.

7.18 SUMMARY OF ENVIRONMENTAL IMPACTS

The following table presents a summary of environmental and social impacts, which consists of a final assessment that summarizes and classifies the main impacts identified during the environmental and social impact assessment (ESIA). At this stage, the negative and positive impacts on the environment resulting from the project's activities are analyzed according to environmental factors, in relation to the criteria used to assess the impacts (magnitude, duration, incidence, probability, etc.) and their scale (section 7.1), without assigning a numerical value to their significance. Climate change not caused by the project, but rather globally by potential climate change that could have impacts at the national level, was also included in this summary.

Table 44: Summary of environmental impacts

Descriptor	Impact	Phase	Activity/area affected	Impact Features
Climate	-Change in evapotranspiration at ground level and increased perception of heat discomfort	Construction and operation	Clearing and earthmoving (blasting), installation and use of the construction site, construction and operation of the grain terminal.	Negative, direct, reduced magnitude, temporary and permanent (operation), reversible and irreversible (operation), unlikely, local and insignificant.
Geology/geomorphology	-Changes in local geomorphology (caused by excavation, landfill, and dredging works)	Construction and operation	Clearing and earthmoving (clearing), installation and use of the shipyard, dredging for the construction of the pier.	Negative, direct, reduced magnitude, permanent, irreversible, certain, local, and significant.
Soils	-Risks of soil contamination (concrete, oil, and fuel resulting from accidental spills) -Soil compaction (due to the movement of machinery, equipment, and personnel)	Construction	Clearing of land, movement of soil, and handling of hazardous products and effluents.	Negative, direct, low magnitude, temporary and permanent (operation), reversible, probable, probable and certain, local and insignificant.
Land use	-Change in land use	Construction and operation	Project area	Negative, direct, low magnitude, temporary and permanent (operation), reversible and irreversible (operation), certain, local, and insignificant.
Water Resources (marine)	-Changes in the quality of marine waters and sediments (erosion, dredging, accidental spills, and/or waste runoff) -Changes in coastal dynamics	Construction and operation	Cleaning and earthmoving (clearing), installation and use of the construction site, dredging for the construction and maintenance of the pier.	Negative, direct and indirect, reduced magnitude, temporary and permanent, reversible and irreversible, unlikely, widespread and insignificant.

Descriptor	Impact	Phase	Activity/affected area	Impact characteristics
Flora	-Disturbance and dusting of surrounding flora; -Disturbance of marine flora; -Contamination and destruction of terrestrial and marine flora	Construction and operation	Clearing and stripping of land, earthworks/blasting, installation and use of construction sites, construction of buildings and other infrastructure, transportation of people and materials, dredging.	Negative, direct, small in scale, temporary (contamination) and permanent, reversible and irreversible, probable (contamination) and uncertain, local and widespread, significant and insignificant significant.
Fauna	-Scare away terrestrial and marine fauna; -Disruption and destruction of habitats and individuals (mollusks, crustaceans), etc.; -Disruption of fish migration patterns; -Running over and killing of species; -Barrier effect on the movement of species.	Construction and operation	Cleaning and stripping, circulation of vehicles and machinery, installation and use of construction sites, construction of buildings and other infrastructure, dredging and mooring of ships.	Negative, direct and indirect, small scale, temporary (construction), permanent (operation), reversible and irreversible (in the event of wildlife death), certain and uncertain, local and widespread, significant and insignificant.
Landscape	-Change in the character of the landscape with the introduction of buildings (spatial and functional disorganization of the territory, introduction of "foreign" elements)	Construction and operation	Project area and surroundings	Negative, direct, moderate magnitude, permanent, irreversible and reversible, certain, local and significant.
Air quality	-Emissions of gases and particulate matter (dust) originating from excavation and landfill activities	Construction	Cleaning and stripping of soil, earthworks/blasting, site installation and use, building and infrastructure construction, transportation of people and materials	Negative, direct, low magnitude, temporary, reversible, certain, local and insignificant.
	Increase in the concentration of CO and NOx from road traffic, emission of particulate matter (dust)	Operation	Vehicle traffic and ship docking, dredging, and silo maintenance	Negative, indirect, moderate magnitude, temporary and permanent, reversible, certain, local and widespread, insignificant and significant.

Deskriptor	Impact	Phase	Activity/area affected	Impact characteristics
Noise environment	Increased noise levels (from vehicle traffic vehicles, mostly heavy vehicles used for construction work, and from the operation of machinery and equipment)	Construction/operation	<ul style="list-style-type: none"> - Cleaning and stripping of soil - Earthworks/demolition - Installation and use of the construction site - Construction of the terminal and infrastructure - Transportation of people and materials -terminal operation 	Negative, direct, moderate, temporary, reversible, certain, local and widespread, and significant.
Socioeconomic	Nuisance to the local population (caused by noise and dust emissions, traffic flow constraints)	construction	<ul style="list-style-type: none"> -Cleaning and stripping of soil - Earthworks/clearing - Installation and use of the construction site - Construction of the terminal and infrastructure - Transportation of people and materials 	Negative, indirect, moderate magnitude, temporary, reversible, probable, local and widespread, significant.
	Job creation	Construction	Project surrounding area and area of direct and indirect influence	Positive, direct, moderate magnitude, temporary, reversible, certain, widespread, and significant.
	Boosting of associated sectors of activity	Construction	Project surrounding area and area of direct and indirect influence	Positive, direct and indirect, moderate and high magnitude, reduced, temporary, reversible, probable, extensive and significant.
	Risk of accidents (accidents involving workers and the population)	Construction	Project surrounding area and area of direct and indirect influence	Negative, direct and indirect, low to moderate magnitude, temporary, reversible, probable, extensive, significant.
	Increased population settlement, especially among the working-age population	Operation	Project surroundings and area of direct influence	Negative, indirect, low magnitude, temporary, reversible, probable, local, and insignificant.
	Gender inequality in the workplace, sexual harassment, gender-based violence based on gender	Construction and operation	Project surroundings and area of direct influence	Negative, indirect, low magnitude, permanent, reversible, probable, local, and insignificant.

Descriptor	Impact	Phase	Activity/affected area	Impact characteristics
Infrastructure	Pressure on the road network	Construction and operation	Project area	Negative, direct, low magnitude, temporary (construction) and permanent (operation), reversible, probable, local and widespread, insignificant.
	Pressure on the network energy, water, and sanitation	Operation	Project area	Negative, direct, small magnitude, permanent, reversible, unlikely, local and insignificant.
	Reduction of time grain flow time	Operation	Project Area	Positive, direct, reduced magnitude, permanent, irreversible, probable, regional, and very significant.
Waste	Waste production	Construction and operation	Project Area	Negative impact, direct, low magnitude, temporary and permanent (operation), reversible and irreversible (operation), certain, local, significant, and insignificant.
	Risks of environmental contamination	Construction and operation	Project area and surroundings	Negative, direct impact, of reduced magnitude and moderate, temporary, reversible, probable, local and insignificant.
Climate Change	Temperature variations, heat islands, rising average sea levels, heavy rainfall, storms, floods, landslides, and extreme drought events (Not caused by the project, but by potential climate change)	Construction and operation	Project area and surroundings	Negative impact

7.19 CLASSIFICATION OF ENVIRONMENTAL AND SOCIAL IMPACTS IN TERMS OF THEIR SIGNIFICANCE

The classification regarding the significance of environmental and social impacts is obtained by multiplying the criteria Probability (P), Incidence (I), Magnitude (M), and Duration (T) established in section 7.1.1, taking into account the values assigned to them in Table 37.

The following section presents summary tables of the classification of environmental and social impacts for each impact described, its assessment, and mitigating or enhancing measures. The indication of general and specific measures is in accordance with the code indicated in Chapter 8.

The tables do not exhaust the assessment of impacts, but are intended only to present, in a systematic and expeditious manner, the impacts that were considered, the significance values assigned, and the measures proposed, considering the construction and operation phases.

It should be noted that the impacts caused by the location of the construction site were not taken into account, as its location is unknown, nor were the impacts generated during the decommissioning phase, as they will be similar to those expected to occur during the construction phase.

Table 45: Classification of the environmental and social impacts of the project (construction phase)

DESCRIPTION	IMPACT	NATURE	OCCURRENCE	MAGNITUDE	DURATION	REVERSIBILITY	PROBABILITY	INCIDENCE	MITIGATION MEASURES	SIGNIFICANCE
Climate	Change in evapotranspiration and temperature at ground level	-	D	R	T	RV	PR	L	MGC 1/ MMC 1	-3
Geology and Geomorphology	Changes in local geomorphology	-	D	R	P	IR	C	L	MGC 1/MMC 2	-16
Soil	Soil compaction, contamination, and erosion	-	D	R	T	RV	PR	L	MGC 1/MMC 3,4,5	-3
Land use	Land use change	-	D	R	T	RV	C	L	MGC 1	-4
Marine water	Changes in the quality of marine waters and sediments	-	D	M	T	RV	INC	A	MGC1/MMC 6,7,8	-8
	Changes in coastal dynamics	-	IND	R	P	RV	INC	A	MMC 9,10,11	-8
Flora	Disturbance and destruction of terrestrial flora	-	D	R	R	RV	C	L	MGC 1/MMC 12.13	-4
	Disturbance and destruction of marine flora	-	D	M	T	IR	C	L	MMC 14	-16
	Contamination and destruction of terrestrial and marine habitats	-	D	M	T	RV	PR	A	MC 12,13,14	-12

Aquatic & Terrestrial	contamination of habitats and of individuals (mollusks, crustaceans, other invertebrates, and fish);	-	D	R	T	RV	INC	A	MMC 17;18	-6
	Disruption of fish migration patterns;	-	IND	R	T	RV	INC	A	MMC 19.20	-4
	Disturbance and destruction of habitats and individual birds	-	D	R	P	IR	PR	L	MMC 16, 17, 18, 15	-12
	Risks of species being run over and killed	-	D	R	T	IR	PR	L	MMC 15, 16,	-6
	Disturbance of local fauna	-	D	R	T	RV	C	L	MMC16, 15, 31	-4
	Barrier effect on wildlife circulation	-	D	R	T	RV	PR	L	MMC 21, 22	-3
Landscape	Landscape change	-	D	M	T	RV	C	A	MGC 1/MMC 17,18,21	-16
Air quality	Emissions of gases and particulate matter	-	D	M	T	RV	C	L	MGC 14:11 MMC 20:21,22,23	-8
Noise environment	Increased noise levels	-	D	M	T	RV	C	A	MGC 11.14 MMC 24:25,26	-16
Socioeconomics	Job creation	+	D	M	T	RV	C	A	MGC 6.8/MMC 27	16
	Dynamization of sectors of activity	+	D	E	T	RV	C	A	MGC 2,6,8/MMC 28	24
	Nuisance to local residents (vehicle traffic, noise, dust)	-	D	M	T	RV	PR	A	MGC 2,6,8/MMC 29	-12

DESCRIPTION	IMPACT	NATURE	OCCURRENCE	MAGNITUDE	DURATION	REVERSIBILITY	PROBABILITY	INCIDENCE	MITIGATION MEASURES	SIGNIFICANCE
	Accident risks	-	D	M	T	RV	PR	A	MGC 4,6,8,12,14 MMC 30,31	-12
Infrastructure	Pressure on the road network	-	D	R	T	RV	PR	A	MMC 32, 33, 34, 35	-6
	Time reduction due to proximity to EN-100, Porto, and CFB railway line	+	D	M	T	RV	PR	A	SM	+12
Waste	Waste production	-	D	M	T	RV	C	L	MGC 3.10/MMC 39	-8
	Risks of environmental contamination	-	D	R	T	RV	INC	A	MGC 3 MMC 36, 37, 38	-4

Nature: Positive (+), Negative (-)

Occurrence: Direct (D), Indirect (Ind)

Magnitude: Low (L), Moderate (M), High (H) **Incidence:**

Local (L), Widespread (W), Regional (R) **Duration:**

Temporary (T), Permanent (P) **Reversibility:** Reversible (Rv.),

Irreversible (Ir)

Probability of occurrence: Unlikely (IMP), Uncertain (INC), Likely (PR), Certain (C)

Significance: Very Significant (VS), Significant (S), Not Significant (NS) GCM-general

measures for the construction phase

MMC-specific mitigation measure for the construction phase

SM-No measure

Table 46: Identification and assessment of the environmental impacts of the project (operation)

DESCRIPTION	IMPACT	NATURE	OCCURRENCE	MAGNITUDE	DURATION	REVERSIBILITY	PROBABILITY	INCIDENCE	MITIGATION MEASURES	SIGNIFICANCE
Climate	Increased perception of heat discomfort	-	IND	R	P	R	IMP	L	MMO 1	-2
Geology and Geomorphology	Changes in local geomorphology	-	D	R	P	IR	INC	L	MMO 2.3	-8
Soil	Risk of soil contamination from accidental spills	-	D	R	T	RV	PR	L	MGO 2/MMO 5.6	-3
	Compaction due to the movement of people and vehicles	-	D	R	P	IR	IMP	L	MMO 3	-4
Land use	Land use change	-	D	R	P	IR	C	L	SM	-16
Resources Marine water	Changes in the quality of marine waters and sediments	-	IND	R	T	RV	PR	A	MGO 2/MMO 7,8,9	-6
	Changes in coastal dynamics	-	IND	R	P	IR	IMP	A	MMO 10, 11	-8

DESCRIPTION		IMPACT	NATURE	OCCURRENCE	MAGNITUDE	DURATION	REVERSIBILITY	PROBABILITY	INCIDENCE	MITIGATION MEASURES	SIGNIFICANCE
Flora		Disturbance and destruction of surrounding terrestrial flora	-	D	R	P	RV	PR	L	MMO 12, 13, 14, 16	-6
		Disturbance and destruction of marine flora	-	D	M	P	IR	INC	A	MMO 13, 14, 15, 16	-32
		Contamination and destruction of terrestrial and marine habitats	-	D	M	T	IR	INC	A	MGO 1/ MMO 12,13,14	-16
Aquatic & Terrestrial	1	Contamination of habitats and individuals (mollusks, crustaceans, other invertebrates, and fish);	-	IND	M	T	RV	INC	A	MGO 1/ MMO 17, 23, 24,	-2
		Disruption of fish migration patterns;	-	IND	M	P	IR	INC	A	MMO 25, 26	-16
		Disturbance and destruction of habitats and individual birds.	-	D	R	P	IR	INC	A	MMO 19, 21, 22	-16
		Risks of species being run over and killed	-	D	R	P	IR	INC	A	MMO 20, 21, 22	-16
		Disturbance of local fauna	-	D	R	P	IR	PR	A	MGO 1/ MMO 6, 20, 21, 22	-24
		Barrier effect on the circulation of terrestrial fauna	-	D	R	P	IR	IMP	L	MGO 1.10/MMO 27, 28	-4

DESCRIPTION	IMPACT	NATURE	OCCURRENCE	MAGNITUDE	DURATION	REVERSIBILITY	PROBABILITY	INCIDENCE	MITIGATION MEASURES	SIGNIFICANCE
Landscape	Change in the character of the landscape with the introduction of buildings and landscaping	-	D	M	P	IR	C	L	MMO 23, 24, 25, 26	-32
Air quality	Emissions of gases and particulate matter	-	D	M	P	RV	C	A	MGO 7.9/MMO 27, 28, 29, 30, 31, 32	-32
Noise environment	Increased noise levels	-	D	M	P	RV	PR	A	MGO 7.9/MMO 33, 34, 35, 36	-24
Socioeconomic	Job creation	+	D	M	P	IR	C	A	MGO 8/MMO 39	64
	Revitalization of sectors of activity	+	D	M	P	IR	C	R	MMO 38,37,40	96
	Nuisance to the population (vehicle traffic, noise, dust)	-	IND	R	P	RV	PR	L	MGO 8/ MMO 41	-6
	Risks of accidents involving the population	-	D	M	P	RV	PR	A	MGO 2/MMO 43,44,45	-24

DESCRIPTION	IMPACT	NATURE	OCCURRENCE	MAGNITUDE	DURATION	REVERSIBILITY	PROBABILITY	INCIDENCE	MITIGATION MEASURES	SIGNIFICANCE
Infrastructure	Pressure on the road network	-	D	R	P	RV	PR	A	MMO 49	-8
	Pressure on the energy, water, and sanitation supply network	-	D	R	P	RV	INC	A	MMO 50,51,52	-8
	Reduction in grain transport time via EN-100, Porto, and CFB railway line	+	D	E	P	RV	PR	R	SM	54
Waste	Waste production	-	D	M	P	IR	C	L	MGO 3.7.9/MMO 53.55	-32
	Risks of environmental contamination	-	D	M	T	RV	PR	A	MGO 2,3,7,9/MMO 54,55,56	-12

Nature: Positive (+), Negative (-)

Occurrence: Direct (D), Indirect (Ind)

Magnitude: Reduced (R), Moderate (M), High (E) **Incidence:**

Local (L), Extended (E), Regional (RE) **Duration:** Temporary

(T), Permanent (P) **Reversibility:** Reversible (Rv.), Irreversible

(Ir)

Probability of occurrence: Improbable (IMP), Uncertain (INC), Probable (PR), Certain (C)

Significance: Very Significant (VS), Significant (S), Not Significant (NS) MGO-general

measures for the operational phase

MMO-specific mitigation measure for the operational phase

SM-No measure

8 MITIGATION MEASURES

8.1 GENERAL CONSIDERATIONS

Mitigation, in the environment, consists of human intervention with the aim of reducing or remedying a specific harmful environmental and social impact. It also means reference to a specific act.

According to the *National Environmental Policy Act*, mitigation measures include:

- Preventive measures (aimed at avoiding an impact);
- Minimizing measures (which aim to reduce an impact);
- Compensatory measures (which aim to compensate for an unavoidable impact) (CEQ, 1987).

Mitigation measures may consist of specific actions to be implemented during the preparation/construction and operation phases of the Project. This EIA suggests several generic mitigation measures to be implemented by the end of the preparation/construction phase and some specific mitigation measures for the negative impacts identified at the level of the different descriptors in both phases, thus aiming to reduce the impacts in a comprehensive manner and covering all descriptors.

The changes caused by the activities planned in the project can be minimized, prevented, compensated for, monitored, or improved through the adoption of measures and programs aimed at improving the environmental and social quality of the project and adapting its integration into the environment.

The first level of mitigation measures applies to the Implementation Project, which will be developed by the winner of the tender for the construction of the Grain Terminal. This project will be prepared based on the Base Project analyzed in this EIAS report. The measures to be implemented in the Implementation Project focus on the technical specifications of the project elements and the construction methodologies to be adopted by the Contractor.

The second level of mitigation measures refers to preventive actions, whose main objective is to avoid the emergence of negative impacts and reduce the environmental risks of certain activities of the construction or operation phase of the project.

In addition to the hierarchical approach, the presentation of mitigation measures is also structured according to the project phases (execution, construction, and exploitation/operation) and organized by thematic areas.

The proposed measures focus on impact prevention and mitigation. However, as the project is located in an area of critical habitats, it will be necessary, in accordance with AfDB Operational Safeguard 3, to adopt compensatory measures. This issue is detailed in the Biodiversity Action Plan, a document complementary to this EIA, which will describe the proposed compensatory measures, with an emphasis on the conservation of the region's fauna and flora.

The mitigation measures presented follow the guidelines of the African Development Bank's Integrated Safeguards System, particularly Operational Safeguards (OS) 1, 3, 4, and 5, as well as the regulations and standards established by international conventions.

Six complementary initiatives are presented aimed at supporting local organizations, as well as training and awareness-raising actions for the community in the region.

These measures were directly related to the effects to be caused by the construction and operation of the grain terminal owned by the Carrinho Group, SA.

8.2 GENERAL AND SPECIFIC MEASURES

The proposed general and specific measures will be implemented during the construction and operation phases.

As presented in Tables 47 and 48.

Table 47: Mitigation and enhancement measures for environmental and social impacts (construction phase)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
	<u>General Measures</u>		
MGC 1	Develop and Implement a Construction Site Management Program	Contractor	(included in the construction site installation cost)
MGC 2	Development and Implementation of a Complaint Resolution Mechanism.	Contractor	2,000 USD/month
MGC 3	Monitoring Plan for Stored Effluents	Contractor	3,500 USD
MGC 4	Development and implementation of the Worker Health and Safety Plan	Contractor	8,000 USD
MGC 5	Preparation and implementation of an Emergency Plan	Contractor	8,000 USD
MGC 6	Preparation and implementation of the Environmental and Social Management Plan	Contractor	5,500 USD/month
MGC 7	Prepare and implement Environmental Education Program	Contractor	\$1,000/month
MGC 8	Preparation and implementation of the Communication and Stakeholder Relations Plan	Contractor	3,000 USD/month
MGC 9	Preparation and implementation of an environmental and social monitoring plan on the progress of the works, including the impacts caused and the measures taken to mitigate and/or compensate for them, which must be submitted to MINAMB.	Contractor	3,500 USD/per report
MGC 10	Preparation and implementation of a Waste Management Plan	Contractor	4,500 USD
MGC 11	<u>Installation of fencing</u> In order to reduce noise, dust, and exhaust emissions to the outside, the construction site will be fenced around its entire perimeter with opaque hoardings at least 2 m high.	Contractor	(included in the site installation cost)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MGC 12	<p><u>Safety signage</u></p> <p>The terminal construction site and access roads must be properly signposted and marked to avoid and prevent any type of incident and/or accident involving workers and/or the general public.</p>	Contractor	(included in the cost of setting up the construction site)
MGC 13	Install adequate sanitary facilities for workers	Contractor	(included in the cost of setting up the construction site)
MGC 14	Provide personal and collective protective equipment appropriate to the type of activities to be carried out	Contractor	(included in the cost of setting up the site)
MGC 15	<p><u>Appointment of a person responsible for implementing mitigation measures</u></p> <p>The contractor shall appoint a qualified environmental technician who shall be solely responsible for coordinating the implementation of measures to mitigate environmental impacts and monitoring programs. This professional will act as an intermediary between the person responsible for executing the work and the teams in charge of implementing the established monitoring programs.</p>	Contractor	(included in the cost of the contract)
MGC 16	<p><u>Supply of aggregates to the work</u></p> <p>The supply of material from the quarry to the construction site should be carried out, whenever feasible, directly from the quarry to the work areas, in order to minimize the occupation of space with construction materials in the construction zone, in addition to reducing the frequency of loading and unloading operations of aggregates.</p>	Contractor	(included in the shipyard installation cost)
MGC 17	<p><u>Origin of aggregates</u></p> <p>All aggregates used in the construction work must be of legal origin, i.e., they must be purchased from quarries authorized by the competent authority and duly licensed by the Ministry of the Environment.</p>	Contractor	(included in the cost of the contract)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MGC 14	<p><u>Transportation of aggregates</u></p> <p>Ensure the proper storage of construction materials and waste, especially those of a powdery or particulate nature, in order to prevent their dispersion and falling onto public roads during transport to the construction site or final disposal site.</p>	Contractor	(included in the cost of the contract)
	Climate		
MMC 1	<p><u>Change in evapotranspiration and temperature at ground level</u></p> <p>Limit excavation and waterproofing to areas where strictly necessary.</p>	Contractor	(Included in the work to be performed by the Contractor)
	Geology and geomorphology		
MMC 2	<p><u>Change in local geomorphology</u></p> <p>Limit excavations to areas where strictly necessary.</p>	Contractor	(Included in the work to be carried out by the Contractor)
	Soils		
MMC 3	<p><u>Reduction of water infiltration capacity</u></p> <p>The movement of machinery and other equipment involved in the work must be strictly confined to the designated areas;</p>	Contractor	(Included in the work to be carried out by the Contractor)
MMC 4	<p><u>Soil erosion</u></p> <p>Avoid prolonged exposure of soils</p>	Contractor	(Included in the work to be performed by the Contractor)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 5	<p><u>Spill contamination</u></p> <p>Keep equipment and machinery in good working order; maintenance must be carried out in a safe, waterproof location.</p>	Contractor	(included in the cost of setting up the construction site)
	Surface water resources (marine)		
MMC 6	<p><u>Change in water quality and marine sediments</u></p> <p>Use controlled dredging techniques (e.g., suction dredging with turbidity control).</p>	Contractor	(included in the cost of setting up the construction site)
MMC 7	<p><u>Change in water quality and marine sediments</u></p> <p>Install turbidity curtains (floating barriers) to limit the dispersion of suspended sediments.</p>	Contractor	(included in the cost of installing the site)
MMC 8	<p><u>Change in water quality and marine sediments</u></p> <p>Store effluents and hazardous products correctly under a containment basin, thus preventing their runoff and contamination of the sea.</p>	Contractor	(included in the cost of setting up the construction site)
MMC 9	<p><u>Changes in coastal dynamics</u></p> <p>Adapt the layout of the terminal and infrastructure (such as breakwaters and jetties) to the natural currents and sedimentation patterns, minimizing interference.</p>	Contractor	(included in the cost of setting up the construction site)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 10	<u>Change in coastal dynamics</u> Carry out beach nourishment with compatible sand to compensate for erosion caused by changes in currents;	Contractor	(Included in the work to be performed by the Contractor)
MMC 11	<u>Changes in coastal dynamics</u> Establish a program to monitor the coastline, sediment transport, and marine currents during and after construction, in order to detect changes and apply corrections in a timely manner;	Contractor	(Included in work to be carried out by the Contractor)
	Flora		
MMC 12	<u>Disturbance and destruction of native flora</u> Avoid degradation of existing vegetation cover by restricting vehicle traffic areas;	Contractor	(Included in the work to be carried out by the Contractor)
MMC 13	<u>Disturbance and destruction of native flora</u> Do not set fire to surrounding vegetation and implement fencing around natural areas where endemic and endangered species occur.	Contractor	(Included in the work to be performed by the Contractor)
MMC 14	<u>Disturbance and destruction of marine flora</u> Avoid excavation, dredging, and installation of structures directly over areas with marine flora , schedule works during periods of lower ecological sensitivity (outside the breeding season or underwater vegetation growth season).	Contractor	(included in the cost of the contract)
	Fauna		
MMC 15	<u>Disturbance of local fauna (terrestrial and marine)</u> Raise awareness among workers and communities about the importance of preserving endemic or endangered species;	Contractor and NGOs	(included in the cost of the contract)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 16	<p><u>Risks of species being run over and killed</u></p> <p>Reduce the speed of machinery and vehicles in order to prevent the running over and killing of species. Monitoring and relocation of wild species, especially endangered or endemic species;</p>	Contractor	(Included in the work to be carried out by the Contractor)
MMC 17	<p><u>Disturbance and destruction of marine fauna</u></p> <p>Conduct campaigns to remove marine animals (such as dolphins, turtles, and fish) before starting dredging or pile driving activities, using non-aggressive methods (e.g., low-frequency sounds or patrol boats), and reduce intense night lights, which can disorient sea turtles and other light-sensitive species;</p>	Contractor	(Included in the work to be performed by the Contractor)
MMC 18	<p><u>Disturbance and destruction of marine fauna</u></p> <p>Use sediment curtains and controlled dredging techniques to avoid burying benthic organisms and destroying habitats;</p>	Contractor	(Included in the work to be performed by the Contractor)
MMC 19	<p><u>Disturbance of fish migration currents</u></p> <p>Use technologies that reduce underwater noise (e.g., bubble curtains, acoustic insulation of equipment), minimizing disorientation and displacement of migratory species.</p>	Contractor	(Included in the work to be performed by the Contractor)
MMC 20	<p><u>Disruption of fish migration patterns</u></p> <p>Schedule more intrusive works and operations (such as dredging and pile driving) outside the known migration periods of local species, and implement scientifically supported monitoring programs to map and track the migratory routes of key species , adjusting activities according to the data.</p>	Contractor	(Included in the work to be performed by the Contractor)
MMC 21	<p><u>Barrier effect on the movement of species</u></p> <p>Conduct surveys and modeling on the movement patterns of local fauna to guide the layout and positioning of structures.</p>	Contractor	(Included in the work to be performed by the Contractor)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 22	<u>Barrier effect on species circulation</u> Reduce the area occupied by foundations and bases of structures to keep routes free for circulation, and opt for modular designs or structures with discontinuities that maintain connectivity between coastal and marine areas.	Contractor	(Included in the work to be carried out by the Contractor)
	Landscape		
MMC 23	<u>Landscape alteration</u> Support infrastructure, materials, and equipment must be established in appropriately selected areas in order to avoid dispersion.	Contractor	(included in the cost of the contract)
MMC 24	<u>Landscape alteration</u> Respect for the construction typology of the work;	Contractor	(included in the cost of the contract)
	Air quality		
MMC 25	<u>Air quality degradation (particulate and gas emissions)</u> Avoid driving vehicles and machinery at high speeds, obeying the speed limits (60 km/h and 30 km/h) near and within towns;	Contractor	(Included in the work to be carried out by the Contractor)
MMC 26	<u>Air quality degradation (particle and gas emissions)</u> Moisten areas where dust may be generated;	Contractor	(included in the cost of the contract)
MMC 27	<u>Degradation of air quality (particulate and gas emissions)</u> Keep machinery and vehicles in good technical condition and use them strictly when necessary;	Contractor	(included in the cost of the contract)
MMC 28	<u>Air quality degradation (particulate and gas emissions)</u> Avoid burning waste and vegetation;	Contractor	(Included in the work to be performed by the Contractor)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 29	<p><u>Air quality degradation (particulate and gas emissions)</u> In order to reduce dust and exhaust emissions to the outside, the construction site will be fenced off around its entire perimeter with opaque hoardings at least 2 m high.</p>	Contractor	(included in the cost of setting up the construction site)
	Noise environment		
MMC 30	<p><u>Increased noise levels</u> Avoid high-speed vehicle traffic, complying with the established limits (60 km/h and 30 km/h) near and within localities;</p>	Contractor	(Included in the work to be carried out by the Contractor)
MMC 31	<p><u>Increased noise levels</u> In order to reduce noise emissions to the outside, the construction site will be fenced off around its entire perimeter with opaque hoardings at least 2 m high.</p>	Contractor	(included in the cost of setting up the construction site)
MMC 32	<p><u>Increased noise levels</u> Perform regular maintenance on equipment and machinery, and use them only when strictly necessary.</p>	Contractor	(included in the cost of the contract)
	Socioeconomics		
MMC 33	<p><u>Job creation</u> The creation of new unskilled jobs should primarily benefit the populations living in the immediate vicinity of the infrastructure; All labor employed by the terminal will comply with the provisions of international conventions on the protection of the rights of children and workers to which Angola is a signatory through the International Labor Organization (ILO), as well as the provisions of the AfDB's Integrated Safeguards System, namely the Operational Safeguard 5.</p>	Contractor	(included in the cost of the contract)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 34	<u>Boosting the local economy and associated sectors</u> Materials to support this phase should preferably be purchased on the local market.	Contractor	(included in the cost of the contract)
MMC 35	<u>Increased inconvenience for the local population</u> Vehicles must comply with the speed limits (60 km/h and 30 km/h) in and around within towns, avoiding the use of audible signals that disturb residential areas;	Contractor	(Included in the work to be carried out by the Contractor)
MMC 36	<u>Accident risks</u> Vehicles must comply with the speed limits (60 km/h and 30 km/h) near and within towns;	Contractor	(Included in the work to be performed by the Contractor)
MMC 37	<u>Accident risks</u> Training and awareness campaigns on defensive driving	Contractor	USD 2,000/month
	Infrastructure		
MMC 38	<u>Pressure on the road network and urban infrastructure (water, energy, and sanitation)</u> Comply with the established speed limits (60 km/h and 30 km/h) near and within towns, and reduce speed on unpaved roads;	Contractor	(Included in the work to be carried out by the Contractor)
MMC 39	<u>Pressure on the road network and urban infrastructure (water, energy, and sanitation)</u> Training and awareness campaigns on defensive driving	Contractor	(included in the cost of the contract)
MMC 40	<u>Pressure on the road network and urban infrastructure (water, energy, and sanitation)</u> Water abstraction must be preceded by authorization from the competent authority, and specific measures must be adopted for its management;		(included in the cost of the contract)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 41	<p><u>Pressure on the road network and urban infrastructure (water, energy, and sanitation)</u></p> <p>Wastewater must be properly stored in appropriate containers in a safe area, and its collection, treatment, and disposal must be carried out by a company duly licensed for this purpose.</p>	Contractor	(included in the cost of the contract)
	Waste		
MMC 42	<p><u>Risks of environmental contamination</u></p> <p>Non-hazardous waste must be disposed of by a company duly licensed for this purpose;</p> <p>All polluting substances used must be stored in appropriate, restricted-access, properly waterproofed locations in order to reduce the risk of accidental spills. In the event of an accidental spill of any polluting substance, contamination containment measures must be implemented immediately, including immediate cleaning of the site, stripping and removal of the affected soil layer, where applicable, and transport of the resulting waste to an appropriate final destination.</p>	Contractor	(included in the cost of the contract)
MMC 43	<p><u>Risks of environmental contamination</u></p> <p>All hazardous waste derived from machine maintenance and other activities must be stored in a suitable location and sent to a licensed company for final disposal;</p>	Contractor	(included in the cost of the contract)
MMC 44	<p><u>Risks of environmental contamination</u></p> <p>Prohibit the burning of any type of waste in the open air and/or its burial.</p>		(Included in the work to be performed by the Contractor)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMC 45	<p><u>Waste production</u></p> <p>The contractor will adopt a Waste Management Plan based on the following guidelines. To ensure efficient management of waste generated on site and its temporary storage, a specific area for selective waste disposal will be created on the construction site, which will be covered and equipped with big bags and metal or plastic containers properly identified according to the type of waste to be disposed of.</p> <p>Metal containers/drums shall be available for at least the following types of waste: wood, iron and steel, concrete, plastics/PVC, paper/cardboard, and packaging, among others.</p> <p>Hazardous waste, such as that containing hydrocarbons, solvents, batteries, and contaminated fabrics, must be stored in specific containers, properly identified and protected by a cover.</p> <p>This approach will promote the separation of all waste at source, preventing mixing and contamination, as well as facilitating its recovery when transferred to waste management operators duly licensed by the competent authorities. This measure follows the guidelines established in Presidential Decree No. 190/12, of August 24, which defines the general regime applicable to waste prevention, generation, and management, in addition to regulating the licensing and concession of waste management activities.</p> <p>The disposal of construction waste must comply with the provisions of Executive Decree No. 17/13 (Management of Construction and Demolition Waste).</p> <p>This action complies with the requirements of Operational Safeguard 4, which the contractor is required to comply with.</p>	Contractor	(included in the cost of the contract)

Table 48: Mitigation and enhancement measures for environmental and social impacts (operation phase)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
	<u>General Measures</u>		
MGO 1	<p><u>Manual of Good Environmental Practices</u></p> <p>To ensure that the grain terminal's activities do not pose unnecessary pollution risks, the facilities must have a Manual of Good Environmental Practices, which establishes the environmental management procedures to be followed by both employees and service providers when accessing the facilities. This manual should ensure that waste generated is properly disposed of, stored, and transported to authorized and regulated locations, in accordance with Presidential Decree No. 190/12 of August 24, which defines the general regime applicable to waste prevention, generation, and management, in addition to regulating the licensing and concession of waste management activities.</p>	Proponent	USD 3,500
MGO 2	<p><u>Emergency plan</u></p> <p>The grain terminal must have a pollution control system, compatible with the scale of the activities carried out there, that allows for the rapid and safe removal of potentially polluting substances, such as hydrocarbons and others, that may be accidentally spilled and could affect the soil or air.</p> <p>This measure complies with the provisions of the AfDB's Integrated Safeguard System, namely Operational Safeguard 4.</p>	Proponent	USD 16,000/year

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MGO 3	<p><u>Waste Management Plan</u></p> <p>Carrinho, Sa, will adopt a Waste Management Plan based on the following guidelines. To ensure the selective collection of waste generated during terminal operations, appropriate containers will be installed for the temporary storage of different types of waste, including those produced by terminal users (municipal solid waste), those resulting from loading and unloading activities, and a specific area for the disposal of hazardous waste. All containers will be properly identified with an indication of the type of waste that can be disposed of in each one. The storage, transport, and final disposal of waste will be carried out in accordance with Presidential Decree No. 190/12 of August 24, which defines the general regime applicable to waste prevention, generation, and management, as well as the rules for licensing and concession of waste management activities.</p> <p>This measure follows the provisions of Operational Safeguard 4, which the contractor is obliged to comply with.</p>	Proponent	(included in the operating costs of the facilities)
MGO 4	<p><u>Simulations</u></p> <p>The grain terminal must have a plan for conducting accident drills involving spills of hydrocarbons and other polluting substances. This plan should enable the assessment and supervision of the technical resources available at the terminal, ensuring that they are in good operating condition. Evidence of the implementation and compliance with the plan must be accessible to the authorities during inspection and enforcement actions.</p>	Proponent	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MGO 5	Development and implementation of the Worker Health and Safety Plan	Proponent	(included in facility operating costs)
MGO 6	Implementation of the Environmental and Social Management Plan	Proponent	(included in facility operating costs)
MGO 7	Preparation of monitoring reports to be submitted to MINAMB	Proponent	(included in facility operating costs)
MGO 8	Implementation of a Complaints Resolution Mechanism.	Proponent	(included in facility operating costs)
MGO 9	Implementation of external audits	Proponent/Minamb/Local Administration	USD 22,000/year
MGO 10	Pest control and eradication plan	Proponent	12,000 USD/year
	Climate		
MMO 1	<u>Increased perception of heat discomfort</u> Promote the restoration of the areas affected by planting gardens and trees that are suited to the area;	Proponent	(included in facility operating costs)
	Geology and geomorphology		
MMO 2	<u>Change in local geomorphology</u> Take into account the micro-basin of the region in order to effectively direct rainwater;	Contractor/proponent/supervision	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 3	<u>Change in local geomorphology</u> Circulation of machinery and vehicles only in designated areas;	Proponent	(included in facility operating costs)
MMO 4	<u>Change in local geomorphology</u> Avoid exposing areas that will not be used in the short term;	Contractor/Proponent	(included in facility operating costs)
	Soils		
MMO 5	<u>Soil contamination due to accidental spills</u> Keep equipment and machinery in good working order; maintenance must be carried out in a safe, waterproof location.	Proponent	(included in facility operating costs)
MMO 6	<u>Soil contamination due to accidental spills</u> Develop an internal spill management and response plan.	Proponent	(included in the costs of facility operation costs)
	Surface water resources (marine)		
MMO 7	<u>Change in the quality of marine waters and sediments</u> Maintenance of generators and other equipment must be carried out in a specific, waterproofed area with the necessary safety conditions (spill emergency kit) and drainage systems and oil-water separators must be installed to prevent pollutants from reaching the sea;	Proponent	(included in facility operating costs)
MMO 8	<u>Change in the quality of marine waters and sediments</u> When installing urban and industrial wastewater treatment systems, they must comply with current legislation regarding discharge standards.	Proponent	(included in facility operating costs)
MMO 9	<u>Change in the quality of marine waters and sediments</u> Implement regular sampling programs to assess parameters such as turbidity, pH, dissolved oxygen, heavy metals, hydrocarbons, among others.	Contractor/Supervision/Proponent	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 10	<u>Change in coastal dynamics</u> Carry out beach nourishment with compatible sand to compensate for erosion caused by changes in currents.	Contractor/Supervision/Propo nent	(included in facility operating costs)
MMO 11	<u>Changes in coastal dynamics</u> Establish a program to monitor the coastline, sediment transport, and marine currents during and after construction to detect changes and apply corrections in a timely manner.	Proponent	(included in facility operating costs)
	Flora		
MMO 12	<u>Disturbance and destruction of native flora</u> Prevent degradation of existing vegetation cover by restricting vehicle traffic areas;	Proponent	(included in costs of facility operation costs)
MMO 13	<u>Disturbance and destruction of marine flora</u> Ensure that water from operations (washing, contaminated rainwater, spills) is treated before being discharged into the sea to prevent contamination of marine flora;	Proponent	(included in facility operating costs)
MMO 14	<u>Disturbance and destruction of native flora (marine and terrestrial)</u> Raise awareness among workers and communities about the importance of preserving endemic and endangered species.	Proponent/NGOs/Administration	\$10,000/year
MMO 15	<u>Disturbance and destruction of marine flora</u> Regularly monitor the state of marine flora in affected and adjacent areas, using indicators of vegetation cover, plant health, and presence of invasive species.	Proponent	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 16	<u>Disturbance and destruction of flora (marine and terrestrial)</u> Support local associations focused on research and preservation of flora.	Proponent	(included in facility operating costs) facility operation costs)
	Fauna		
MMO 17	<u>Disturbance of local fauna</u> Raise awareness among workers and communities about the importance of preserving endemic or endangered species;	Proponent/NGOs/Administration	(included in facility operating costs)
MMO 18	<u>Disturbance of local fauna (terrestrial and marine)</u> Avoid noisy activities at night;	Proponent	(Included in the work to be carried out by the operator)
MMO 19	<u>Disturbance of local fauna (terrestrial and marine)</u> Direct lighting from the facilities downwards, thus avoiding disturbance and/or accidental death of birds against fixed objects;	Contractor/Proponent	(included in facility operating costs)
MMO 20	<u>Risks of species being run over and killed</u> Reduce the speed of machinery and vehicles in order to prevent the running over and killing of species. Monitoring and relocation of wild species, especially endangered or endemic ones.	Proponent/Service providers	(Included in the work to be carried out by the operator)
MMO 21	<u>Preservation of species</u> Raise awareness among workers not to kill animals that invade the facilities; to this end, they should always be captured and returned to their natural habitat.	Proponent	(Included in the work to be carried out by the operator)
MMO 22	<u>Species preservation</u> Support local associations focused on wildlife research and preservation.	Proponent	10,000 USD

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 23	<p><u>Disturbance and destruction of marine fauna</u> Treat all wastewater and prevent illegal discharges of pollutants into the sea, which can directly affect fauna, and implement emergency plans to contain spills of fuel or toxic products that could harm marine organisms;</p>	Proponent	(included in facility operating costs)
MMO 24	<p><u>Disturbance and destruction of marine fauna</u> Periodically monitor the presence and behavior of marine fauna in areas adjacent to the project, adjusting measures according to the results;</p>	Proponent	(Included in the work to be carried out by the operator)
MMO 25	<p><u>Disturbance of fish migration currents</u> Use technologies that reduce underwater noise (e.g., bubble curtains, acoustic insulation equipment), minimizing disorientation and displacement of migratory species during pier maintenance dredging;</p>	Contractor/Supervision/Proponent	(included in facility operating costs)
MMO 26	<p><u>Disruption of fish migration currents</u> Implement scientifically supported monitoring programs to map and track the migratory routes of key species, adjusting activities according to the data;</p>	Proponent	(included in facility operating costs)
MMO 27	<p><u>Barrier effect on species circulation</u> Conduct surveys and modeling on the movement patterns of local fauna to guide the maintenance dredging route.</p>	Contractor/Supervision/Proponent	(included in facility operating costs)
MMO 28	<p><u>Barrier effect on species circulation</u> Monitor wildlife behavior after the structures are installed and, if necessary, adapt or modify parts of the project to restore connectivity;</p>	Proponent	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 29	<u>Barrier effect on species movement</u> Inform operators about sensitive areas and wildlife movement zones to avoid additional disturbances from traffic or maneuvers;	Proponent	(Included in the work to be carried out by the operator)
	Landscape		
MMO 30	<u>Landscape alteration</u> Maintain facilities in good condition;	Proponent	(included in the costs of facility operation costs)
MMO 31	<u>Landscape alteration</u> Create a specific area for parking machinery and vehicles;	Contractor/Proponent	(included in the costs of facility operation costs)
MMO 32	<u>Landscape alteration</u> Night lighting should be directed downward;	Contractor/Proponent	(included in the costs of facility operation costs)
MMO 33	<u>Landscape alteration</u> Do not use colors that contrast significantly with the surroundings.	(included in the operating costs facility operation costs)	(included in the facility operation costs)
	Air quality		
MMO 34	<u>Air quality degradation (particulate and gas emissions)</u> Avoid driving vehicles and machinery at high speeds, obeying the speed limits (60 km/h and 30 km/h) near and within towns;	Grain operator/transporters	(Included in the work to be performed by the operator)
MMO 35	<u>Air quality degradation (particle and gas emissions)</u> Moisten areas where dust may be generated;	Operator	(included in the costs of facility operation costs)
MMO 36	<u>Air quality degradation (particulate and gas emissions)</u> Keep machinery and vehicles in good technical condition and use them strictly when necessary;	Operator	(included in facility operating costs)
MMO 37	<u>Air quality degradation (particulate matter and gas emissions)</u> Avoid burning any type of waste and surrounding vegetation;	Operator	(Included in the work to be carried out by the operator)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 38	<u>Air quality degradation (odor emissions)</u> All waste must be properly stored in suitable containers to mitigate odor emissions.	Operator	(included in facility operating costs)
MMO 39	<u>Air quality degradation (particle and gas emissions)</u> When disinfecting the premises, avoid spraying insecticides during very dry and windy periods.	Operator	(Included in the work to be performed by the operator)
	Noise environment		
MMO 40	<u>Increased noise levels</u> Avoid high-speed vehicle traffic, obeying the established limits (60 km/h and 30 km/h) near and within localities;	Operator/Grain transporters	(Included in the work to be performed by the operator)
MMO 41	<u>Increased noise levels</u> Implement a noise monitoring program.	Operator	(included in the costs of facility operation costs)
MMO 42	<u>Increased noise levels</u> Perform regular maintenance on equipment and machinery, and use them only when strictly necessary.	Operator	(included in facility operating costs)
MMO 43	<u>Increased noise levels</u> Whenever possible, noisy equipment should be encapsulated or installed in enclosed areas to mitigate the noise levels generated.	Operator	(included in facility operating costs)
	Socioeconomics		
MMO 44	<u>Boosting the local economy and associated sectors</u> Materials to support the facilities at this stage should preferably be purchased on the local market;	Operator	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 45	<p><u>Boosting the local economy and associated sectors</u></p> <p>Stipulate fair and competitive prices for grain purchases, which encourage increased production by individual farmers and existing cooperatives</p>	Operator/Local administration	(included in facility operating costs)
MMO 46	<p><u>Job creation</u></p> <p>The creation of new unskilled jobs should primarily benefit the populations in the immediate vicinity of the infrastructure;</p> <p>All labor employed by the terminal will comply with the provisions of international conventions on the protection of children's and workers' rights to which Angola is a signatory through the International Labor Organization (ILO), as well as the provisions of the AfDB's Integrated Safeguards System, namely Operational Safeguard 5.</p> <p>5.</p>	Operator	(included in facility operating costs)
MMO 47	<p><u>Boosting the local economy and associated sectors</u></p> <p>Providing technical support and knowledge of good agricultural practices to the most disadvantaged populations</p> <p>disadvantaged populations, in order to obtain higher yields and strengthen crops, thereby contributing to the fight against poverty.</p>	Operator/NGOs/Local administration	USD 20,000/month
MMO 48	<p><u>Increased inconvenience for the local population</u></p> <p>Vehicles must comply with the speed limits (60 km/h and 30 km/h) in and around within towns, avoiding the use of audible signals that disturb residential areas;</p>	Grain operators/transporters	(Included in the work to be performed by the operator)
MMO 49	<p><u>Increased food availability</u></p> <p>Food must be made available in accordance with quality standards to promote the health and well-being of consumers;</p>	Grain Operator/Transporters	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 50	<u>Accident risks</u> Vehicles must comply with the speed limits (60 km/h and 30 km/h) near and within towns;	Grain operators/transporters	(Included in the work to be performed by the operator)
MMO 51	<u>Accident risks</u> Training and qualification in occupational health and safety, and availability of PPE and CPE.	Operator	(included in the costs of facility operation)
MMO 52	<u>Accident risks</u> Training and awareness campaigns on defensive driving	Operator/Grain transporters of grain	(included in the costs of facility operation costs)
MMO 53	<u>Appraisal of agricultural land in the region</u> The local administration must guard against land price speculation;	Operator/Local administration	(Included in the work to be carried out by the operator)
	Infrastructure		
MMO 54	<u>Pressure on the road network</u> Comply with the established speed limits (60 km/h and 30 km/h) near and within towns, and reduce speed on unpaved roads;	Operator/Grain transporters	(Included in the work to be performed by the operator)
MMO 55	<u>Pressure on the road network</u> Training and awareness campaigns on defensive driving	Operator/Grain transporters of grain	(included in the costs of facility operation costs)
MMO 56	<u>Pressure on the road network</u> Transport goods at pre-established times, avoiding congested routes whenever possible;	Grain operator/transporters	(Included in the work to be performed by the operator)
MMO 57	<u>Pressure on urban infrastructure (water, energy, and sanitation)</u> Water abstraction must be preceded by authorization from the competent local authority, and specific measures must be adopted for its management;	Proponent	(included in facility operating costs)

ID	MITIGATION MEASURES	RESPONSIBILITY	COSTS (USD)
MMO 58	<u>Pressure on urban infrastructure (water, energy, and sanitation)</u> Wastewater must be properly stored in appropriate containers in a safe area, and its collection, treatment, and disposal must be carried out by a company duly licensed for this purpose.	Proponent	(included in facility operating costs)
MMO 59	<u>Pressure on urban infrastructure (water, energy, and sanitation)</u> Monitor water and energy consumption and waste production, drawing up a plan to reduce them.	Proponent	(included in facility operating costs)
	Waste		
MMO 60	<u>Risks of environmental contamination</u> Develop and implement a waste management plan	Proponent	(included in the costs of facility operation costs)
MMO 61	<u>Risks of environmental contamination</u> All hazardous waste derived from machine maintenance must be stored in a suitable location and sent to a licensed company for final disposal.	Proponent	(included in facility operating costs)
MMO 62	<u>Risks of environmental contamination</u> Install equipment (recycling bins) that facilitates the segregation and reuse of waste in accordance with the waste management plan (WMP), and encourage practices aimed at reducing waste production;	Proponent	(included in facility operating costs)
MMO 63	<u>Risks of environmental contamination</u> Prohibit the burning of any type of waste in the open air and/or its disposal in landfills.	Proponent	(Included in the work to be carried out by the operator)

9 CUMULATIVE IMPACTS

The cumulative effects of the project refer to the combined impact of the activities of the Lobito Ocean Terminal over time, added to the impacts of other developments and activities in the region. These effects can be synergistic, when they interact and amplify each other, or additive, when they simply add to existing impacts.

This section summarizes the significant residual impacts that were identified for the construction and operation phases of the infrastructure in Chapter 7. Thus, residual impacts are those that remain significant after the application of the mitigation and enhancement measures proposed in Chapter 8.

Given the nature of the terminal, the main cumulative effects include changes in air quality due to atmospheric emissions and particle dispersion, impacts on water resources resulting from consumption and effluent disposal, and possible consequences for local biodiversity. In addition, increased heavy vehicle traffic and economic activity may generate additional challenges related to noise, road safety, and urban infrastructure.

The assessment of cumulative effects is essential to ensure that the implementation and operation of the project occur in a sustainable manner, preventing irreversible impacts and promoting effective mitigation measures. To this end, an integrated approach to environmental monitoring, emissions control, waste management, and dialogue with local communities will be adopted, ensuring a balance between economic development and environmental conservation.

10 PROGRAM FOR MONITORING AND TRACKING ENVIRONMENTAL AND SOCIAL IMPACTS

Monitoring consists of establishing discrete or continuous measurements of the numerical attributes of each impact. Follow-up consists of observing environmental quality after a given action. The frequency of actions varies for each impact and for each phase of the project. The objectives of these actions are to verify the efficiency of each mitigation measure established for each impact, and to maintain and/or restore environmental balance.

This EIA encourages the business group to adopt and develop measures aimed at achieving better environmental and social performance in the execution of its activities, in order to achieve excellence in relation to its environmental policy, following the exemplary model that has been implemented in the other units of this business group.

Thus, the following monitoring and follow-up programs were proposed:

- 1) Program for monitoring effluents stored in septic tanks
- 2) Worker health and safety program
- 3) Atmospheric emission and air quality monitoring program
- 4) Noise level monitoring program
- 5) Environmental education program
- 6) Waste monitoring and management program.
- 7) Biodiversity monitoring program
- 8) Emergency plan
- 9) Pest control and management plan
- 10) Communication and stakeholder relations program.
- 11) ESIA monitoring report submission mechanism
- 12) Environmental and social performance audits

11 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

11.1.1 General considerations

The Environmental and Social Management Plan (ESMP) for the Lobito Ocean Grain Terminal establishes guidelines, preventive measures, and corrective actions to ensure that the construction and operation of the project are conducted in an environmentally sustainable and socially responsible manner.

The main objective of this plan is to mitigate the potential environmental and social impacts resulting from the installation and operation of the terminal, ensuring compliance with current legislation and international best practices in environmental management. In addition, it seeks to promote worker safety, the quality of life of local communities, and the conservation of the region's natural resources.

The implementation of the PGAS involves a set of programs and measures aimed at monitoring environmental quality, controlling atmospheric emissions, proper waste management, protecting biodiversity, occupational safety and health, and strengthening dialogue with stakeholders. The integrated approach of this plan will minimize environmental and social risks, contributing to the sustainability of the project and the socioeconomic development of the region.

This chapter details the main components of the PGAS, including institutional responsibilities, monitoring and reporting mechanisms, and environmental mitigation and compensation strategies. Strict adherence to these guidelines will ensure that the Lobito Grain Terminal operates in accordance with the principles of sustainability, promoting a balance between economic growth, environmental preservation, and social well-being.

11.2 MONITORING PROGRAM FOR EFFLUENTS STORED IN SEPTIC TANKS

11.2.1 Objective

- Ensure that effluents stored in septic tanks comply with environmental standards;
- Reduce environmental impacts and protect water resources and public health;
- To assess the efficiency of the facility's sanitary sewage treatment system;
- Identify possible contamination and propose corrective measures.

11.2.2 Justification

- Improper storage of effluents can result in soil infiltration and groundwater contamination;
- Inadequate decomposition of organic matter can generate odors and proliferation of disease vectors;
- Compliance with environmental and health regulations prevents penalties and protects the local community.

11.2.3 Parameters to be analyzed and monitoring frequency

The following parameters should be analyzed regularly:

Table 49: Parameters to be analyzed and frequency of monitoring

Parameter	Unit	Frequency	
		Construction phase	Operational phase
PH	-	Monthly	Quarterly
BOD (Biochemical Oxygen Demand)	mg/L	Monthly	Quarterly
COD (Chemical Oxygen Demand)	mg/L	Monthly	Quarterly
Total Suspended Solids (TSS)	mg/L	Bimonthly	Quarterly
Nitrates and Nitrites	mg/L	Bimonthly	Semiannual
Thermotolerant Coliforms	NMP/100mL	Monthly	Quarterly
Oils and greases	mg/L	Quarterly	Semiannual

11.2.4 Monitoring methods

- Sample collection: Use of sterilized bottles in accordance with environmental standards;
- Laboratory analysis: Samples must be analyzed by a certified laboratory, applying standardized methodologies, such as:
 - Potentiometric method for pH;
 - Winkler method for BOD;
 - Spectrophotometry for COD and nitrates/nitrites;
 - Filtration and incubation technique for coliforms.
- On-site measurements: Checking effluent levels and observing odors and signs of leakage. The installation of high-level alarms can also warn when the septic tank is about to reach its maximum capacity.
- Periodic cleaning of the septic tank, usually every 1-3 years, is essential to remove accumulated sludge.

11.2.5 Responsibilities

Contractor: Responsible for monitoring during the construction phase. **Carrinho, SA:**

Responsible for implementing the program during the operational phase. **Local environmental**

agency: Conduct periodic inspections and audits.

Accredited laboratory: Analysis of samples and issuance of technical reports.

11.3 WORKER SAFETY AND HEALTH PLAN

11.3.1 Objective

- Ensure the physical and mental integrity of workers during the construction and operation phases of the silos;
- Prevent workplace accidents and minimize occupational risks;
- Ensure compliance with current occupational safety and health standards;
- Promote a safe and healthy work environment.

11.3.2 Justification

The construction and operation of silos involve risks such as falls, exposure to dust, high noise levels, inhalation of toxic gases, and handling heavy machinery.

- The adoption of preventive measures reduces accidents and absences due to occupational illnesses;
- Compliance with labor and environmental legislation to avoid penalties and ensure the well-being of workers.

11.3.3 Parameter to be analyzed and frequency of monitoring

Table 50: Parameters to be analyzed and frequency of monitoring

Parameters	Unit/indicator	Frequency	
		Construction phase	Operation phase
Work accidents	Number of occurrences	Monthly	Quarterly
Absenteeism rate	%	Monthly	Semester
Ergonomic conditions	Qualitative assessment	Quarterly	Semiannual
Noise level	dB(A)	Monthly	Quarterly
Air quality (dust, gases)	mg/m ³	Monthly	Half-yearly
Use of personal protective equipment (PPE)	% compliance	Monthly	Monthly
Safety training	Number of training sessions held	Bimonthly	Semester

11.3.4 Monitoring method

- Periodic inspections at workplaces to identify risks;
- Laboratory analyses of air and noise to assess environmental quality;
- Reports on occupational accidents and illnesses for control and continuous improvement;
- Training and awareness-raising for workers on safe practices;
- Use of PPE such as masks, gloves, ear protectors, and safety belts;
- Implementation of safety signage in hazardous areas;
- Regular occupational medical examinations to monitor workers' health.

11.3.5 Responsibilities

Contractor: Responsible for worker safety during the construction phase.

Carrinho, SA: Responsible for implementing the plan during the operational phase.

Occupational Safety Technician: Monitoring, training, and enforcement of safety standards.

Supervisors and managers: Ensuring compliance with preventive and corrective measures.

Workers: Follow safety guidelines, use PPE, and report hazards.

Regulatory authorities: Conduct inspections and audits in accordance with current legislation.

11.4 ATMOSPHERIC EMISSIONS AND AIR QUALITY MONITORING PROGRAM

11.4.1 Objective

- Assess and control atmospheric emissions from silo construction and operation activities;
- Ensure that air quality is within legal and recommended limits for public health and the environment;
- Identify sources of pollution and implement mitigation measures to minimize negative impacts;
- Prevent respiratory risks to workers and nearby communities.

11.4.2 Justification

During the construction phase, activities such as soil movement, material transport, and the use of machinery generate airborne particles (dust) and polluting gases (CO₂, NO₂, SO₂).

During the operational phase, grain handling, exhaust from transport engines, and silo ventilation processes can release particulate matter and gases that affect air quality.

Regular monitoring allows pollution patterns to be detected and operational practices to be adjusted to reduce impacts.

11.4.3 Parameter to be analyzed and monitoring frequency

Table 51: Parameters to be analyzed and monitoring frequency

Parameters	Unit/indicator	Frequency	
		Construction phase	Operation phase
Particulate matter (PM ₁₀ , PM _{2.5})	µg/m ³	Monthly	Quarterly
Sulfur dioxide (SO ₂)	ppm	Monthly	Semiannual
Nitrogen oxides (NO _x)	ppm	Monthly	Semiannual
Carbon monoxide (CO)	ppm	Monthly	Semiannual
Carbon dioxide (CO ₂)	ppm	Monthly Quarterly	Semiannual
Volatile organic compounds (VOCs)	ppm	Monthly Quarterly	Semiannual
Odors (grain decomposition)	Qualitative assessment	Whenever necessary	Quarterly

11.4.4 Monitoring method

- Direct measurements with portable equipment for CO, NO₂, SO₂, and VOCs;
- Sampling with air filters for laboratory analysis of particulate matter;
- Continuous monitoring at strategic points in and around the facility to assess pollutant dispersion;
- Use of fixed sensors for automatic real-time measurements (if applicable);
- Periodic reports for trend analysis and operational adjustments.

11.4.5 Responsibility

Contractor: Responsible for implementing control measures during the construction phase.

Carrinho, SA: Responsible for continuous monitoring and application of mitigation measures during the operational phase.

Environmental Technician: Sample collection, data analysis, and report preparation.

Environmental and Regulatory Agencies: Conducting audits and enforcing compliance with environmental standards.

11.5 NOISE LEVEL MONITORING PROGRAM

11.5.1 Objective

- To assess and control the noise levels generated by the construction and operation of the silos;
- Ensure that noise levels are within legal and recommended standards for public health and community well-being;
- Identify sources of excessive noise and adopt mitigation measures to reduce negative impacts;
- Prevent occupational risks for workers exposed to high noise levels.

11.5.2 Justification

During the construction phase, activities such as soil movement, use of heavy equipment, transportation of materials, and assembly of structures can generate high noise levels, affecting workers and nearby residents.

During the operational phase, the operation of fans, exhaust fans, engines, and truck traffic can result in noise levels above acceptable limits. The project intervention area, which is characterized as a residential area, is 55 dB(A) during the daytime (7:00 a.m. to 10:00 p.m.) and 45 dB(A) at night.

Continuous monitoring will allow trends to be assessed and corrective actions to be implemented to reduce noise impacts.

11.5.3 Parameter to be analyzed and monitoring frequency

Table 52: Parameters to be analyzed and monitoring frequency

Parameters	Unit/Indicator	Frequency	
		Construction phase	Operation phase
Sound Pressure Level (Leq)	dB(A)	Weekly	Quarterly
Maximum Noise Peak (Lmax)	dB(A)	Weekly	Quarterly
Background Noise (L90)	dB(A)	Monthly	Semiannual
Noise Perceived by Workers	Qualitative assessment	Whenever necessary	Whenever necessary

11.5.4 Monitoring method

- Measurements with sound level meters at strategic points inside and around the facility;
- Continuous monitoring in sensitive areas (nearby residential areas, administrative offices);
- Use of portable equipment for spot measurements at different times of the day (daytime and nighttime);
- Comparison with legal limits established by environmental and occupational safety standards;
- Periodic reports for trend analysis and adjustments to operations.

11.5.5 Responsibility

Contractor: Responsible for monitoring and controlling noise during the construction phase.

Carrinho, SA: Responsible for monitoring and mitigating noise levels during the operational phase.

Environmental and Occupational Safety Technician: Collection of samples, data analysis, and preparation of reports.

Environmental and Regulatory Agencies: Conducting audits and enforcing compliance with noise regulations.

11.6 ENVIRONMENTAL EDUCATION PROGRAM

11.6.1 Objective

- Raise awareness among workers and local communities about good environmental practices;
- Reduce environmental impacts associated with the construction and operation of silos;
- Promote the sustainable use of natural resources;
- Strengthen the culture of environmental safety and sustainability;
- Ensure compliance with environmental legislation and best practices.

11.6.2 Justification

During the construction phase, it is essential to train workers on waste management, emissions control, and environmental safety.

During the operational phase, environmental education will help maintain sustainable practices, prevent pollution, and involve the community in environmental actions.

11.6.3 Parameter to be analyzed and monitoring frequency

Table 53: Parameters to be analyzed and monitoring frequency

Parameters	Indicator	Frequency	
		Construction phase	Operation phase
Number of training sessions conducted	Number of sessions/month	Monthly	Quarterly
Worker participation	% of participation	Monthly	Quarterly
Topics covered	Content checklist	Semester	Annual
Community awareness actions	Number of events	Quarterly	Semiannual
Adoption of good environmental practices	Qualitative assessment	Quarterly	Semi-annual

11.6.4 Monitoring method

- Training and lectures on waste, water use, pollution, and environmental conservation;
- Distribution of educational materials (booklets, videos, banners);
- Practical training on waste segregation, environmental accident prevention, and workplace safety;
- Community actions such as tree planting and cleaning of public areas;
- Periodic evaluation through forms and interviews.

11.6.5 Responsibility

Contractor: Implementation of the program during construction.

Carrinho, SA: Continuation of the program during the operational phase.

Environment and Safety Technician: Coordination of activities and evaluation of results.

Local Environmental Agencies: Monitoring of compliance with environmental standards.

11.7 COMMUNICATION AND STAKEHOLDER RELATIONSHIP PROGRAM

11.7.1 Objectives

- Establish effective channels of communication between Carrinho, SA and stakeholders;
- Ensure transparency in the construction and operation of silos;
- Prevent and mitigate conflicts with local communities and regulatory bodies;
- Promote community involvement in the environmental and social management of the project;
- Respond quickly and efficiently to stakeholder concerns.

11.7.2 Justification

During the construction phase, it is necessary to provide information on temporary impacts such as noise, vehicle traffic, and waste management.

During the operational phase, ongoing dialogue will help manage expectations, prevent conflicts, and keep the community informed about environmental measures and socioeconomic opportunities.

11.7.3 Parameter to be analyzed and monitoring frequency

Table 54: Parameter to be analyzed and monitoring frequency

Parameters	Indicator	Frequency	
		Construction phase	Operation phase
Meetings with stakeholders	Number of meetings held	Quarterly	Semiannual
Active communication channels	Number of channels implemented (telephone, email, meetings)	Continuous	Continuous
Complaints received and resolved	Number of records and resolution rate (%)	Monthly	Quarterly
Community involvement actions	Number of events or social projects developed	Quarterly	Semiannual
Dissemination of project information	Number of press releases or newsletters published	Semiannually	Semiannual

11.7.4 Methods

- Creation of communication channels (telephone, email, public meetings, information panels);
- Regular meetings with local authorities, communities, and other stakeholders;
- Dissemination of reports and bulletins on impacts and mitigation measures;
- Recording and analysis of complaints with structured responses and proposed solutions;
- Service platform for community questions and suggestions.

11.7.5 Responsibility

Carrinho, SA: Implementation and supervision of the program.

Community Relations Manager: Mediation between the company and stakeholders.

Environmental and Municipal Agencies: Monitoring and oversight of communication activities.

Community and Workers: Active participation in communication channels.

11.8 WASTE MONITORING AND MANAGEMENT PROGRAM.

11.8.1 Objective

- Ensure that solid and liquid waste is managed in an environmentally sound manner and in accordance with applicable legislation;
- Minimize environmental and health impacts resulting from the generation, storage, transportation, and final disposal of waste;
- Promote recycling, reuse, and proper disposal of waste, reducing the amount sent to landfills;
- Prevent soil, water, and air contamination associated with poor waste management;
- Monitor the effectiveness of waste segregation and disposal practices throughout the project's life cycle.

11.8.2 Justification

During the construction phase, debris, construction waste, packaging, hazardous waste (paints, solvents, oils), and organic waste from the work team will be generated. Proper segregation and disposal are essential to avoid environmental and social impacts.

During the operational phase, the silos will produce organic waste (spoiled grain), packaging from inputs, hazardous waste (lubricants, oils), and municipal solid waste from employees. Monitoring the management of this waste will prevent contamination and ensure environmental compliance.

11.8.3 Parameter to be analyzed and monitoring frequency

Table 55: Parameter to be analyzed and monitoring frequency

Parameters	Unit/indicator	Frequency	
		Construction phase	Operational phase
Volume of waste generated	kg/month	Monthly	Quarterly
Percentage of recyclable waste	%	Monthly	Quarterly
Amount of hazardous waste	kg/month	Monthly	Quarterly
Final disposal of waste	Documentary verification	Monthly	Quarterly
Storage conditions	Visual inspection	Biweekly	Monthly

11.8.4 Monitoring method

- Segregation at source: Implementation of identified containers for different types of waste;
- Record of waste generated: Documentary analysis of the quantities and types of waste collected;
- Regular inspections: Verification of correct storage and transport of waste;
- Final destination analysis: Checking manifests and licenses of treatment and disposal operators;
- Periodic reports: Preparation of documents containing monitoring data for internal control and environmental audits.

11.8.5 Responsibility

Contractor: Responsible for waste management during the construction phase, including segregation and disposal.

Carrinho, SA: Responsible for waste management during the operational phase, ensuring environmental compliance.

Environmental and Occupational Safety Technician: Responsible for monitoring and preparing reports.

Regulatory Agencies: Monitoring compliance with applicable environmental legislation.

11.9 BIODIVERSITY MONITORING PROGRAM

11.9.1 Objectives

- Assess the impacts of the construction and operation of the silos on local fauna and flora;
- Monitor possible changes in the region's ecosystems due to the project's activities;
- Identify and mitigate impacts on protected or endemic species;
- Ensure compliance with national and international environmental regulations;
- Promote biodiversity conservation and the sustainability of the project.

11.9.2 Justification

The construction and operation of silos can cause environmental disturbances, such as habitat loss, soil changes, and impacts on local wildlife;

- Monitoring biodiversity allows for the mitigation of negative impacts and the adoption of corrective measures to prevent environmental degradation;
- Meets legal requirements and good environmental practices required by regulatory bodies;
- Enables early detection of adverse impacts and the adoption of adaptive measures.

11.9.3 Parameters to be analyzed and monitoring frequency

Table 56: Parameters to be analyzed and monitoring frequency

Parameters	Unit/indicator	Frequency	
		Construction phase	Operation phase
Vegetation cover	% of vegetation removed vs. compensated areas	Semiannual	Annual
Terrestrial fauna	Record of species sighted and number of roadkill	Semiannual	Annual
Habitat quality	Degree of degradation of areas adjacent to the development	Quarterly	Annual
Presence of protected species	Occurrence of endangered species in the area of influence	Semiannual	Annual
Land use and habitat fragmentation	Extent of the impacted area	Semiannual	Annual

11.9.4 Methods

- Inventory of fauna and flora, comparing with data prior to the project;
- Monitoring using camera traps to identify mammals and birds in the area of influence;
- Analysis of vegetation cover using satellite images and drones to detect changes in vegetation;
- Interviews with local with and experts to assess changes in biodiversity;
- Monitoring of ecological corridors to verify impacts on wildlife movement;
- Periodic reports with recommendations for corrective actions.

11.9.5 Responsibility

Carrinho, SA: Responsible for implementing and financing the program.

Environmental Management Team: Coordinates the monitoring and implementation of mitigation measures.

Specialized Environmental Consulting: May be hired to conduct independent surveys and audits.

Local Environmental Agencies (Ministry of the Environment, Conservation Institutes, etc.):
Oversee and validate monitoring results.

Local Community and Environmental NGOs: Can contribute observations and information on changes in biodiversity.

11.10 EMERGENCY PLAN

11.10.1 Objectives

- Ensure the safety of workers, neighboring communities, and the environment in the event of incidents or disasters.
- Minimize the impacts of emergencies such as fires, hazardous product spills, explosions, structural collapses, and extreme weather events.
- Define clear procedures for rapid and effective response in emergency situations.
- Ensure compliance with national and international safety and environmental regulations.
- Train workers and stakeholders to act efficiently in emergencies.

11.10.2 Justification

- Grain storage can pose risks such as dust explosions, fires, environmental contamination, and structural collapse.
- The presence of heavy machinery and vehicles during construction and operation increases the likelihood of accidents.

- Compliance with environmental and safety regulations requires the implementation of emergency response plans.
- Proper preparation reduces financial, operational, and social risks arising from serious incidents.

11.10.3 Parameters to be analyzed and monitoring frequency

Table 57: Parameters to be analyzed and monitoring frequency

Parameters	Unit/indicator	Frequency	
		Construction phase	Operation phase
Fire risk	Storage conditions for flammable materials	Monthly	Quarterly
Explosion risk	Levels of dust suspended in silos	Monthly	Quarterly
Emergency training	Number of training sessions conducted and worker participation	Semiannual	Annual
Alert and response system	Alarm and firefighting system tests fire	Quarterly	Quarterly
Evacuation plan	Evacuation drills conducted	Semiannual	Annual
First aid	Verification of emergency kit availability	Monthly	Quarterly

11.10.4 Methods

- Development of an emergency response plan, detailing actions for each type of incident;
- Periodic training and simulations for workers and emergency response teams;
- Regular safety inspections to ensure that firefighting equipment, emergency exits, and ventilation systems are operational;
- Monitoring of air quality and airborne dust to reduce explosion risks;
- Continuous review of the plan to incorporate improvements based on audits and simulations;

- Coordination with local authorities and emergency services, ensuring a prompt response in case of need.

11.10.5 Responsibility

Cart, SA: Responsible for implementing and financing the plan.

Safety and Environment Team: Coordinates training, simulations, and maintenance of emergency equipment.

Local Emergency Services (Fire Department, Police, Health): Support incident planning and response.

Environmental and Safety Regulatory Agencies: Oversee the implementation of the plan and compliance with current legislation.

Workers and Community: Must be aware of the plan's guidelines and participate in training and simulations.

11.11 PEST CONTROL AND EXTERMINATION PLAN

11.11.1 Objectives

- Establish preventive and corrective measures to minimize pest infestation in grain storage silos.
- Ensure the quality and safety of stored products, preventing economic losses and risks to public health.
- Comply with health and environmental standards applicable to grain storage.

11.11.2 Justification

The presence of pests, such as insects, rodents, and fungi, can compromise grain quality, causing losses due to contamination, deterioration, and disease transmission. Continuous monitoring

allows for early detection and the adoption of effective measures to prevent the proliferation of these pests.

11.11.3 Parameters to be analyzed and monitoring frequency

Table 58: Parameter to be analyzed and monitoring frequency

Parameters	Unit/indicator	Frequency	
		Construction phase	Operational phase
Pest identification	Insects, rodents, and fungi	Biweekly inspections	Biweekly inspections
Storage conditions	Humidity, temperature, and ventilation	-----	Continuous monitoring
Effectiveness of control measures	Application of biocides and traps	-----	Monthly assessment
Incident log	Occurrence of infestations and corrective actions	-----	Quarterly reports

11.11.4 Methods

- Regular visual inspections of silos and adjacent areas.
- Use of traps and baits to capture and monitor pests.
- Laboratory analysis of samples to identify fungi and insects.
- Application of preventive measures, such as humidity control and sealing off access points.
- Use of pesticides and integrated pest management, prioritizing less toxic alternatives.

11.11.5 Responsibilities

Contractor: will be responsible for implementing pest prevention measures on organic materials and waste that may attract infestations.

Carrinho, SA: responsible for implementing the plan during the operational phase, including hiring specialized pest control services and training workers in identification and proper handling.

Health and Environmental Authorities: Periodic inspection of compliance with standards and good storage practices.

11.12 MECHANISM FOR SUBMITTING THE EIAS MONITORING REPORT

11.12.1 Objectives

- Ensure the environmental and social compliance of the project as defined in the Environmental and Social Impact Assessment (ESIA);
- Ensure transparency and accountability to regulatory authorities and stakeholders;
- Monitor the effectiveness of mitigation measures implemented during the construction and operation phases;
- Identify possible deviations and propose corrective actions to minimize environmental and social impacts.

11.12.2 Justification

During the construction phase, it is essential to monitor the implementation of environmental and social measures to mitigate temporary impacts.

During the operation phase, reports will enable the continuous assessment of environmental and social impacts, ensuring the sustainability of the project.

Continuous monitoring and reporting are legal and regulatory requirements that must be complied with by Carrinho, SA.

11.12.3 Parameter to be analyzed and monitoring frequency

Table 59: Parameter to be analyzed and monitoring frequency

Parameters	Indicator	Frequency	
		Construction phase	Operation phase
Implementation of mitigation measures	% of measures implemented in accordance with the EIAS	Quarterly	Semiannual
Waste management	Volume and type of waste managed Correctly	Monthly	Quarterly
Water quality	Laboratory analysis results	Quarterly	Semiannual
Air quality	Atmospheric emission levels compared to legal standards	Quarterly	Semiannual
Noise levels	Comparison with limits established in legislation	Monthly	Quarterly
Stakeholder engagement	Number of meetings and consultations held	Quarterly	Semiannual
Worker safety and health	Number of incidents and accidents	Monthly	Quarterly

11.12.4 Method

- Field data collection, including environmental and social measurements;
- Laboratory analysis of effluents, atmospheric emissions, and air quality;
- Photographic and documentary records to demonstrate compliance;
- Documentary review of waste records, complaints, and community services;
- Preparation of periodic reports detailing monitoring results and recommendations;
- Presentation of reports to environmental authorities and regulatory agencies, as well as relevant stakeholders.

11.12.5 Responsibility

Carrinho, SA: Responsible for preparing and presenting reports.

Environmental and Social Management Team: Collects data, performs analyses, and structures reports.

Regulatory Bodies (Ministry of the Environment, Municipal Authority, Financiers, etc.):

Receive and analyze reports.

Third-party environmental monitoring companies: Support in performing laboratory analyses.

Community and Workers: Contribute relevant information through communication channels.

11.13 ENVIRONMENTAL AND SOCIAL PERFORMANCE AUDITS

11.13.1 Objectives

- Assess the project's compliance with the environmental and social requirements established in the Environmental and Social Impact Assessment (ESIA);
- Identify non-compliance and propose corrective and preventive measures;
- Verify the effectiveness of the mitigation measures and monitoring programs implemented;
- Ensure compliance with current environmental and social legislation, as well as applicable international standards;
- Continuously improve the environmental and social management of the project.

11.13.2 Justification

During the construction phase, it is essential to ensure that activities are aligned with best environmental and social practices, minimizing negative impacts.

During the operational phase, audits enable the continuous assessment of environmental and social performance, ensuring the sustainability of the project.

Periodic audits are a legal requirement and a good practice to ensure transparency and credibility in project management.

11.13.3 Parameters to be Analyzed and Monitoring Frequency

Table 60: Parameter to be analyzed and monitoring frequency

Parameters	Indicator	Frequency	
		Construction phase	Operational phase
Legal and regulatory compliance	Percentage of compliance with environmental and social standards	Semiannual	Annual
Implementation of mitigation measures	Degree of execution of actions proposed in the EIAS	Quarterly	Semiannual
Waste management	Volume and type of waste managed correctly	Quarterly	Semi-annual
Water and effluent quality	Compliance of analyzed parameters with environmental standards environmental	Quarterly	Semiannual
Air quality and emissions	Atmospheric emission levels compared to legal standards	Quarterly	Semiannual
Noise levels	Comparison with limits established in legislation	Quarterly	Semiannual
Relationship with the community	Number of complaints and mitigation measures adopted	Half-yearly	Annual
Occupational health and safety	Number of accidents and compliance with safety standards	Quarterly	Semi-annual

11.13.4 Methods

- Field inspections to verify the implementation of environmental and social measures;
- Interviews with workers and stakeholders to assess perceptions and identify problems;
- Laboratory analyses of water quality, atmospheric emissions, and effluents;
- Document review of waste management, occupational safety, community outreach, and environmental monitoring records;
- Application of audit checklists based on legal and regulatory requirements;
- Preparation of audit reports containing conclusions, recommendations, and corrective action plans.

11.13.5 Responsibility

Cart, SA: Responsible for conducting audits and implementing corrective actions.

Environmental and Social Management Team: Coordinates audits and ensures that recommendations are implemented.

External Environmental Consultant: May be hired to conduct independent and impartial audits.

Regulatory Bodies (Ministry of the Environment, Municipal Authority, financiers, etc.):

Supervise and monitor reports and actions implemented.

Community and Workers: Can contribute information on observed environmental and social impacts.

11.14 COSTS OF IMPLEMENTING MONITORING PROGRAMS

The presentation of the costs associated with the implementation of the Monitoring Programs proposed in this environmental and social impact assessment (ESIA) is structured in two phases: Construction Phase and Operation Phase.

The financial costs related to the implementation of the monitoring programs during the construction phase will be borne by the contractor.

The costs of implementing the monitoring programs during the operational phase will be borne by Carrinho, SA.

Table 61: Program implementation costs

Programs	Estimated costs (annual)	
	Construction phase	Operational phase
Monitoring plan for effluents stored in septic tank	3,500 USD	8,200 USD
Worker health and safety plan	8,000 USD	10,000 USD
Program for monitoring emissions and air quality	12,000 USD	15,000 USD
Noise level monitoring program	4,500 USD	6,000 USD
Environmental education program	12,000 USD	18,000 USD
Biodiversity monitoring program	7,500 USD	9,000 USD
Emergency plan	8,000 USD	16,000 USD
Waste monitoring and management program	4,500 USD	\$8,000
Pest control and eradication plan		12,000 USD
Communication and stakeholder relations program	18,000 USD	22,000 USD
mechanism presentation of reports	10,000 USD	12,000 USD
EIAS monitoring reports		
Environmental and social performance audits		20,000 USD
Total	88,000 USD	156,200 USD

12 INSTITUTIONAL CAPACITIES AND STRENGTHENING PLAN

Angola is a country that offers effective guarantees of functioning as a rule of law, particularly with regard to security, compliance with legislation, and human rights, including gender equality, public participation in government decisions, sustainable economic opportunities, and social development in the areas of health, education, and welfare.

In this context, the implementation of major private infrastructure projects in Angola, such as the present project for the Grain Terminal, follows internationally recognized procedures adopted as a model in Western countries.

This process involves applying for international financing to bring the project to fruition. Once financing has been approved, Carrinho, SA holds an international public tender to select contractors in accordance with well-defined legal rules, guaranteeing the right to contest and request clarification.

With regard to construction supervision, Carrinho, SA also conducts international selection processes to choose inspection companies, which operate completely independently from the construction company. In addition to civil construction activities, supervision may also include environmental monitoring, ensuring the implementation of the project's environmental management guidelines.

On the other hand, at the governmental level, Angola has several regulatory institutions involved in these processes, such as the Ministry of the Environment, responsible for implementing environmental policies in a wide range of sectors (biodiversity, waste, natural resources, pollution, among others), in accordance with guidelines established by the democratically elected government. In addition, this body plays a crucial role in supervising the environmental and social impacts associated with large public and private projects.

In the most significant projects, the Ministry of Agriculture and Environment, as the national environmental impact assessment authority, begins by analyzing and approving the Environmental and Social Impact Studies of public or private initiatives, followed by monitoring compliance with the measures to mitigate the identified impacts.

It is also important to mention that state power in Angola is still centralized through municipal administrations, which hinders public management that is more attuned to local needs.

As for Carrinho, SA, as a private company and promoter of the Lobito Ocean Grain Terminal project, its main responsibilities in the area of Environmental Management are highlighted below, namely:

- ✓ Ensuring that the environmental and social management system is defined, applied, and maintained in accordance with the requirements of current standards;
- ✓ Informing line managers about the performance of the environmental and social management system for review, including suggestions for improvement;
- ✓ Ensuring that professionals under their supervision have the appropriate skills, whether through academic training, professional training, or practical experience;
- ✓ Identify training needs associated with environmental aspects and the environmental management system environmental management system, promoting training or other actions to meet these requirements;
- ✓ Develop, apply, and maintain procedures so that employees are aware of:
 - The importance of complying with the environmental policy, procedures, and requirements of the environmental management system;
 - The main environmental aspects and related impacts, actual or potential, linked to their activities, as well as the environmental benefits resulting from the improvement of their individual performance;
 - Their roles and responsibilities in ensuring compliance with the requirements of the environmental management system;
 - The possible consequences of non-compliance with established procedures.
- ✓ Develop, implement, and maintain processes to:
 - Facilitate internal communication between the various levels and sectors of the organization;
 - Receive, record, and respond to relevant communications from external stakeholders.

- Ensure that the environmental management system documentation contains information on environmental policy, objectives, targets, description of the scope of the environmental management system, main components of the system, and references to other related documents;
- ✓ Develop, implement, and maintain processes to:
 - Approve documents for suitability prior to issuance;
 - Review and update, whenever necessary, and validate documents;
 - Ensure that modifications and the current revision status of documents are identified;
 - Ensure that updated versions of applicable documents are accessible at the locations where they are used;
 - Ensure that documents remain legible and easily identifiable;
 - Ensure that external documents considered relevant by the organization are properly controlled;
 - Prevent the inadvertent use of outdated documents, ensuring that they are properly identified if they need to be retained for any reason;
 - Identify and plan operations associated with significant environmental aspects, in line with environmental policy, objectives, and targets, ensuring that they are carried out under previously established conditions.
- ✓ Define, apply, and maintain procedures to identify potential emergency situations and accidents that may cause environmental impacts, as well as ways to respond to such occurrences;
- ✓ Act promptly in real emergency situations and accidents, seeking to prevent or minimizing the associated adverse environmental impacts;
- ✓ Periodically review and, whenever necessary, update emergency preparedness and response procedures, especially after incidents have occurred;
 - ✓ Conduct regular tests of emergency response procedures, whenever feasible;
 - ✓ Develop, implement, and maintain processes to periodically monitor and measure the main characteristics of operations that may cause significant environmental impacts;

- ✓ Ensure that monitoring and measurement equipment is calibrated or verified, properly maintained, and that the corresponding records are archived;
- ✓ Establish, implement, and maintain procedures to regularly assess compliance with applicable legal requirements;
- ✓ Assess compliance with other requirements voluntarily assumed by the organization, combining this analysis with the assessment of legal compliance or creating specific processes for this purpose;
specific for this purpose;
- ✓ Implement processes to deal with actual and potential non-conformities, promoting corrective and preventive actions;
- ✓ Identify and correct non-conformities, taking measures to minimize their environmental impacts;
- ✓ Investigate the causes of non-conformities and implement actions to prevent their recurrence;
- ✓ Assess the need for preventive measures and take appropriate action to prevent future occurrences;
- ✓ Record the results of corrective and preventive actions implemented;
- ✓ Verify the effectiveness of the corrective and preventive measures adopted;
- ✓ Make necessary changes to the environmental management system documentation where applicable;
- ✓ Create and maintain essential records to demonstrate compliance with environmental requirements and verify the results obtained;
- ✓ Implement processes for the identification, storage, protection, retrieval, retention, and disposal of records;
- ✓ Ensure that records are legible, identifiable, and traceable;
- ✓ Implement the Terminal's Environmental and Social Management Plan;
- ✓ Suggest improvements for updating the Terminal's Environmental and Social Management Plan;
- ✓ Periodically review the environmental management system to ensure its continued suitability, adequacy, and effectiveness;

- ✓ Conduct internal audits of the environmental management system at predefined intervals to verify its compliance with planned procedures and its effective implementation.

13 PUBLIC CONSULTATION AND PARTICIPATION

13.1 GENERAL CONSIDERATIONS

Public consultations are national and international requirements in the construction, operation, and decommissioning of any project to be developed. Public consultations are one of the fundamental pillars of the Environmental Impact Assessment (EIA) process and are a legal requirement established by **Presidential Decree No. 117/20 of April 22**, which approves the Regulation on the Environmental Impact Assessment Procedure in Angola. This process aims to ensure the informed and active participation of stakeholders, promoting transparency and the integration of social, environmental, and economic interests in decision-making on the implementation of projects with potential environmental impact.

13.2 PURPOSE OF PUBLIC CONSULTATIONS

In the context of this project for the Construction of Agricultural Infrastructure "Silos," the public consultations have the following objectives:

- Inform local communities, administrative authorities, and other stakeholders about the objectives, nature, location, and potential impacts of the project;
- Gather opinions, concerns, suggestions, and local knowledge that can contribute to the improvement of mitigation measures and the design of the project itself;
- Promote dialogue and the inclusive involvement of all relevant actors in order to strengthen social acceptance of the project and prevent future conflicts.
- Compliance with operational safeguard 1 of the bank financing the projects, etc.

13.3 LEGAL FRAMEWORK

Public consultations in the Environmental Impact Assessment (EIA) process are legally supported by Angolan law and are a mandatory and essential step to ensure the democratic and informed participation of communities and other stakeholders in the assessment of projects with potential environmental impact.

The main legal instrument governing this matter is Presidential Decree No. 117/20 of April 22, Regulation on the Environmental Impact Assessment Procedure

This decree establishes the principles, phases, and requirements of the EIA procedure and clearly defines the role of public consultations as a mechanism for participation and social inclusion. The following relevant points are noteworthy in this regard:

- **Article 20 (Public Participation):**

It establishes that the EIA process must ensure effective public participation, particularly by communities directly affected by the project, through appropriate consultation and communication mechanisms.

- **Article 21 (Public Consultation):**

Defines that public consultation must be carried out during the preparation of the Environmental Impact Study and/or during the technical analysis by the licensing authority. Responsibility for its organization and implementation lies with the project proponent, in coordination with the competent environmental authority.

- **Article 22 (Documentation and Dissemination of Public Consultation):**

Requires the proponent to prepare a **Non-Technical Summary of the EIA**, in clear and accessible language, to be made available to the public. The consultation must be widely publicized **at least 15 days in advance**, using effective means such as local radio stations, public notices, community networks, among others.

- **Article 23 (Public Consultation Report):**

Requires the preparation of a report containing the main comments, questions, and suggestions gathered during the process, as well as the responses given and any changes to the project or study based on the contributions received. This report must be included in the assessment process and submitted to the Ministry of the Environment.

In addition to Decree No. 117/20, the **Basic Environment Law** (Law No. 5/98 of June 19), in its Article 10, also enshrines the principle of **public participation** as a right of citizens and a duty of the State, guaranteeing access to information and the involvement of citizens in environmental protection and management.

13.4 METHODOLOGY

The methodology adopted for conducting public consultations within the scope of this Environmental Impact Assessment (EIA) aims to ensure inclusion, transparency, access to information, and effective participation of stakeholders, as established in **Article 21** of Presidential Decree No. 117/20 of April 22.

1. Identification of Stakeholders

The process begins with the identification and mapping of stakeholders, including:

- Potentially affected local communities;
- Traditional and administrative authorities (communal and municipal administrations);
- Civil society organizations (agricultural, environmental associations, etc.);
- Representatives of vulnerable groups (women, youth, the elderly);
- Relevant technical entities and government institutions.

2. Preparation and Dissemination of Information

A non-technical summary of the EIA was prepared in clear and accessible language. It was disseminated through:

- Announcements on community radio stations and social media accounts of the respective administrations;
- Communication with local authorities and community leaders;
- Delivery of physical copies of the summary to easily accessible locations (municipal administration).

3. Holding of Public Consultation Sessions

The sessions will be held in person, in the communities covered by the project's area of influence, with the following structure:

- Presentation of the project and its objectives;
- Presentation of the main environmental and social impacts identified;
- Discussion of the proposed mitigation measures;
- Opportunity for questions, comments, and recommendations from participants.

During the sessions, representatives of the proponent, the EIA technical team, local authorities, and, where applicable, representatives of the Ministry of the Environment or delegated body will be present.

EIA technical team, local authorities and, where applicable, representatives of the Ministry of the Environment or delegated body.

4. Registration and Processing of Contributions

All contributions from participants will be recorded in writing or on audio/video, with the necessary consent. A Public Consultation Report will be prepared, containing:

- List of participants and entities represented;
- Summary of issues raised;
- Responses provided by technical experts;
- Analysis of the integration of suggestions into the final version of the EIA.

5. Submission of the Report to the Competent Authorities

The public consultation report will be submitted together with the complete Environmental Impact Assessment to **the Ministry of the Environment** as part of the licensing process, in compliance with national legislation.

13.5 SUMMARY OF EVENTS HELD

As part of the consultation process with the various stakeholders in the Agricultural Infrastructure Construction Project "Silos" in the province of Benguela, on June 13, 2025, the various local government entities associated with the municipalities where the projects will be implemented (Lobito, Balombo, and Ganda) were consulted, each with specific interests, in accordance with the AfDB requirements expressed in Operational Safeguard 1.

implemented (Lobito, Balombo, and Ganda), each with specific interests, in accordance with the AfDB requirements expressed in Operational Safeguard 1.

Among the local government institutions, the following were present:

- Provincial Vice-Governor;
- Administrator of Balombo;
- Administrator of Ganda (via Zoom);
- Administrator of Lobito (represented);
- Deputy Administrator for Technical and Infrastructure;
- Provincial Office for the Environment, Waste Management, and Community Services;
- Provincial Office for Integrated Economic Development;
- Provincial Office of Agriculture, Livestock, and Fisheries;
- Provincial Office for Infrastructure and Technical Services (represented);
- Media Office of the Provincial Government of Benguela.

The provincial environment department is a stakeholder in the project, acting as a supervisory body that will monitor the project's development, especially during the construction and operation phases.

The administrators, as the entity responsible for municipal administration and therefore representing the population of Lobito, Balombo, and Ganda, will be interested in learning about and monitoring the development of the construction and operation of agricultural infrastructure.

However, to facilitate the discussions, the proposed topics were presented concisely, adding the importance of sharing environmental and social safeguard documents related to the potential risks and impacts of the project.

Considering the interest of the participants, some concerns and contributions arose, which are summarized below:

The Administrative Bodies (Lobito, Balombo, and Ganda) highlighted the following elements:

Balombo Municipal Administration: Expressed gratitude, mentioning that the municipality already has experience with "Carrinho Agri" and has land available for infrastructure. The Administrator considers the project to be of great benefit and will provide all the support necessary to ensure its implementation.

Lobito Municipal Administration: The Lobito Administration highlighted the strategic advantage of being a port city, with designated hinterland areas. The municipality eagerly awaits the start of the project, believing it will bring significant value to local communities.

Ganda Municipal Administrator: It was clarified that the project aims to increase the current grain storage capacity from 8,000 tons to 28,000 tons.

Provincial Office for Integrated Economic Development: The Provincial Office for Integrated Economic Development emphasized the project's alignment with the challenge of food self-sufficiency. It also highlighted the importance of the project's focus on production, storage, and processing in order to ensure grain quality and food security.

Provincial Office for the Environment, Waste Management, and Community Services: Expressed the importance of consulting with communities, reiterating that the project is extremely important and will bring great benefits. In terms of environmental impact, the project does not have any significant impacts.

Provincial Office of Agriculture, Livestock, and Fisheries: Expressed great optimism about the project, believing that it will address fundamental problems and guaranteeing the full support of the agricultural sector for its implementation.

Once the discussions had been concluded and the issues raised clarified, the Carrinho, SA Group Team (i) reaffirmed its willingness to continue dialogue with the Provincial Government and the Municipal Administrations concerned; (ii) shared the presentation and other supporting documents; and (iii) noted the need to work with the Provincial Government of Benguela in due course on the action plan within the framework of its social responsibility;

Note: For proof of the activity described, see Annexes V, VI, and VII.

14 TECHNICAL AND KNOWN GAPS

In general, the difficulties encountered during the preparation of this study are related to the lack of detailed information on some environmental descriptors (fauna, flora, and socio-economics), which are fundamental for determining the environmental and social impacts of the project's implementation.

Another factor is that, on many occasions during the preparation and construction phase, deviations from the original project occur that cannot be taken into account during the preparation of the Environmental and Social Impact Study. All these reasons contribute to the estimation of the degree of uncertainty, the magnitude of which is frankly difficult to assess.

Despite the difficulties mentioned above, this Environmental and Social Impact Study of the Lobito ocean grain terminal was prepared with rigor and objectivity in assessing the potential impacts of its construction and operation, as well as the potential environmental and social factors to be affected, and mitigation measures were defined to avoid and mitigate adverse impacts and enhance positive impacts.

15 CONCLUSIONS AND RECOMMENDATIONS

The construction of silos for grain storage represents a strategic investment for modern agriculture, providing significant benefits in terms of storage, conservation, and management of agricultural products. Silos not only protect grains from adverse factors such as pests and moisture, but also allow farmers to store their crops for extended periods, increasing efficiency and maximizing profitability.

In addition, the implementation of advanced technologies in the design and operation of silos can further optimize storage safety and efficiency, contributing to sustainable agricultural practices. Therefore, when planning the construction of a silo, it is essential to consider not only the initial costs but also the long-term returns and the positive impact on the production chain.

It is worth highlighting the various benefits that this will bring to the local and surrounding community in terms of job creation and economic growth in various sectors.

In terms of the environment, this environmental and social impact study focused mainly on analyzing the descriptors that may be affected by the actions arising from the construction, operation, and decommissioning phases, either directly or indirectly. Mitigation and compensation measures were taken into account in order to minimize negative impacts and maximize positive ones.

During the construction phase, most of the impacts are considered to be negative and insignificant, with the most notable being those resulting from the use of the construction site and vehicle traffic, pressure on road infrastructure, dredging, and the construction of other buildings. However, positive direct and indirect impacts are also expected, resulting from the revitalization of associated sectors of activity and job creation.

During the terminal's operational phase, the negative impacts identified will also be insignificant and will relate to soil sealing and its allocation, visual impact due to the presence of the grain terminal in contrast to the surrounding area, degradation of air quality due to greenhouse gas emissions, alteration of the natural landscape, and pressure

on the electricity supply network and accessibility, use of the quay and maintenance garage, etc.

Significant positive impacts are also expected in terms of socio-economics, job creation, provision of various types of services, and stimulation of associated sectors, export and import of grain and other raw materials, etc.

During the decommissioning phase, although insignificant negative impacts similar to those that will occur during the construction phase have been identified, the positive impacts in this phase outweigh them. This is because once the terminal is decommissioned, the impact or pollution in the different descriptors analyzed is reduced and the probability of the environment returning to its undisturbed state increases.

According to the analyses carried out during this Environmental and Social Impact Study, the project is adequate in terms of environmental quality. The aspects identified as most vulnerable are subject to mitigation, requiring environmental control measures to be included in the executive project and correctly implemented.

It is recommended that those responsible for implementing the measures mentioned in this study apply them with the utmost rigor.

In short, the construction of grain silos is not only a practical solution, but an essential basis for food security and economic development in rural communities and beyond. Investing in grain storage infrastructure is investing in the future of agriculture.

Based on the study presented, no impact was identified that, in the opinion of the team that prepared this EIS, questions the environmental viability of the project under normal operating conditions, considering the implementation of the proposed mitigation measures. The positive impacts remain throughout the entire period of operation of the project.

16 BIBLIOGRAPHY

- LUIS AUGUSTO GRANDVAUX BARBOSA (1914-1983). Phytogeographic map of Angola
- DINIZ, A.C. (2002). Resources in Lands Suitable for Irrigation; 1st edition; Gráfica Europam, Lisbon.
- LEVY, J.Q. and CABEÇA, A.J (2006); Urban Solid Waste - Principles and processes; 1st Edition; Bidondesign; Lisbon.
- DECIVIL, DECEMBER 2006 (VERSION 05/28/07). *Guide for the Technical Assessment of Environmental Impact Studies Trade Sector*
- EFMA- 2nd EDITION, FEBRUARY 2008. Guide for preparing Environmental Impact Studies for EFMA projects
- AFONSO, G. (2019). Importance of the mangroves of São Tomé: perceptions and ecosystem services . *Master's Degree in Marine Ecology*. Lisbon.
- ALONGI, M. (2007). Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science*.
- BARBOSA, L. A. GRANDVAUX (1970). Phytogeographic Map of Angola. Institute of Scientific Research of Angola, Luanda.
- BARBOSA, L. A. GRANDVAUX (2009). Phytogeographic Map of Angola. Association of Portuguese Language Universities.
- COPQUE, C., CUNHA, R., SOUZA, F., (2009). Environmental characterization of the mangrove ecosystem on the east coast of Salinas da Margarida-Bahia (Brazil).
- DUKE, C.; MEYNECKE, O.; DITTMANN, S.; ELLISON, M.; ANGER, K.; BERGER, U.;
- CANNICCI, S.; DIELE, K.; EWEL, C.; FIELD, D.; KOEDMAN, N.; LEE, Y.; MARCHAND, C.;
- NORDHAUS, I. & DAHDOUH-GUEBAS, F. (2007). A world without mangroves? *Science*, 317: 41-43.

- HUNTLEY, J. (2023) Ecology of Angola: Terrestrial Biomes and Ecoregions. University of Porto Porto, Portugal.
- HUNTLEY, J. RUSSO, V. LAGES, F. & ALMEIDA N. F. (2019). Biodiversity of Angola. Art and Science.
- LEAL, M. & SPALDING, M. (2022). The State of the World's Mangroves 2022. Global Mangrove Alliance (GMA).
- GUIMARÃES, A. (2007). Multitemporal analysis of the mangrove surface of the of Pernambuco: The role of aquaculture in the conversion of mangrove areas into nurseries. Master's thesis. Federal Rural University of Pernambuco. Recife.
- GOSSWEILER, J. & MENDONÇA, F. (1939). Phytogeographic Map of Angola. Ministry Colonies Colonies, Lisbon, 242 pp.
- GOVERNMENT OF ANGOLA (2019). Draft National Strategy and Action Plan for Biodiversity - NBSAP, 2019-2025.
- MASIKE, S. (2014). Economic Assessment of the Mangrove Ecosystem in the Limpopo River Estuary . For the USAID Southern Africa Limpopo River Basin Resilience Program (RESILIM) Southern Africa.
- MINISTRY OF THE ENVIRONMENT (MINAMB) (2017). Strategic Plan for the Protected Areas System of Angola (PESAP). Luanda, Angola.
- MINISTRY OF URBAN PLANNING AND ENVIRONMENT (MINUA) (2006). First National Report National for the Conference of the Parties to the Convention on Biological Diversity. Strategy and Plan for Biodiversity (NBSAP).
- POPA (2018). Ministry of Fisheries and the Sea: Fisheries and aquaculture management plan Aquaculture Plan 2018-2022.
- PASCOAL, B. (2023). Contribution to knowledge of the fauna profile of the mangroves in Angola: Case study of the Morro dos Veados coast (Luanda). Faculty of Natural Sciences, Agostinho Neto University. Luanda.

- UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP) (2010). Global Mangrove
- Extent Much Smaller than Previously Estimated, Climate Change.
- SAENGER, P & BELLAN, M. (1995). The mangrove vegetation of the Atlantic Coast of Africa: a review, University of Toulouse, Toulouse, France. Copyright P Saenger 1995.
- SANTOS, C. (2007). Macroinvertebrate and fish communities associated with the Halodule wrightii (Ascherson, 1868) seagrass bed in Mussulo Lagoon, Angola (Ph.D. Thesis). University of Lisbon, 209 p.
- SOUZA, C.; DUARTE, L.; JOÃO, A. & PINHEIRO, A. (2018). Biodiversity and conservation of mangroves: bioecological and economic importance, Chapter 1: pp. 16-56. In: PINHEIRO, M. & TALAMONI, A. (Eds.). Environmental Education on Mangroves. São Vicente: UNESP, Institute of Biosciences, São Paulo Coastal Campus, 165 p.
- SPALDING, M. BLASCO, E. & FIELD, D. (1997). World Mangrove Atlas. The International Society for Mangrove Ecosystems, Okinawa, Japan. 17H pp.
- TAHAL (2010). National Coastal Zone Management Plan (PNOOC) – Atlas of the Angolan Coastline (AO-24480-R10-201). TAHAR Engineers and Consultants. November 2010.
- FARIA, V. V., M. T. MCDAVITT, P. CHARVET, T. R. WILEY, C. A. SIMPFENDORFER & G. J. P. NAYLOR. 2013. Species delineation and global population structure of critically endangered sawfishes (Pristidae). Zoological Journal of the Linnean Society 167: 136–164.
- FIGUEIREDO, E., SMITH, G., CÉSAR, J. (2009). The flora of Angola first record of diversity and endemism. Taxon 58(1): 233-236(4). International Association for Plant Taxonomy.
- FREEMAN, R. EDWARD (1984). Strategic Management: A Stakeholder Approach (in English).

- FREEMAN, R. EDWARD; REED, DAVID L. (1983). "Stockholders and Stakeholders: A new perspective on Corporate Governance." *California Management Review*. Accessed on October 21, 2021.
- GERALD BENDER & STANLEY YODER, WHITES IN ANGOLA ON THE EVE OF INDEPENDENCE: The politics of numbers, *Africa Today*, 21 (4), 1976, pp. 23-37. See also José Manuel Zenha Relá, *Angola entre o presente e o futuro*, Lisbon: Escher, 1992
- GIRI, C., OCHIENG, E., TIESZEN, L.L., ZHU, Z., SINGH, A., LOVELAND, T., MASEK, J. & DUKE, N. (2011). Status and distribution of mangrove forests of the world using earth observation satellite data (version 1.4, updated by UNEP-WCMC). *Global Ecology and Biogeography* 20: 154-159.
- GOVERNMENT OF ANGOLA (2019). Draft National Strategy and Action Plan for Biodiversity NBSAP, 2019-2025.
- HUNTLEY, B.J. 1974. Outlines of wildlife conservation in Angola. *Journal of the Southern African Wildlife Management Association* 4: 157-166.
- HUNTLEY, B.J., RUSSO, V., LAGES, F. & FERRAND, N. (2019). Biodiversity of Angola. *Science & Conservation: a Modern Synthesis*. SpringerOpen.
- NATIONAL INSTITUTE OF STATISTICS. Indicators on Employment and Unemployment, Annual Report of the Employment Survey in Angola 2019, Luanda, 2020.
- NATIONAL INSTITUTE OF STATISTICS. Survey of Expenditure, Income, and Employment in Angola 2018-2019, Analytical Report – Volume I, Luanda, 2020.
- NATIONAL INSTITUTE OF STATISTICS. Survey of Expenditure, Income and Employment in Angola 2018-2019, Results Tables – Volume II, Luanda, 2020.
- NATIONAL INSTITUTE OF STATISTICS. Multiple Indicator and Health Survey 2015-2016, Luanda, 2018.
- NATIONAL INSTITUTE OF STATISTICS. Population Projection 2014-2050, Benguela, 2016.
- NATIONAL INSTITUTE OF STATISTICS. General Population and Housing Census 2014, Benguela, 2016.
- IUCN STANDARDS AND PETITIONS SUBCOMMITTEE. (2014). Guidelines for using the IUCN Red List categories and criteria. Version 11. Prepared by the Standards and

PETITIONS SUBCOMMITTEE. AUGUST 7, 2021. IUCN (2021). The IUCN Red List of Threatened Species. Version 2021-2. <<https://www.iucnredlist.org>>

- KARIDOZO, M., LAGRANGE, K. & OSBORN, F.V. (2016). Assessment of the human wildlife conflict mitigation measures being implemented by the Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA) partner countries. Report to the KAZA TFCA Secretariat (BMZ No.: 2009 66 788 and BMZ No.: 2006 65 646), Kasane, Botswana.
- KEITH, D.A., FERRER-PARIS, J.R., NICHOLSON, E. AND KINGSFORD, R.T. (EDS.) (2020). The IUCN Global Ecosystem Typology 2.0: Descriptive profiles for biomes and ecosystem functional groups. Gland, Switzerland: IUCN.
- KNIGHT, M.H. 2019. African Rhino Specialist Group report. Pachyderm 60: 14–39.
- LANGE, G. (2013). BENTHIC COMMUNITIES IN WATERS OFF ANGOLA. Master's thesis Master's Degree in Marine Biology. University of Rostock, Germany. 86 pp.
- LAW No. 5/98, OF JUNE 19. Basic Environment Law.
- PRESIDENTIAL DECREE No. 194/11 OF JUNE 7. Liability for Environmental Damage.
- PRESIDENTIAL DECREE No. 261/11 OF OCTOBER 6. Water Quality.
- PRESIDENTIAL DECREE No. 190/12 OF AUGUST 24. Waste Management.
- DECREE No. 31/94 OF SEPTEMBER 5. Principles Aimed at Promoting Safety, Hygiene, and Health at Work.
- SOAPRO (2010). Environmental Impact Study of the Cruzeiro Fuel Station, Huambo
- AfDB (2022). Wastewater Management Study for the Coastal Cities of Benguela, Lobito, and Baía Farta
- NATIONAL INSTITUTE OF STATISTICS INE (2016). Final Results of the General Population and Housing Census (2014 Census) - Benguela Province.
- PLAN FOR MUNICIPAL DEVELOPMENT FOR LOBITO PDML (2012). Municipal Administration of Lobito.
- EXECUTIVE DECREE No. 128/04 OF NOVEMBER 23. Occupational Health and Safety Signage.

- PRESIDENTIAL DECREE No. 117/20. Regulation on Environmental Impact Assessment and Environmental Licensing Procedures
- COSTA E., DOMBO, A., PAULA M. (2009). Threatened Plants in Angola. Agostinho Neto University. Botany Center, Luanda-Angola.
- MINISTRY OF THE ENVIRONMENT (2006). Report on the General State of the Environment in Angola
- COSTA ESPERANÇA, MEDICINAL PLANTS OF ANGOLA, (2013). Center for , Agostinho Neto University, Luanda
- DINIZ, C. (2006). Mesological Characterization of Angola, Portuguese Institute for Development Support, Lisbon – Portugal.

WEBSITES CONSULTED.

- www.portalangop.co.ao
- www.wikipedia.org
- www.info-angola.ao
- http://www.welcometoangola.co.ao/_provincias

17 APPENDICES

- I. Business License;
- II. Publication in the Official Gazette;
- III. Location sketch;
- IV. Consulting Company Certificate Issued by the Ministry of the Environment.
- V. Minutes of the Public Consultation meeting
- VI. Public Consultation Attendance List
- VII. External communication

ANNEX IV-CONSULTANCY CERTIFICATE



REPÚBLICA DE ANGOLA

GABINETE JURÍDICO E INTERCÂMBIO

CERTIFICADO DE CONSULTORIA AMBIENTAL

N.º 14110503250

O Gabinete Jurídico e Intercâmbio do Ministério do Ambiente, atesta que foram cumpridas todas as formalidades legais conducentes ao Registo Técnico da Sociedade de Consultoria Ambiental HSG - CONSTRUCAO, ENG. E COMERCIO ,LDA, nos termos do Decreto Executivo nº 86/12, de 23 de Fevereiro de 2012, que aprova o Regulamento sobre o Registo Técnico de Sociedade de Consultoria Ambiental.

Emitida em, 29 de Abril de 2025	Válida até, 29 de Abril de 2026
---	---

Assinatura

MIRANDA AMBIDOS KIALA

(DIRECTOR DO GABINETE JURÍDICO E INTERCÂMBIO)



A autenticidade deste documento poderá ser verificada através dos passos a seguir:
1. Aceda ao Portal MINAMB (<https://sia.minamb.gov.ao/validacaodocumentos>)
2. Introduza o código RCONST-0T12NTYXNTG= no campo "Código de Validação"
3. Clique em "Pesquisar!"
Número do Certificado: 14110503250



ANNEX V-MEETING MINUTES

	ACTA DE REUNIÃO CONSULTA PÚBLICA: PROJECTO DE INFRA-ESTRUTURAS AGRÍCOLAS	 2030 CARRINHO
---	---	---

REUNIÃO DE CONSULTA PÚBLICA PARA APRESENTAÇÃO DO PROJECTO E INSTRUMENTOS AMBIENTAIS E SOCIAIS			
Província: Benguela	Municípios: Lobito, Balombo e Ganda		
1. OBJECTIVOS			
<ul style="list-style-type: none"> o Dar a conhecer o Projecto e as suas actividades associadas; o Recolher contribuições (feedback) e as eventuais sugestões, bem como eventuais preocupações sobre o projecto. 			
2. INFORMAÇÕES/TEMAS APRESENTADOS NA CONSULTA PUBLICA			
<ul style="list-style-type: none"> ▪ Apresentação dos instrumentos Ambientais e Sociais relevantes no Projecto; ▪ Componentes e respectivos objectivos do Projecto; ▪ Riscos e Impactos, Ambientais e Sociais referentes ao Projecto; ▪ Expectativas e Preocupações relativas a Projecto. 			
Local da Reunião:	Governo Provincial da Benguela	Benguela	
Data: 13/06/2025	Hora Inicio: 08h:30	Hora término: 12h:00	
3. SOBRE OS PARTICIPANTES			
Entidades/Orgãos Consultadas		Dono da Obra – Carrinho SA	
Vice-Governador Provincial, Adilson Dellany Martins Gonçalves; Administrador do Balombo- José Cambiete; Administrador da Ganda- Francisco Prata (via zoom);	Nº de Participantes (Consultados) (desagregados por sexo: 9 (Homens 8 e 1 Mulher)	Nome	Função
		Samuel Candundo	<i>Executive Board (ESG Committee Member)</i>
		Lissandro Filipe	<i>Administrative Director (ESG Committee Member)</i>
		Maria Filomena Silva Melo	<i>Director of Quality and Corporate Affairs (ESG Committee Member)</i>
		Euclides Calenga	Environmental, Social, Manager

Administrador do Lobito (representado) – Administrador adjunto Técnico e infraestrutura - António Alberto dos Santos César; Gabinete Provincial do Ambiente, Gestão de Resíduos e Serviços Comunitários -Marisa Kinzimba; Gabinete Provincial do Desenvolvimento Económico Integrado-Samuel Maleze Quinda; Gabinete Provincial da Agricultura, Pecuária e Pesca-Leilande da Costa; Gabinete Provincial de Infraestruturas e Serviços Técnicos (representado)- Adriano Paixão Mbinja; Gabinete de Comunicação Social do Governo Provincial de Benguela-Job Seque Seque Alfredo André.

Alede da Cunha

Compliance - Legal Affairs
Environmental and Social Requirements Specialist (Agriculture)

4. RESUMO DA ACTIVIDADE E PRINCIPAIS CONTRIBUTOS

Com intuito de dar a conhecer o Projecto de Infra-estruturas Agrícolas e suas respectivas componentes, bem como recolher sugestões inerentes á sua implementação, participaram os órgãos públicos da Administração (Lobito; Balombo e Ganda), conforme as datas acima referenciadas, de modo presencial.

No entanto, para facilitar os debates, foram apresentados, concisamente, as abordagens dos temas propostos, adicionado da importância da partilha dos documentos de salvaguardas ambientais e sociais, relacionados com os potenciais riscos e impactos do projecto.

Considerando o interesse dos participantes, surgiram algumas preocupações e contribuições das quais, de forma resumida, se apresentam a seguir:

Os **Órgãos da Administração (Lobito; Balombo e Ganda)** destacaram os seguintes elementos:

- **Administração Municipal do Balombo**-Expressou gratidão, mencionando que o município já possui experiência com a "Carrinho Agri" e dispõe de terrenos cedidos para infraestruturas. O Administrador considera que o projeto é um grande benefício e que assegurará todo o apoio para garantir a implementação do projecto.



ACTA DE REUNIÃO
CONSULTA PÚBLICA: PROJECTO DE INFRA-ESTRUTURAS AGRÍCOLAS



- **Administração Municipal do Lobito**-A Administração do Lobito destacou a vantagem estratégica de ser uma cidade portuária, com zonas de retro-porto já designadas. O município aguarda ansiosamente o início do projeto, acreditando que trará um valor significativo as comunidades locais.
- **Administrador Municipal da Ganda**- Ficou esclarecido que o projecto visa aumentar a capacidade actual de armazenamento dos grãos de 8 mil toneladas para 28 mil toneladas.
- **Gabinete Provincial do Desenvolvimento Económico Integrado**- O Gabinete Provincial do Desenvolvimento Económico Integrado, enfatizou o alinhamento do projeto com o desafio da autossuficiência alimentar. O Gabinete Provincial do Desenvolvimento Económico Integrado ressaltou a importância do projecto em se focar na produção, armazenamento e transformação de forma a garantir a qualidade dos grãos e a segurança alimentar.
- **Gabinete Provincial do Ambiente, Gestão de Resíduos e Serviços Comunitários**-Expressou a importância da auscultação com as comunidades, reiterando que o projeto é de extrema importância e trará grandes benefícios. Em termos de impacto ambiental, o projecto não apresenta impactos significativos.
- **Gabinete Provincial da Agricultura, Pecuária e Pesca**-Demonstrou grande otimismo em relação ao projeto, acreditando que este responderá aos problemas fundamentais e garantiu o apoio total do setor da agricultura para a sua concretização.

5. ENCONTROS DE CONSULTAS PÚBLICAS COM REPRESENTANTES DO GOVERNO DE BENGUELA: REGISTO FOTOGRÁFICO (SE AUTORIZADO)



6. EQUADRAMENTO LEGAL DO PROJECTO: LEGISLAÇÃO ANGOLANA RELEVANTE NESTA CONSULTA PÚBLICA

- Decreto Presidencial nº 200/22 de 23 de Julho de 2022 - O Plano Nacional de Fomento para a Produção de Grãos (PLANAGRÃO).
- Decreto Presidencial nº 117/20 de 22 de Abril de 2020 - Regulamento Geral de Avaliação de Impacte Ambiental e do Procedimento de Licenciamento Ambiental.
- Decreto Executivo n.º 87/12 de 24 de Fevereiro de 2012 - Regulamento de Consultas Públicas dos Projectos Sujeitos à Avaliação de Impacte Ambiental.



ACTA DE REUNIÃO
CONSULTA PÚBLICA: PROJECTO DE INFRA-ESTRUTURAS AGRÍCOLAS



7. DOCUMENTO PARTILHADOS PELO DONO DA OBRA COM AS PARTES INTERESSADAS NA CONSULTA PÚBLICA

- 1) Apresentação do Projecto Carrinho "Infra-Estruturas Agrícolas".
- 2) Políticas Grupo Carrinho – ESMS.
- 3) Standards (Procedimentos) "Chave" Grupo Carrinho – ESMS (Consulta Pública).
- 4) Resumo dos Relatórios Técnicos e Não Técnicos dos Estudos de Impacto Ambiental e Social (Subprojectos: Infraestruturas Agrícolas - Silos de Grão), referentes aos Municípios: Lobito, Balombo e Ganda.
- 5) Consulta Pública - Registo de Diálogo e Reclamação.

8. ASSINATURAS DOS PARTICIPANTES

Nome	Assinatura
Hilom Gonçalves	
Adriano	
Jose Machado	
Maria Fingir	
Samuel Malese Quinda	
António P. M. de Costa	
José Manuel A. André	
Samuel Gonçalves	
Simão José Furtado	
Rui Fraz de Sá	
Alade da Cunha	
Quelidos Calenga	
ADRIANO Paixão R. F. J.	

ANNEX VI-ATTENDANCE LIST



REPÚBLICA DE ANGOLA
Governo Provincial de Benguela

Gabinete do Vice-Governador para os Serviços Técnicos e Infra-Estruturas

LISTA DE PRESENÇA

DATA: ___/___/___

Nº	NOME	ORGANISMO	FUNÇÃO	CONTACTO	CORREIO ELECTRÓNICO
1	Adilson Cuncalves	GPB	IGSTI	923583554	adkellany@hotmail.com
2	André Alberto dos Santos Costa	AM	ADM. ADJ. Tec. Uda	935243436	andre.alberto.costa@gmail.com
3	Jose Carrabete	Secretariação N. Político	Secretário N. Político	983388994	jose.carrabete@gmail.com
4	Samuel Malote Quiñda	GPDEI	Director	922965506	malotequiñda@gmail.com
5	Machito P. K. da Costa	GPAGRSC	Director	923521867	machito.p.k.da.costa@outlook.pt
6	Adriano P. K. da Costa	GPAPP	Director	927380791	adriano.p.k.da.costa@gmail.com
7	José Roque Roque Chifredo André	GC3 / Gov. Angola	Chefe de Departamento	937075611	joseroque2000@gmail.com
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

Gabinete do Vice-Governador / Serviços Técnicos e Infra-estrutura
Governo Provincial de Benguela
Rua de Timor
Telef: 244 272254021
E-mail: svz.la@benguela.gov.ao
Benguela-Angola
www.benguela.gov.ao



ANNEX VII-EXTERNAL COMMUNICATION

07:46   

 Publicação de Governo Provincial de Benguela

 **Governo Provincial de Benguela** · Seguir
15 h · 

GOVERNO PROVINCIAL DE BENGUELA E GRUPO CARRINHO AVALIAM PROJECTO AGRÍCOLA

O Vice-Governador de Benguela, Adilson Gonçalves, recebeu uma delegação do Grupo Carrinho para analisar o Projecto de Infra-estruturas Agrícolas a ser implementado nos municípios do Lobito, Balombo e Ganda.

A reunião visou apresentar os Instrumentos Ambientais e Sociais do projecto e recolher contribuições das comunidades. A iniciativa prevê o aumento da produtividade agrícola, promoção do emprego local e mitigação de impactos ambientais.

O Vice-Governador destacou a importância do projecto para o desenvolvimento da província. O Grupo Carrinho, representado por Samuel Candundo, informou que as obras começarão após aprovação legal pelo Ministério do Ambiente.

O Governo Provincial reafirmou o compromisso com o desenvolvimento sustentável e conta com a participação activa das comunidades.

GABINETE DE COMUNICAÇÃO SOCIAL DO GOVERNO PROVINCIAL DE BENGUELA

 Alda Gouveia + 92 4 comentários 4 partilhas

 Gosto  Comentar  Partilhar

07:47



< Publicação de Governo Provincial de Benguela

3

Gosto

Comentar

Partilhar



3

Gosto

Comentar

Partilhar



4

Gosto

Comentar

Partilhar