PROCESL

STRATEGIC SANITATION PLAN OF
MOCÍMBOA DA PRAIA MUNICIPALITY

Phase IV
Environmental and Socio-Economic Studies and Levels of Demand

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MINISTRY OF PUBLIC WORKS AND HOUSING

WATER AND SANITATION INFRASTRUCTURES AUTHORITY

STRATEGIC SANITATION PLAN OF MOCÍMBOA DA PRAIA MUNICIPALITY

PHASE IV – ENVIRONMENTAL AND SOCIO-ECONOMIC STUDIES AND LEVELS OF DEMAND

EXECUTIVE SUMMARY

The **Environmental and Socio-Economic Studies and Levels of Demand** were developed under Phase IV of the Strategic Sanitation Plan (SSP), whose study area cover the Mocímboa da Praia municipality, part of the WASIS Project – Water Services and Institutional Support Project and funded by the International Development Association (IDA - World Bank) and by a grant from the Australian Government (AusAID).

Mocímboa da Praia municipality was elevated into the village category in 1959 by law 10/97, May 31. The municipality is located in the Northeast of the Province of Cabo Delgado, more specifically in the district with the same name (one of the 17 districts of the province). Its territorial area is divided into a municipal reserved area and 10 *bairros*: 1º de Maio, 30 de Junho, Buji, Cimento, Milamba, Muengue, Nanduadua, Nanchemele, Pamunda, Unidade, considering only as area of intervention the ten *bairros* of the municipality.

The study was developed with the purpose of integrating the environmental and social components in the decision making, in order to be a guiding document for defining the actions to be implemented in the SSP, bearing in mind that access to sanitation is a right for all and its current limitations have negative impacts on productive capacity, but especially in the quality of life and decent welfare of the communities.

To achieve this purpose, the adopted methodology obeyed to the following three phases:

- **Phase 1 – Preparatory works**, that corresponded to the collection, analysis and systematization of the information from various sources, on the one hand,

and on the other hand, to the preparation of two types of questionnaires (one addressed to the household and other addressed to people with disabilities).

- **Phase 2 – Field work**, which focused on the realization of 389 questionnaires (structured interviews), spread over each *bairro* of the municipality, according to their number of houses. The timing of data collection took place in five days, June 2014, by a local team. Field work also included the realization (semi-structured) of interviews with all *Secretarias de Bairro* (10, total number), the visit of schools and health care units in the municipality. Additionally, a field reconnaissance (observation of *bairros*) was performed.

- **Phase 3 – Study development**, where the gathered information in the previous phases ends with the development of the study itself.

QUESTIONNAIRE RESULTS

From the 389 questionnaires addressed to the households, 60.1% of the interviewed were women and the remaining 39.9% were men.

A **household** is constituted, on average, by 6.6 people (higher than 5 people, number of people usually considered in Mozambique). From the total covered population by the questionnaires (2,565 inhabitants), the results obtained demonstrate a balance between the number of men and women, where 47.8% are male and 52.2% female, i.e., 91.7 men in 100 women. The age structure of the household is indicative of a young population, where 54.3% are children (0-14 years) and youth (15-18 years), and only 1.3% have 65 years or more.

Were identified 35 **people with disabilities**, representing 1.4% of the target population (2,565 inhabitants), of which 40.6% have a physical disability, 28.1% a visual impairment, 21.9% a hearing impairment and 9.4% a mental disability. From the 35 detected cases of disability, only 51.4% (18 people) answered the questionnaire specifically developed for this group of people, verifying that most are women (63,2%). 55.6% of the respondents belonging to this group are between 19 and 64, which stated that 26.7% of this universe are children (0-14 years).

As for the **housing condition**, 78.9% of the dominant housing is “straw-huts” type. Much of the surveyed households (84.8%) supply their housing with water from unsafe sources (wells and river water, lake or pond). More than a half of the households (67.4%) claim to have access to sanitation in their homes and less than a half (40.4%) claim to have access to electricity in their homes.

Concerning to **economic status**, 3.6% of the households claim not to have any type of income and, on average, a household has 1.4 sources of income. Less than a half of the households (42.9%) claim of not having any durable good and, on average, a household has 1.2 durable goods. 52.4% of the households claim not to acquire every week non-essential food and, on average, a household purchases a non-essential food every week.

In terms of sanitation and especially with regard to **domestic wastewater**, 67.4% of the households claim to have access to sanitation in their homes, 50.8% have traditional latrines, 43.9% have improved latrines and only 5.3% have toilets (with or without cistern), verifying that more than a half of the households is satisfied with the existing sanitation option in their homes. The excreta are often rejected to a hole in the yard. Despite of the continuing efforts of local authorities to eradicate the practice of open defecation, a considerable number of respondents confirm that still continue practicing open defecation (25.8%) on the beach, in the bush or in the river, depending on the proximity to its houses. This practice is strongly associated with lack of latrines or toilets at home.

In relation to **stormwater**, more than a half of the households (53.0%) identified problems related to floods and have been reported that the stagnant water tends to remain for extended periods of time.

As for the **waste**, mainly of organic origin and green matter, its deposition is mostly performed in a hole at the yard, and was also verified that a significant percentage of people admit depositing his own waste at open air.

The results obtained regarding the **hygiene** habits were satisfactory, since the vast majority claim to wash their hands before meals and after using the toilet, using the soap in this task.

Finally, the majority of the households showed **willingness to pay** for an improved sanitation facility. Nevertheless, the analysis of a set of indicators, come to reveal an undeveloped economic level, concluding that the households will, in general, a low ability to pay for an improved sanitation facility.

BASELINE CONDITIONS

Regarding its **biophysical characterization**, Mocímboa da Praia municipality is part of a territory of rainy tropical savannah climate, characterized by a hot rainy season from December to April, and a dry and less hot season, from May to November. The average annual rainfall is 972.1 mm, and the average annual temperature is 26.9°C.

The terrain is relatively flat and low. The relief of the municipality is a little disaggregated by the hydrographic network, by itself, little dense and essentially represented by small courses of water of seasonal regime. This is a less favourable region for the use of groundwater, where the occurrence of groundwater is limited or deprived of groundwater resources.

Soils are generally of low fertility, where the groundwater level, located very near the surface, prevents the infiltration of rainwater, resulting in the rainy season the appearance of flood zones.

Its geographical location and biophysical characteristics make the Mocímboa da Praia municipality a territory susceptible to cyclones and floods, and extensive evidences were reported in the field, emphasizing the floods that occurred in April of this year, with material damages associated. The risk of erosion (coastal and soil) was also observed in the field, giving particular attention to soil erosion caused by rainfall intensity, where the main forms are manifested mainly with fissures in the soil, caused by huge amounts of water that are transported in a short period of time. The study area is considered vulnerable to the effects of climate changes, not only by their exposure to those extreme events, as well as the absence of physical resistance to the propagation when affected by extreme events; already predisposed by socioeconomic and demographic conditions itself; and the behavioural habits that influence people's ability to absorb the shock and adapt to returning to an acceptable state.

In **socio-economic** terms, Mocímboa da Praia municipality saw its population grow, between 1997 and 2007, at a much higher pace than the respective district, province and even in the national context. In 2014, the projections pointed to a population of 52,022 inhabitants, accompanied by a high population density, much higher than the respective district and province.

According to the interviews and field observation, agriculture and fishery are the dominant activities in Mocímboa da Praia municipality, where communities (particularly low-income) have their main source of food supply, and in the existence of surplus, some income source. Not least, the trade is also an important source of income. Poorly promoted, the Mocímboa da Praia municipality offers a reduced tourist offer making the economic agents not encouraged to invest.

As for **social facilities**, currently there are eight primary schools in the municipality and two secondary schools, with a network of health care composed of a rural hospital and two health centres, suggesting a lack of equipment and professionals to meet community needs. The collected data allows characterizing an epidemiological framework dominated by diseases, mainly caused by poor sanitation and inadequate

hygiene behaviours, with special emphasis on malaria and acute diarrheal diseases, constituting these last described diseases, the first cause of morbidity and mortality, especially in children.

With regard to **services**, the municipality doesn't benefit yet from a public domiciliary water supply system, lack that will quickly be overtaken with the entry into operation of the new water supply system of Mocímboa da Praia, conceived under the WASIS Project. Similarly to this service, Mocímboa da Praia municipality isn't served by any domestic wastewater network, and there are significant records of communities without access to sanitation. Currently, the Mocímboa da Praia stormwater drainage system, covers only a few parts of the central *bairros*, being insufficient to face the flood problems that the municipality records. It is also known that the solid waste management is a Municipal Council responsibility, having been detected failures in the management practiced. This reality may be the cause of the high percentage of unsatisfied respondents with the way that is handled the waste in their municipality.

The **current land use** of the municipality is a territory of clear urban characteristics resulting of the population growth verified in recent decades that has been a significant impact in occupation of the land, distinguishing between two types of distinct areas: urban area (central zone commonly designated the "*Cidade Cimento*"), ordered, housing mainly of blocks and wide avenues mostly asphalted, which is located much of the municipal and district public management; and peri-urban area (peripheral zone, which might be called by suburbs),of informal settlements, from different densities.

The developed work identified a distinct group of people who may be differentially or disproportionately affected in the absence of sanitation because of their disadvantaged or vulnerable status. Within that group are women, children, people with disabilities and low-income communities.

SYNTESIS

The municipal communities still define a vulnerable sort pattern to the lack of access to sanitation, to the extent that: i) the right to adequate housing that provides basic living conditions does not constitute an acquired condition for all, making communities more susceptible (or sensitive) to suffer damages due to the lack of sanitation; ii) its exposure to hazardous phenomena including floods, is a constant; iii) its resilience is constrained by a low economic level and behaviors are not always the most appropriate, because they simply do not have or know another way to do it.

LEVELS OF DEMAND

The evolution of demand was analysed for the project horizon of 15 years, i.e., 2030, and it's probable that the Mocímboa da Praia municipality will register, in the coming years, a considerable economic growth, accompanied by a positive population trend, in 2030, of 92,788 inhabitants. Following this socio-economic growth, it's expected that the volume of the produced daily wastewater will increase to a value about 20 times above current values, and is also expected that the amount of the produced solid waste will be about 50 beyond today record.

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PHASE IV – ENVIRONMENTAL AND SOCIO-ECONOMIC STUDIES AND LEVELS OF DEMAND

1 INTRODUCTION

The presented document, **Environmental and Socio-Economic Studies and Levels of Demand**, constitutes the Phase IV of a broader development study in the context of the current challenges in the water sector in Mozambique, particularly the Strategic Sanitation Plan (SSP), part of the WASIS Project – Water Services and Institutional Support Project and funded by the International Development Association (IDA - World Bank) and by a grant from the Australian Government (AusAID).

Recognizing that the access to **safe sanitation** (understood as a set of infrastructures, services and behaviours that result in hygienic separation of human excreta from human contact in a sustainable way) is a right for everyone and it's the duty of all, Government, Municipality, civil society, private sector and citizens to contribute progressively and sustainably the materialization of this right, giving greater priority to the most vulnerable sectors of the society.

Acknowledging that the current limitations of access to safe sanitation have negative impacts on productive capacity and, especially, in the quality of life of the citizens.

Aware of the results to be achieved with the development of SSP, whose implementation will be a *sine qua non* for ensuring environmental sustainability presented in Goal 7 of the Millennium Declaration (MD) and provide to the targeted communities a level of dignified welfare, the study presented here was developed in order to integrate a social and environmental component in the decision making, with the ultimate goal of improving the quality of the Plan.

To achieve this purpose, we tried to target an approach based on a dynamic environmental and socio-economic reflection of the territory under study - Mocímboa

da Praia municipality - in order to form a baseline which will guide the definition of the future development scenarios and the options to develop.

The outline procedure that originated the present document is structured into the following chapters:

1. **Introduction**, corresponding to the current chapter, which deals with the mainstay of empirical information, serving as a guiding point to understand the developed study, identifying the objectives that supports the analysis undertaken;

2. **Legal and Institutional Framework**, in which is identified the framework that governs the legal environment, and institutional actors that play a role in its protection;

3. **Geographic framework**, which is presented its location, from a geographical perspective of the study area;

4. **General Framework**, in which contextualizes the territory under study, in a macro scale;

5. **Methodology**, which describes the detailed methodology that guided the study development;

6. **Questionnaire Results**, chapter where the results from the processing and handling of the questionnaires are presented with a predefined sample;

7. **Baseline Conditions**, focused on the approach of a set of dimensions, in order to characterize the current situation from an environmental, social and economical point of view;

8. **Diagnosis**, developed as a result of the characterization of the current situation, constituting an exercise synthesis able to list attributes and limitations of the territory under study, as well as opportunities and threats that come from abroad.

9. **Synthesis**, where are synthesized the main aspects to retain from the characterization performed;

10. **Levels of Demand**, chapter where it's analyzed the evolution of demand for the project horizon (15 years), from which is estimated the domestic wastewater and solid waste productions.

11. **References**, which is presented the references that formed the support of the developed analysis**.**

In addition to the demonstrated results is embedded a set of attachments, in which are included the necessary elements to complement the aspects described in this study:

Annex 1 – Questionnaire addressed to the household;

Annex 2 – Questionnaire addressed to people with disabilities;

Annex 3 – Field worksheets;

Annex 4 – Photographic report.

2 LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Legal Framework

At a national level, the Constitution of the Mozambique Republic (CMR) defines the right of all citizens to live in a balanced environment and the duty to defend it (Article 90), being the state obliged to: i) promote initiatives to ensure ecological balance and the conservation and preservation of the environment to improve the quality of life; and ii) implement policies to prevent and control pollution and to integrate the environmental objectives in all public policies to guarantee to the citizens "The right to the environment in the framework of sustainable development" (article 117 º of CMR).

In this framework of sustainable development, a set of regulations in the environmental area were created, highlighting the **National Environmental Policy**, approved by Resolution No. 5/95 of 6 December, which establishes the bases of all existing supplementary environmental legislation and through which the Mozambican government recognizes, clearly and unequivocally, the interdependence between development and the environment, in order to promote and boost economic growth that is based, as much as possible, on the universal principles of sustainable development. Point 1 of the Article 2 promotes sustainable development through a compromise between the needs of socio-economic development and the environmental protection, so that the functional and productive capacities of resources are preserved for present and future generations.

The legal basis for the implementation of the National Environmental Policy is established in the **Environment Framework Law**, approved by Law No 20/97, 1 October, taking as the fundamental principle "(...) the right of all citizens to an ecologically balanced environment, favorable to your health, to your physical and mental well-being (...)". To this effect, prohibits the environment pollution by limiting "(...) the production, the soil and subsoil storage, the launch into the water or for atmosphere of any pollutant and toxic substances, or any other forms of environmental degradation (...). Since then, several other normative acts were produced, and they are summarized in **Table 2.1**.

Table 2.1 – National Legal Framework

Environment	
Decree Nº 45/04, of September 29	Approves the Regulation on the Process of Environmental and Social Impact Assessment (ESIA), as amended by Decree No. 45/2008, of November 4.

Ministerial diploma Nº 129/2006, of July 19	Approves the General Directive for the Preparation of the Environmental Impact Assessment (EIA).
Ministerial diploma Nº 130/2006, of July 19	Approves the General Directive for Public participation in Environmental Impact Assessment Process (EIA).
Land Use Planning	
Law Nº 19/07, of July 18	Approves the Land Use Law.
Decree Nº 23/08, of July 1	Approves the regulations of the Land Uses Law.
Decree Nº 60/06, of December 26	Approves the regulation for urban land use.
Ministerial diploma Nº 181/2010, of November 3	Approves Directive on the process of expropriation for the purposes of Land Management.
Water	
Law N.º 16/91, of August 3	Approves the Water Law.
Law N.º 4/96, of January 4	Approves the Law of the Sea.
Decree Nº 18/04, of June 2	Approves the Regulation on Environmental Quality Standards and Effluent Emission.
Decree Nº 45/06, of November 30	Approves the Regulations for the Prevention of Pollution and Protection of the Marine and Coastal Environment and repealing Decree No. 495/73, of October 6.
Land	
Law Nº 19/97, of October 1	Approves the Land Law.
Decree Nº 66/98, of December 8	Approves the regulations of the Land Law, as amended by Decree No. 1/2003, of February 18.
Decree Nº 31/12, of August 8	Approves the Regulations on the Resettlement Process Resulting from economic activities. This Regulation is to establish principles and general rules that should guide the process of resettlement of the population resulting from economic activities of public or private initiative. It should be noted that the approval of the resettlement plan shall be a condition to the issuance of the environmental permit projects.
Solid Waste	
Decree Nº 13/06, of June 15	Approves the Regulation on Waste Management, establishing regulations on the management of solid waste at a national level, providing for its principles, objectives and instruments as well as on guidelines for the integrated management, solid waste management, including dangerous, and the responsibilities of generators and the government and to economic instruments applicable.

At an international level Mozambique has been a signatory of several treatises and regional and international protocols, especially in relation to the environment and with a specific interest to the study area, the conventions are shown in **Table 2.2**.

Table 2.2 – International Legal Framework

Climate Change and Natural Hazards	
United Nations Framework Convention on Climate Change (UNFCCC)	Ratified by Mozambique in 1994, through Resolution No. 1/94, of August 24
United Nations Convention to Combat Desertification (CCD)	Ratified by Mozambique, in 1996, through Resolution No. 20/96, of November 26
The Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern Africa Region	Ratified by Mozambique, in 1996, through Resolution No. 17/96, of November 26
Environment	
Convention on Biological Diversity (CBD)	Ratified by Mozambique, in 1994, through Resolution No. 9/94, August 24
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Ratified by Mozambique, in 1981, through Resolution No. 20/81, December 30
African Convention on the Conservation of Nature and Natural Resources	Ratified by Mozambique, in 1981, through Resolution No. 18/81, December 30
Convention for the Protection of Cultural and Natural Heritage of UNESCO World	Ratified by Mozambique, in 1982, through Resolution No. 17/82, November 13

2.2 Institutional Framework

There are several institutional actors that play a role in environmental protection, appearing in sequent points. The ministries involved in this process are set out below:

- The **Ministry of Coordination of Environmental Affairs (MICOA)** was the first created organism focused on the environment. Created in 1994, by the Presidential Decree 2/94, this body has the responsibility to coordinate government activities in the environment area. Plays, therefore, under the Presidential Decree 6/95, the following functions: i) to promote conservation and the sustainable use of the country natural resources, and (ii) to promote environmental policies and strategies to join in the sectorial development plans. The organizational structure of this organization is focused on six areas of activity, including intersectoral coordination, research, planning and

environmental management, land use planning, environmental impact studies, education and awareness on environmental protection and finally, inspection and control. At a local level, MICOA is represented by Provincial Directorates, which are responsible for the coordination of environmental activities at a provincial and a district level. Under the authority of MICOA, we highlight the following organizations:

- The National Environment Fund (FUNAB);
- The National Directorate of Environmental Management (DNGA);
- The National Directorate of Land Use Planning Management (DINAPOT);
- The National Directorate of Environmental Impact Assessment (DNAIA);
- The National Directorate of Environmental Promotion and Education (DNPA);
- Biodiversity Management Projects;
- National Sustainable Development Council (CONDES).

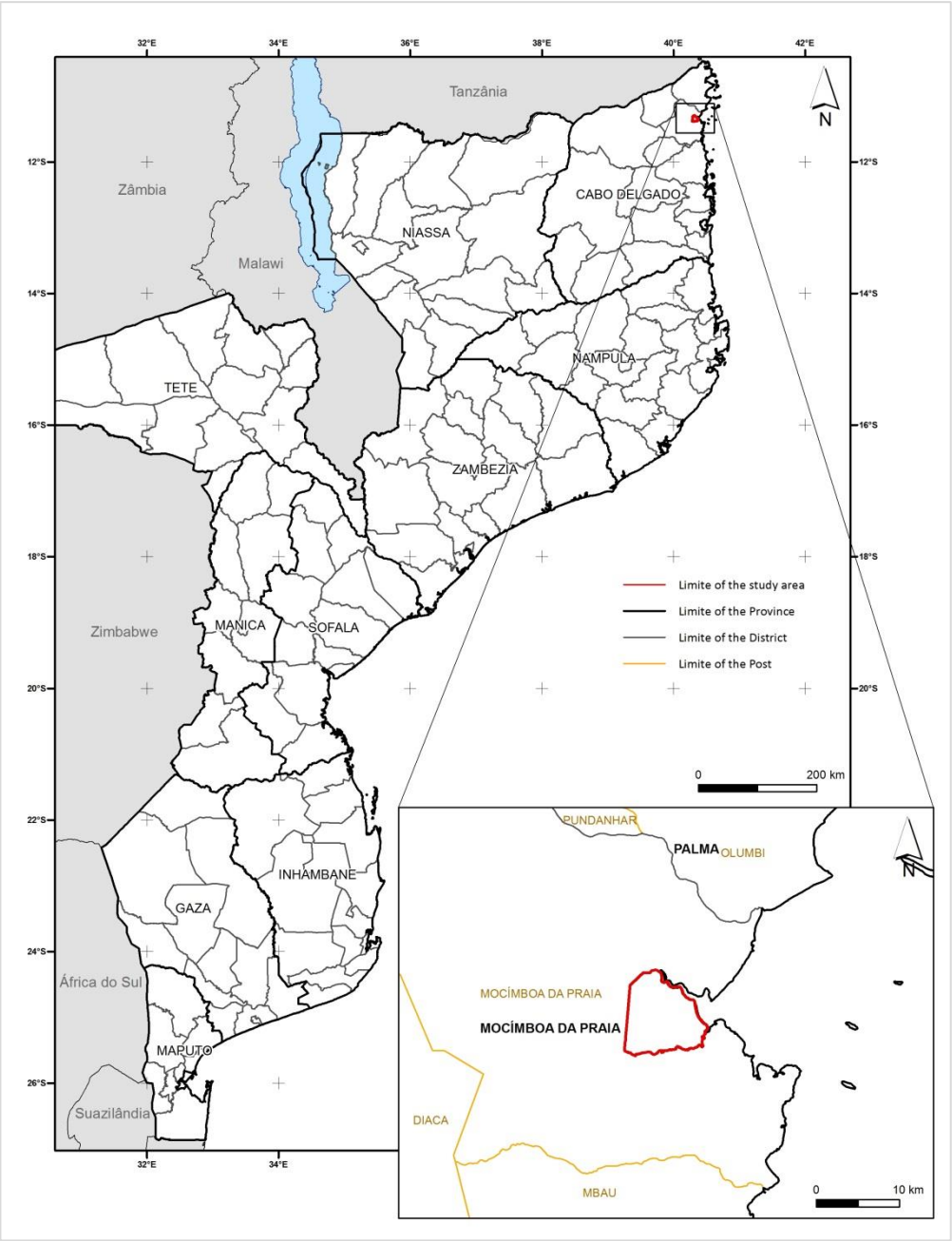
- The Ministry of Public Works and Housing (MOPH), which constitutes the Government body through the National Water Directorate (DNA), is responsible for the strategic and integrated management of the water resources, water supply and sanitation.

3 GEOGRAPHIC FRAMEWORK

As mentioned before, the presented study has as object the study area of Mocímboa da Praia municipality, elevated into the village category in 1959 by law 10/97, May 31.

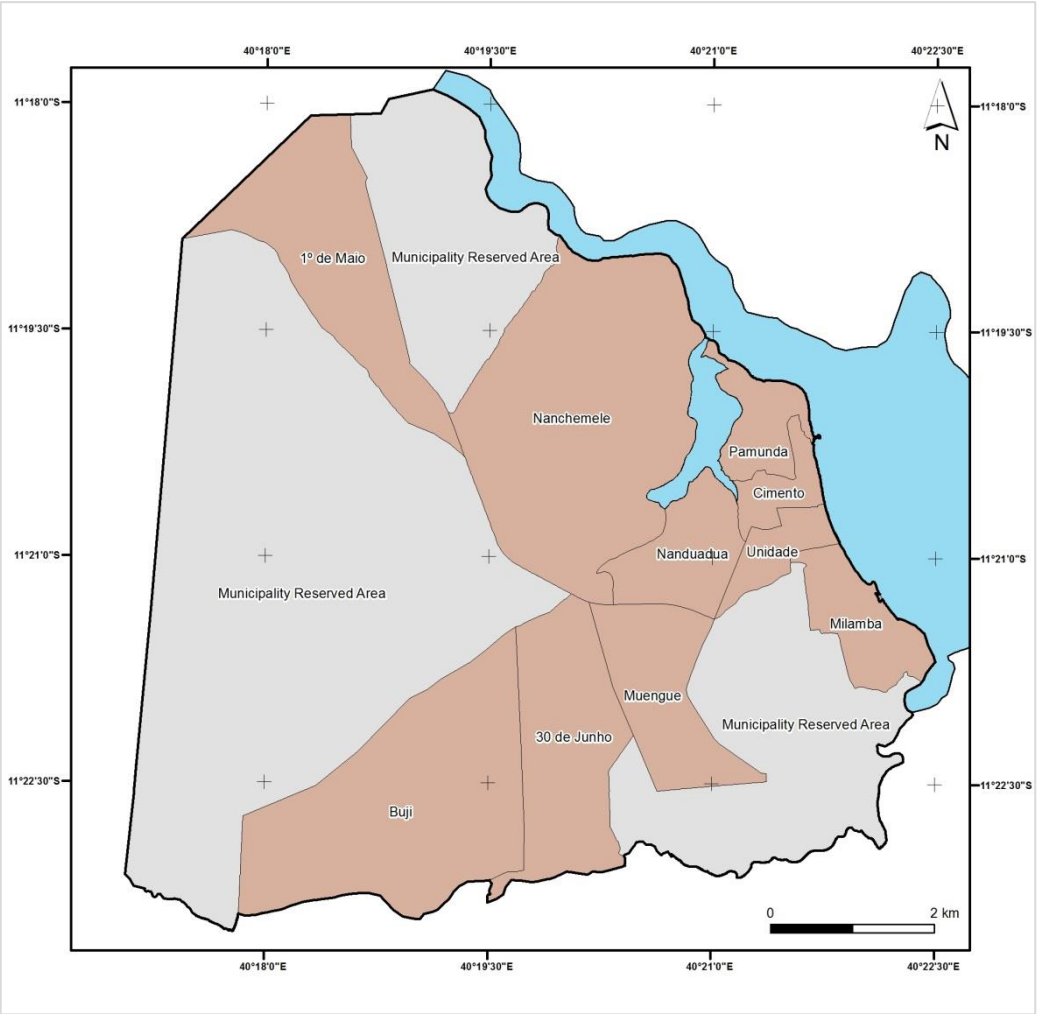
The municipality is located in the Northeast of the Province of Cabo Delgado, more specifically in the district with the same name (one of the 17 districts of the province) (**Figure 3.1**).

Its territorial area is divided into a municipal reserved area and 10 *bairros*: 1º de Maio, 30 de Junho, Buji, Cimento, Milamba, Muengue, Nanduadua, Nanchemele, Pamunda, Unidade, considering only as area of intervention the ten *bairros* of the municipality (**Figure 3.2**).



Source: Own elaboration, 2014

Figure 3.1 – Geographic framework of Mocímboa da Praia municipality



Source: Own elaboration, 2014

Figure 3.2 – Adminstrative Division of the intervention area

4 GENERAL FRAMEWORK

After decades of civil war, Mozambique has gone from one of the poorest countries in the world with a foreign debt of almost 200% of its Gross Domestic Product (according to World Bank data), a poverty level above 80% and inflation almost 50%, to become one of Africa's best performing economies, having achieved an economic and social progress:

- The real economic growth has been above 8% per year, supported by the good performance of sectors as transport, communications, construction and a recovery in agriculture;
- Gross Domestic Product (GDP) per capita increased considerably;
- Due to initiatives for debt relief, the net external debt reduced significantly;
- Poverty decreased significantly, especially in rural areas, having been the second country in the world to get this done, then to Vietnam;
- Primary school enrolment increased significantly;
- Both the infant mortality and mortality of children under five years have significant breaks;
- Access to safe water has nearly doubled, investment in infrastructure and institutional reforms in the management of services produced better quality, reliability and sustainability of water supply services in rural areas;
- The Human Development Index (HDI) has improved, whose score rose more than 2% per year since 2000, although remaining in the bottom of the scale.

This development, as well as the high potential of the country, allowed the generation of large investments, inserting the Cabo Delgado Province in a strategic territory where they are now beginning to generate income. Planned investments in this corridor, namely the construction of road and railway infrastructures, expansion of the container terminal (the Port of Nacala) and the construction of the international airport make this area a center of economic and social development, which accessibility will ease the flow of goods and gradually allow regional integration in international trade. The tourism begins to act as a growing sector, contributing greatly

to the development of the province, but the discovery of large reserves of hydrocarbons in the Rovuma Basin is the sector where bet more to be a big attraction for international natural gas companies. Apart from Anadarko, installed in the country since 2006, other companies are operating in the area of hydrocarbons: the Italian ENI, the Norwegian Statoil and Petronas of Malaysia, whose planned investments that will position Mozambique as one of the major producers of natural gas in the world.

The arrival of these international companies brought a new pace and expectation for the future of Cabo Delgado, where its economy is experiencing a period of stimulation, as associated with the installation of these companies, also other services grows, such as telecommunications, water and energy, and build up infrastructure, which somehow brings benefits to communities. The district of Palma is where it is located the field work of the big gas companies, and in which shall also be installed the factories of natural gas, however the excellent geographical location of Mocímboa da Praia has to act as a staging where the airport, which was not previously used, is now undergoing expansion works, going to be used by company staff to access natural gas platforms, which are at sea. On land, the roads are being improved, appeared new banks and new hotel establishments emerge to accommodate new employees from outside of the province and foreign countries.

5 METODOLOGIA

To achieve the objectives established for this study, we tried to develop a capable methodological application able to build an analysis model as close as the current situation in the Mocímboa da Praia municipality, focused on the most relevant issues for further development of solutions to present in the SSP. In this sense, the adopted methodology followed the phasing plan displayed in the diagram shown in **Figure 5.1** .

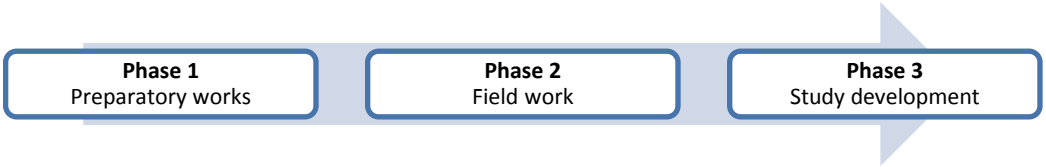


Figure 5.1 – Study phasing plan

5.1 Phase 1 – Preparatory Works

This first phase corresponded to the previous survey of the current information and to the preparation of tools for collecting data, especially directed to the communities' involvement.

5.1.1 Previous survey of the information

The **previous survey of the information** consisted in the collection, analysis and systematization of data from various sources:

- Phase I – Inception Report of the SSP, presented in April of the current year;
- Information provided by the Management Infrastructure for Water and Sanitation (AIAS);
- Information provided by the Municipal Council of Mocímboa da Praia;
- Information provided by the National Institute of Statistics of Mozambique (INE);
- Information provided by the National Institute of Meteorology of Mozambique (INAM);
- Investigation of diverse thematic bibliography and analysis of the available mapping.

The intention with this survey was not only to obtain a preliminary characterization of the biophysical and socio-economic characteristics of the study area, but also to prepare the information that served as basis for the development of the field work.

5.1.2 Preparation of the Questionnaires

The **preparation of the questionnaires** consisted on the previous organization of the information to obtain from the community, being, for this purpose, prepared two types of questionnaires: one directed addressed to the household (**Annex 1**), and another addressed to people with disabilities (**Annex 2**), for the purpose of gathering a set of data to observe, in order to:

- Obtain an understanding of the sample current situation of the sample, in terms of water supply, sanitation, hygiene and treatment of domestic waste;
- Determine the demand based on the degree of satisfaction and expressed availability to pay for an improved service;
- Determine the ability to pay, through the level of life, which is done according to the type of housing, including their basic conditions, possession of "luxury" goods and regular purchases of "luxury" products.

To achieve these objectives, the questionnaire incorporated the following issues:

- Household (composition, gender, age structure and people with disabilities);
- Water supply (form and destination of the affluent);
- Sanitation (availability, satisfaction, destination of the effluent, cost and open air defecation);
- Solid waste (type of waste, disposal, collection, satisfaction and willingness to pay for the improvement of the waste collection and treatment system);
- Hygiene (general hygiene and menstrual hygiene);
- Living standards (housing conditions and economic status);
- Stormwater drainage (floods and willingness to pay for the improvement of the drainage of stormwater system).

The questionnaires were designed to target a structured interview and to present especially closed questions (choice between a limited number of responses) combined, in some cases, with a small number of semi-open questions (list of options with the addiction of the response "other" to allow the respondents to give other answers to targeted by the investigator).

The **target population** of the study was defined based upon the principles of a sample taken from of a universe which is assumed to be representative of all the characteristics, i.e. the household. Whereas the determination of the sample size is one of the most controversial aspects of the sampling technique, involving, cumulatively, a number of concepts (probability, statistical inference and sampling theory itself), we chose a sample that met the following requirements:

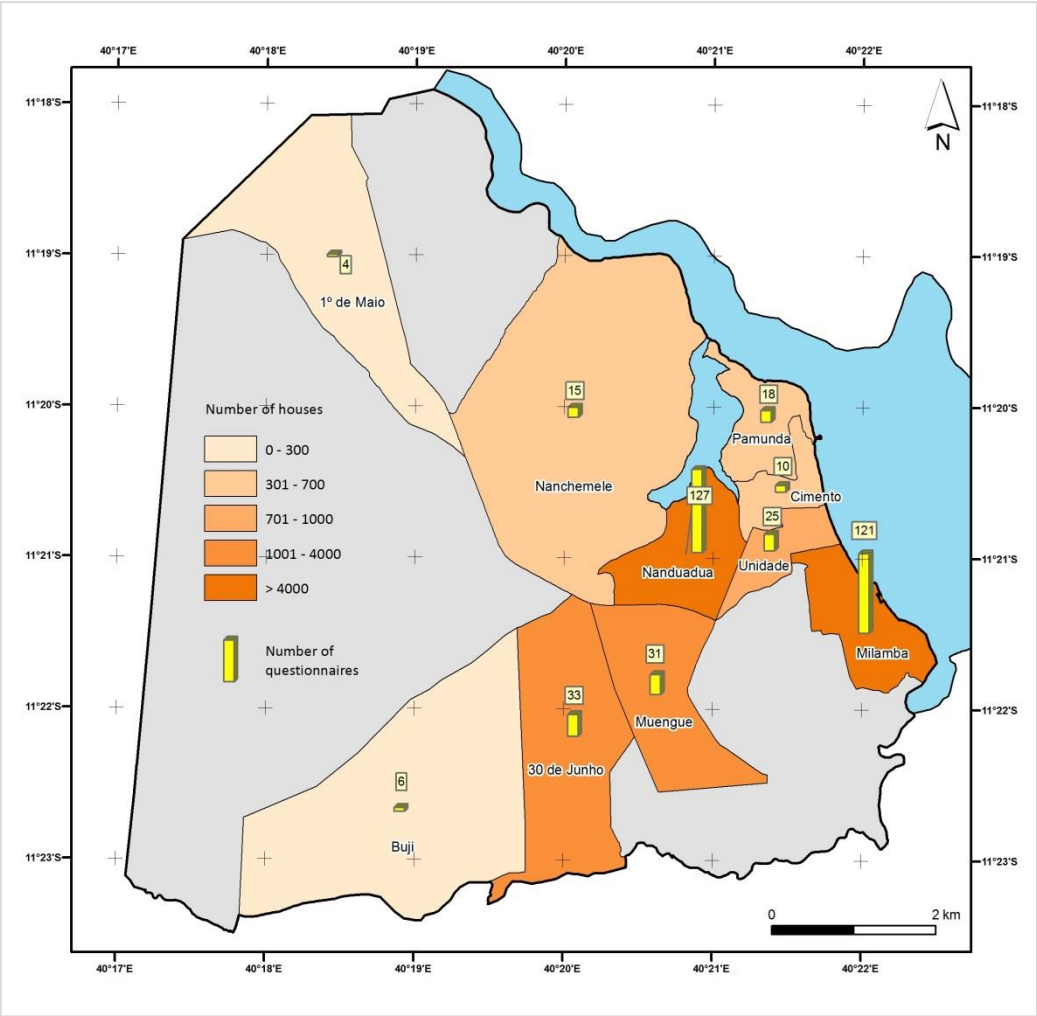
- Parameter: Characteristic of the population.
- Statistics: descriptive characteristic of the elements of a sample.
- Estimation: amount accused by a statistic that estimates the value of a population parameter.
- Sampling error: the difference between the value that the statistic can accuse and the true value of the parameter to be estimated;
- Tolerable sampling error: value that admits mistakes in the evaluation of the parameters of interest.

Assuming a tolerable sampling error of 5% for a confidence level of 95% (corresponding to 95% chance of being true), we obtained a sample of 389 households to interview, considering that the universe corresponds to a total of 13,618[1] households[2].

To ensure a good geographical spread, the sample obtained was divided by each of the *bairros* of the municipality, depending on the number of houses (obtained from the municipal services), according to the distribution shown in **Figure 5.2**.

[1] The universe was obtained based on the survey of parcels carried out by the Mocímboa da Praia municipality under the MCA (Millennium Challenge Account) program.

[2] For the purpose of this study, is defined as household, the individual or group of people, related or not, linked by family ties, who usually live in the same house and whose expenses are supported partially or totally together.



Source: Own elaboration, Municipal Council, 2014

Figure 5.2 – Distribution of the sample by *bairro*

The **sampling method** consisted of a simple random selection (each observation unit is randomly selected), defining regular intervals *in situ*, corresponding to 1 in every 10 houses in denser populated areas, and 1 in 3 homes in the less denser areas, in order to allow each of the sample elements had the same probability in the sample, being only selected once.

5.2 Phase 2 – Field Work

The Phase 2 (Field Work), as mentioned before, was especially directed to the community involvement, which led to the success of the entire preparation process of this study. This engagement didn't aim exclusively the data generation for the environmental and socio-economic characterization of the current situation in the

Mocímboa da Praia municipality, but also lead to the community strengthening for change of reality, having allowed, a greater understanding of the reality, the reduction of potential conflicts by ignorance or lack of information and increased the probability of success of the SSP.

The community involvement went beyond the questionnaires previously prepared in the previous phase. Were also conducted interviews with stakeholders and sectors to which might interest the resulting effects from the implementation of the SSP. Thus, were interviewed all *Secretarias de Bairro* (total number - 10) and visited schools and health care units in the municipality.

The (semi-structured) interviews undertaken were conducted taking into account the worksheets presented in **Annex 3**, and the respective dates of realization are indicated in **Table 5.1**

Table 5.1 – Interviews / visits made

Interview / visits	Date
Presidente do Municipal Council	June 12, 2014
Vereador Responsável pelo Saneamento	June 16, 2014
Secretaria do Bairro 1.º de Maio	June 17, 2014
Secretaria do Bairro 30 de Junho	June 18, 2014
Secretaria do Bairro Buji	June 17, 2014
Secretaria do Bairro Cimento	June 17, 2014
Secretaria do Bairro Milamba	June 15, 2014
Secretaria do Bairro Muengue	June 16, 2014
Secretaria do Bairro Nanduadua	June 18, 2014
Secretaria do Bairro Nanchemele	June 16, 2014
Secretaria do Bairro Pamunda	June 13, 2014
Secretaria do Bairro Unidade	June 18, 2014
Visits to the health care units and interview with the responsibles	June 18, 2014
Visits to schools and interview with the responsibles	June 17 and 18, 2014

Source: Field work, 2014

Interview to the *Secretário do bairro Pamunda*
(Source: Field work, 2014)

Interview to the *Secretário do bairro Unidade*
(Source: Field work, 2014)

Photograph 5.1 – Interviews to the *Secretários de Bairro*

Interview to the professors of *Escola Primária 30 de Junho*
(Source: Field work, 2014)

Interview to the professors of *Escola Primária de Buji*
(Source: Field work, 2014)

Photograph 5.2 – Visits to Schools

Interview to the District Director of Health
(Source: Field work, 2014)

Interview to the Director of the Rural Hospital
(Source: Field work, 2014)

Photograph 5.3 – Visits to the health care units

Additionally, a field reconnaissance was made (observation of *bairros*), where the collection of elements was carried out, which served as a support and a complement to the characterization of the current situation, but also served to clarify any other doubts raised in the office.

The **team responsible** for applying the questionnaires was formed by the following elements:

- **One (1) coordinator**, who worked with the interviews supervisor to ensure that the questionnaire was implemented without delay, with efficient use of resources, and technical quality required, including the areas of training of the interviewers, reviewing questionnaires, database design, field work and data entry;

- **One (1) supervisor**, who had the responsibility to implement measures to ensure the technical quality of the questionnaires, worked in close coordination with the coordinator, making field visits to resolve problems that teams experienced, check the work of inquirers, and check if the questionnaires were complete and fulfilled;

- **Five (5) interviewers and translators** (local), who had the responsibility to ensure that their parts of the questionnaires were implemented efficiently and with quality.

Source: Field work, 2014

Photograph 5.4 – Interviewers and translators Team

Previous to the application of the questionnaires, and in order to achieve the desired success, was provided to the interviewers, a one day **training**, where it was intended:

- To give information about the issues which involved the questionnaire;
- To acquire knowledge on how the questionnaire should be filled out.

The training included, at the end, the realization of a pilot test of the questionnaire to a limited number of respondents, to allow a form and content critical view. This pilot test took place in the *bairro* Pamunda, having attested the relevance of the questionnaire.

Source: Field work, 2014

Photograph 5.5 – Interviewers training

The timing of data collection was held in five days, during the period between June 13 and 17, 2014, according to the schedule shown below, were applied an average of 78 questionnaires per day. The interviews were conducted in Portuguese and / or in kimwane, and each had an average duration of 15 minutes.

Bairros	**Days**									
	1		**2**		**3**		**4**		**5**	
1.º de Maio									4	
30 de Junho								33		
Bugi									6	
Cimento										10
Milamba						121				
Muengue								31		
Nanduadua			127							
Nanthemele										15
Pamunda		13				5				
Unidade									24	

Application of questionnaires — number of questionnaires

Figure 5.3 – Schedule of the realization of the questionnaires

Interviewers performing the questionnaires to a household – b*airro* Nanduadua
(Source: Field work, 2014)

Photograph 5.6 – Interviewers performing the questionnaires to a household

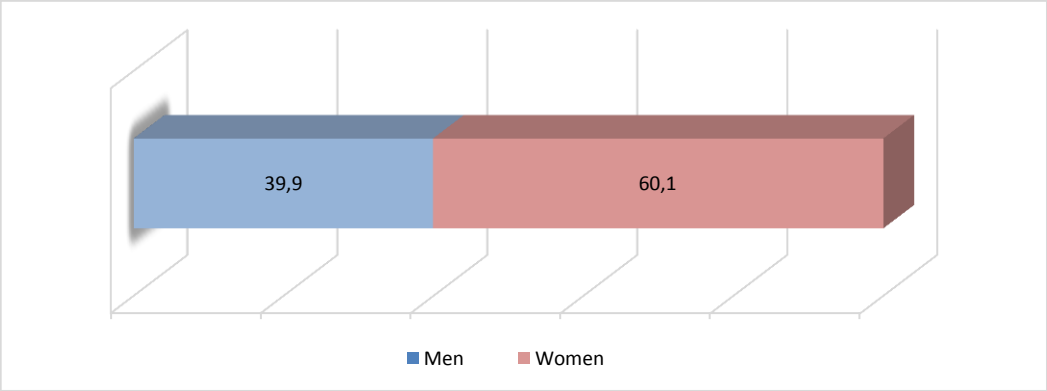
According to the needs of the Study, the information collected in the questionnaires was entered into a **database** from a Windows application (Excel), which provided the necessary tools to organize, to analyze and to interpret the collected data. For the procedures related to the analysis of the physical aspects, consolidated in the form of thematic maps, the information collected was entered into a database in Geographic Information Systems (GIS) environment, where the data were stored by shape format, in order to spatially manipulate the various themes developed.

5.3 Phase 3 – Study Development

The gathered information in the previous phases ends with the development of the study itself, whose results are presented in this document.

6 QUESTIONNAIRE RESULTS

According to the methodology described above, were interviewed 389 households, where 60.1% of respondents were women and the remaining 39.9% were male (**Figure 6.1**). Additionally, 18 people with disabilities answered to the questionnaire specifically developed for this group of people.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.1 – Gender of the respondents (%)

The results of the questionnaires treatment data are presented in the following points. We sought to undertake a comparative analysis of some indicators presented here to the data provided by Census of 2007. However, the absence of the Census disaggregated data at a municipality level was impeditive of the desired analysis.

6.1 Demographic characteristics of the sample

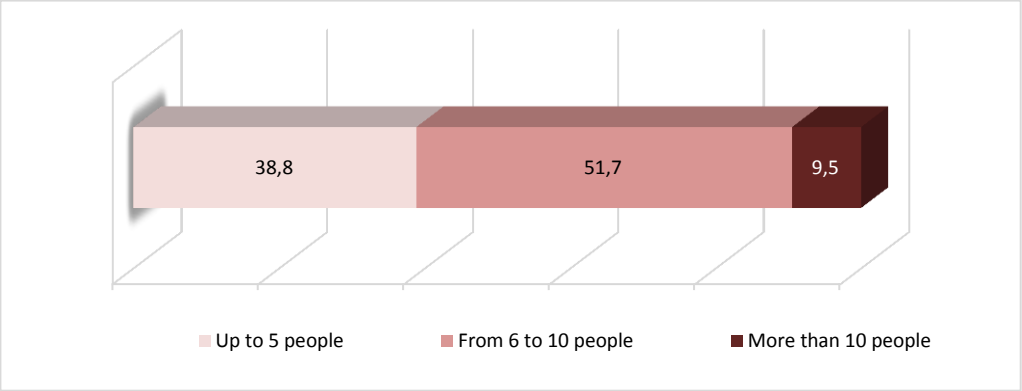
In the demographic characterization of the sample were considered the following indicators:

- Household composition;
- Age structure of the household;
- People with disabilities.

6.1.1 Household composition

A **household** is constituted, on average, by 6.6 people (higher than 5 people, number of people usually considered in Mozambique), where 61.2% of the households are

constituted by more than 5 people, and 9.5% of the respondents have in their household more than 10 people (**Figure 6.2**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.2 – Household composition (%)

From the total population covered by the questionnaires (2,565 inhabitants), the obtained results demonstrate a balance between the number of men and women, where 47.8% are male and 52.2% female, translated into a masculinity index of 91.7 (out of 100 women, 91.7 are men) (**Table 6.1**).

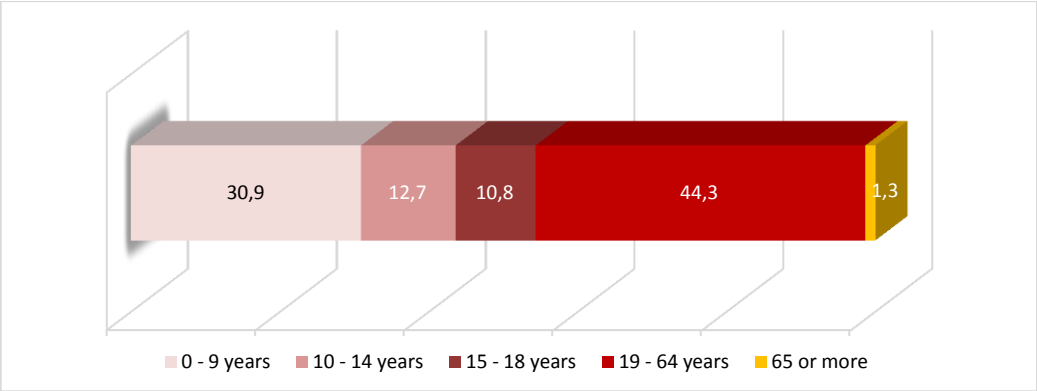
Table 6.1 – Masculinity Index

Total	Men	Women	Masculinity Index
2,565	1,227	1,338	91.7

Source: Questionnaire to the household, 2014

6.1.2 Age structure of the household

The **age structure** of the household illustrates a pyramid with a wide base and a narrow top, the indicative of a young population, represented by a high percentage of children [0-14 Years] and youth [15-18 years], who together represent, 54.3%, and an unrepresentative percentage of the elderly age group [65 and over], registering only 1.3 percentage points (**Figure 6.3**). A territory with this type of pyramid tends to increase its population at a considerable rate, as the result of high birth and mortality rates.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.3 – Age structure of the household (%)

The masculinity index by age group, visible in **Table 6.2**, shows, a certain balance between the proportion of men and women, with the exception to the registered in the elderly age group [65 or more], where in 100 women, only 61.9 are men, as opposed to the 10 to 14 years age group, where there are more men than women registered.

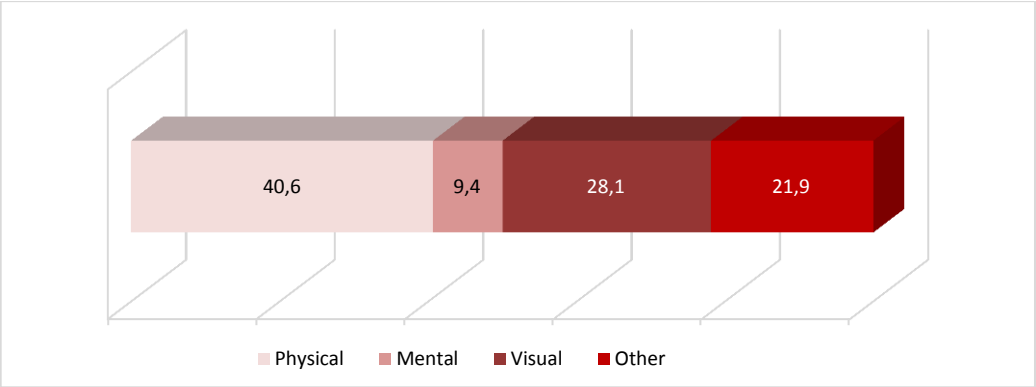
Table 6.2 – Masculinity index by age group

Age group	Men	Women	Masculinity Index
0 – 9 years	398	394	101.0
10 – 14 years	148	178	83.1
15 – 18 years	126	150	84.0
19 – 64 years	542	595	91.1
65 or more	13	21	61.9
Total	**1,227**	**1,338**	**91.7**

Source: Questionnaire to the household, 2014

6.1.3 People with disabilities

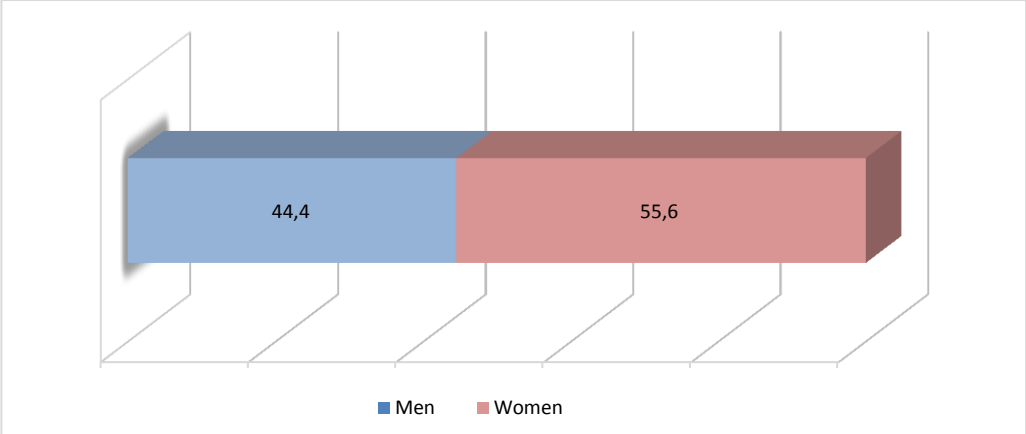
Were also identified 35 **people with disabilities**, representing 1.4% of the covered population (2,565 inhabitants), of which 40.6% have a physical disability, 28.1% a visual impairment and 9.4% a mental disability. In the "Other" category, the 21.9% represent the individuals with a hearing disability (**Figure 6.4**).



Source: Own elaboration, Questionnaire to the household, 2014

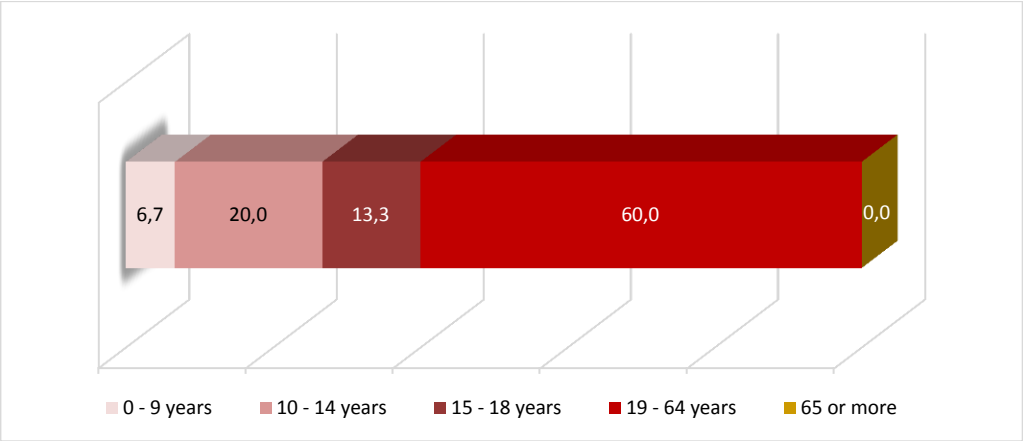
Figure 6.4 – People with disabilities, according to the type of disability (%)

From the 26 cases of deficiency detected 51.4% (18 people) answered the questionnaire specifically developed for this group of people, verifying that the majority of the respondents is represented by females (55.6%), corresponding to an index masculinity of 80.0 (**Figure 6.5**). 60% of the respondents are integrated in [19 to 64 years] age group and 26.7% of this universe are children [0-14 years] (**Figure 6.6**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.5 – People with disabilities, according to gender (%)



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.6 – Age structure of people with disabilities (%)

6.2 Economic characterization of the sample

The following approach took into account a set of indicators, whose analysis allowed to obtain a picture of the housing condition and economic condition of the households under observation.

6.2.1 Housing Condition

To be able to achieve a level of wellbeing and social dignity, the respect of Human Rights and the promotion itself of the human development have constituted a fundamental role, where the right to an adequate housing that provides the basic life conditions is characterized as a fundamental human right. In this sense, it was considered that the characterization of the housing condition, not only the type of housing but also the availability of public services which are included: access to water, access to sanitation and access to electricity.

6.2.1.1 Type of housing construction

To observe this indicator, we considered two types of housing according to the predominant construction materials, including houses with *Matope* or *"pau-a-pique"* walls (commonly known as "straw huts") and houses with block walls, with different types of coverage:

- Matope walls (or pau-a-pique) and Macuti / straw coverage;
- Matope walls and corrugated iron coverage;

- Block walls and Macuti / straw coverage;
- Block walls and corrugated iron coverage.

Houses with *Matope* walls and *Macuti*/straw coverage
(Source: Field work, 2014)

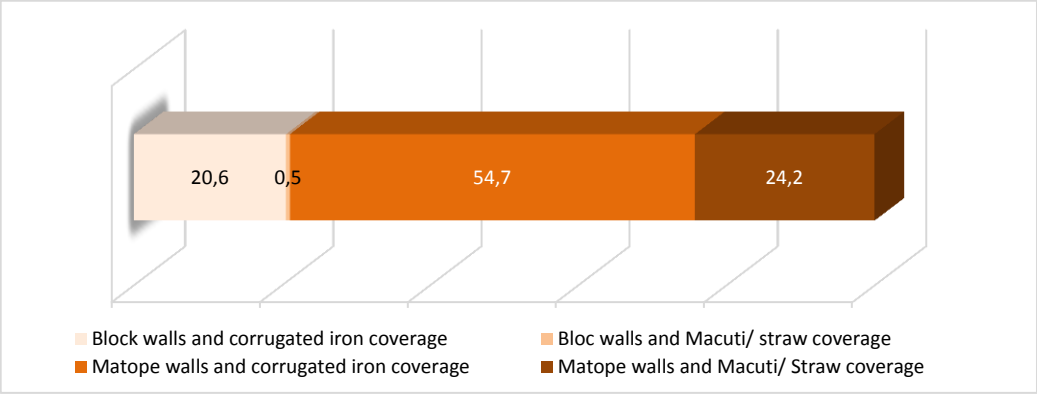
Houses with Matope walls and corrugated iron coverage
(Source: Field work, 2014)

Houses with block walls and *Macuti* / straw coverage
(Source: Field work, 2014)

Houses with block walls and corrugated iron coverage
(Source: Field work, 2014)

Photograph 6.1 – Example of houses due to the construction material

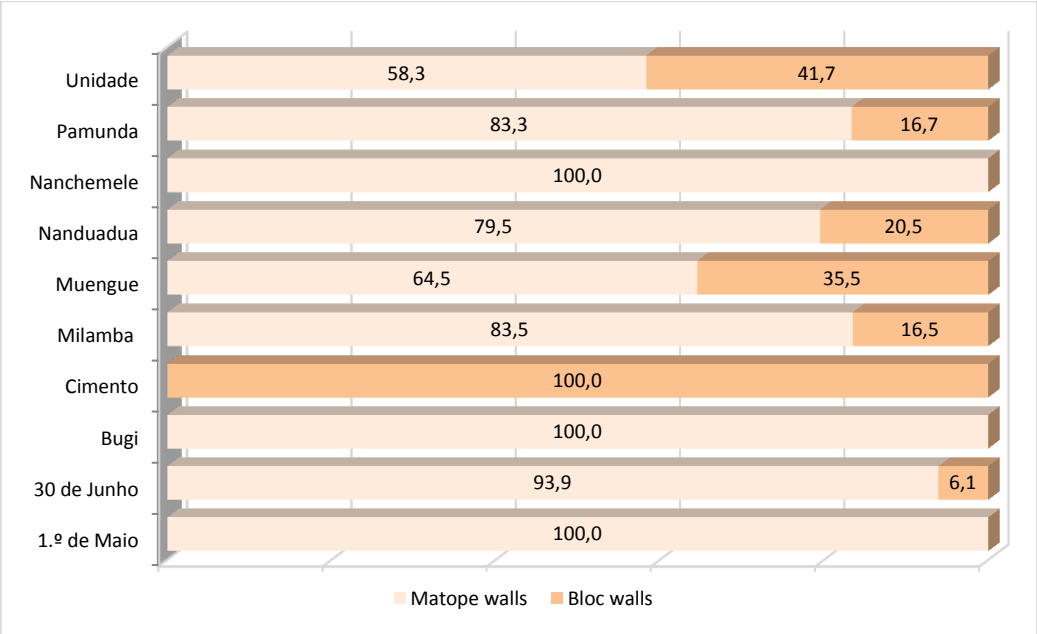
According to the determined results, it is verified that the predominant type of housing observed is the "straw huts"(houses with *Matope* or "pau-a-pique" walls) represented by 54.7% with a corrugated iron coverage and by 24.2% with a *Macuti* / straw coverage. The houses with block walls represent 21.1% of the total, and the majority, 86.8%, have a corrugated iron roof (**Figure 6.7**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.7 – Type of housing construction (%)

The distribution of housing construction type, through the *bairros* in observation, (**Figure 6.8**) demonstrates that the houses from the *Bairro* Cimento, followed by Unidade and Muengue, tend to present better housing conditions regarding the type of materials employed in their construction: block walls and corrugated iron coverage. In the peripheral *bairros*, especially in 1º de Maio, Buji and Nanchemele the predominant houses are from "straw huts" type.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.8 - Distribution of the houses according to the type of construction (%)

6.2.1.2 Access to water

In the access to water, was tried to identify the main source of water supply, being considered the following response categories:

- Piped water inside the house: when the link is in the house, with one or more taps;
- Piped water outside the house/yard: when the connection is located outside the house but inside the yard, or the collection of the water is made in the neighbors house;
- Water standpipe: when the sourcing water in the house is a standpipe. The standpipes may have one or more taps and are generally made of a concrete structure;
- Water from wells with a masonry structure: when the house sourcing water is from the subsoil with protection, usually pulled by a hand pump, located outside, but inside the yard or the neighbors yard, or public;

- Water from a traditional well: when the house sourcing water is from a well without any protection and without a manual pump, located outside, but inside the yard or in the neighbors yard, or public;

- Water from the river / lake / pond: when the house sourcing water is from a river, lake or similar.

Traditional well
(Source: Field work, 2014)

Traditional well in the yard
(Source: Field work, 2014)

Public well with a masonry structure
(Source: Field work, 2014)

Private well with a masonry structure
(Source: Field work, 2014)

Public standpipes
(Source: Field work, 2014)

Pipped water in the yard
(Source: Field work, 2014)

Photograph 6.2 – Sources of water supply

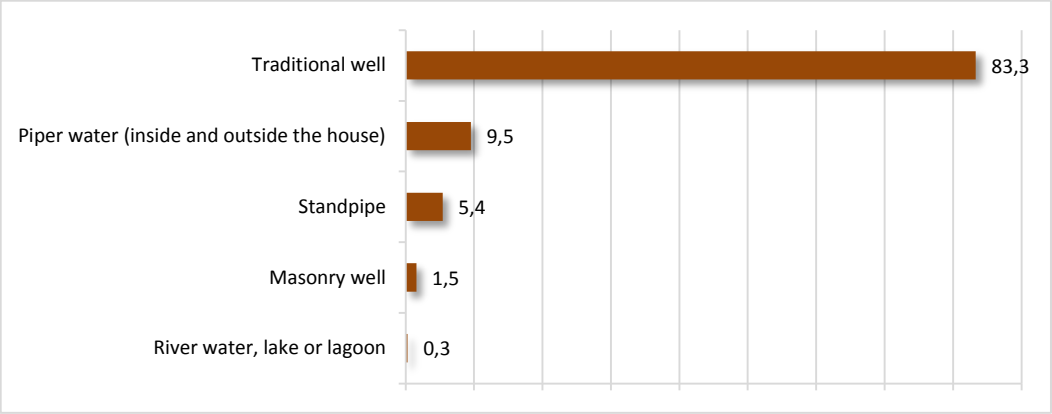
Recognizing water as a human right and the "*Right to Water grants anyone the right to have sufficient water, physical, (...) safe and with an acceptable quality for personal and domestic uses*" (Committee on Economic, Social and Cultural Rights, 2002). The categories of responses previously identified can be grouped according to the security that they offer in terms of public health:

- Unsafe water sources, including wells (whether traditional or masonry structure) and surface waters, including rivers, lakes and ponds;
- Safe water sources, which include standpipes;

- Piped water inside and outside the home.

Subsequently, the questionnaires performed allowed to determine that most of the households (84.8%) supply their houses with water from unsafe sources: traditional well (especially public), well with a masonry structure (public), river water, lake or lagoon. Only 5.4% of the respondents supply their houses with safe water sources, from a standpipe.

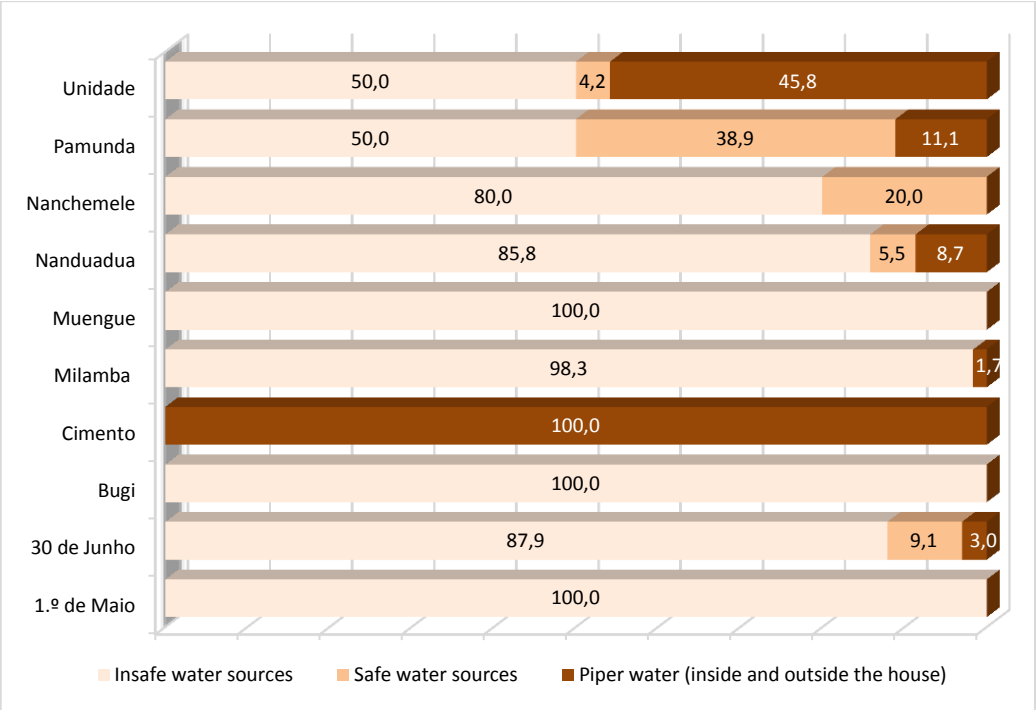
From the 9.5% of the respondents claim to have piped water, 54.1% have a tap outside the home, at the yard, 43.2% carry tap water from neighboring and only 1.0% 1.0% have an indoor tap (**Figure 6.9**). The observed reality translates a coverage rate of proper water supply of 15.7% of the representative sample under study.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.9 – Primary source of water supply (%)

In the distribution of the households, about the source of water supply per *bairro*, in **Figure 6.10Error! Reference source not found.Error! Reference source not found.**, will be concluded that the frequency of houses that are supplied with water from unsafe sources is very high in most of the *bairros*. This reality is especially serious in *bairros* 1º de Maio, Buji and Muengue, where 100% of the respondents claim to supply their house with water from this type of source. The exception to the above mentioned, are *bairros* Pamunda, Unidade and especially Cimento, where the percentage of the houses that are supplied with piped water and from safe water sources tend to be higher. It must be pointed, in this analysis, that the *bairro* Cimento is the only *bairro* where all of the respondents claim to supply their houses with piped water.

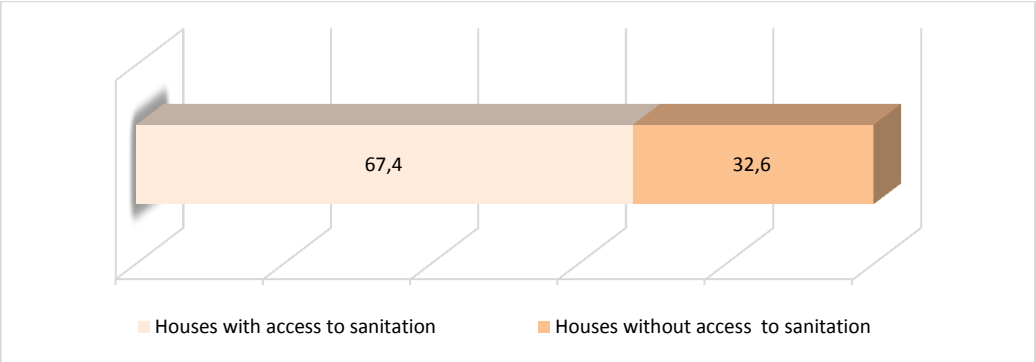


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.10 - Distribution of the households per *bairro* concerning the access to water (%)

6.2.1.3 Access to sanitation

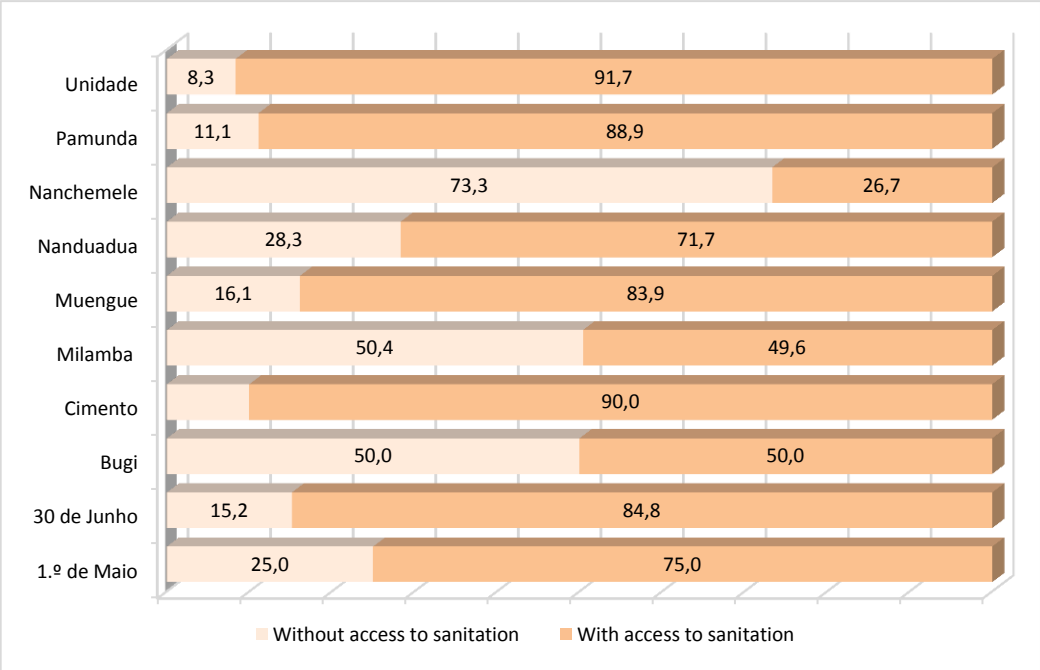
From the obtained results in the questionnaires, 67.4% of the sample claim to have access to sanitation in their homes, verifying, though, a high percentage of homes without such service (32.6%) (**Figure 6.11**). This reality reflects a rate of sanitation coverage of 68.1%.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.11 – Houses according to the access to sanitation (%)

The obtained data also allow us to conclude that, in the distribution of the households concerning the access to sanitation by *bairro* (**Figure 6.12**), Nanchemele, Milamba and Buji constitute the territorial units, where a higher percentage of the respondents do not have any kind of sanitation infrastructure in their houses, representing 73.3%, 50.4% and 50.0%, respectively.

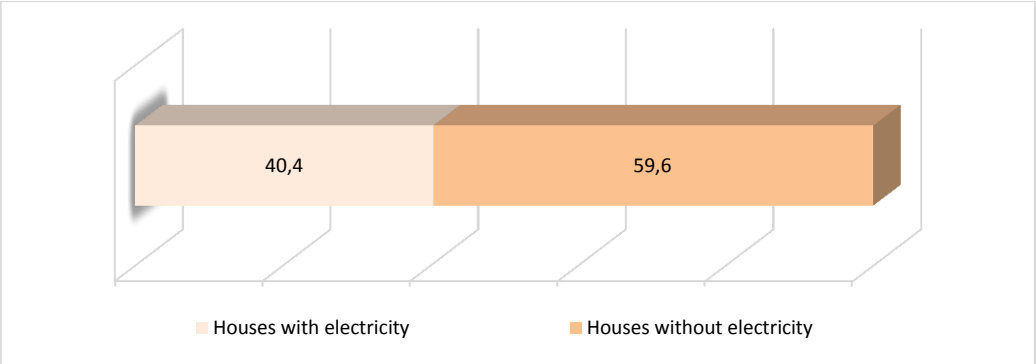


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.12 - Distribution of the households concerning the access to sanitattion per *bairro* (%)

6.2.1.4 Access to electricity

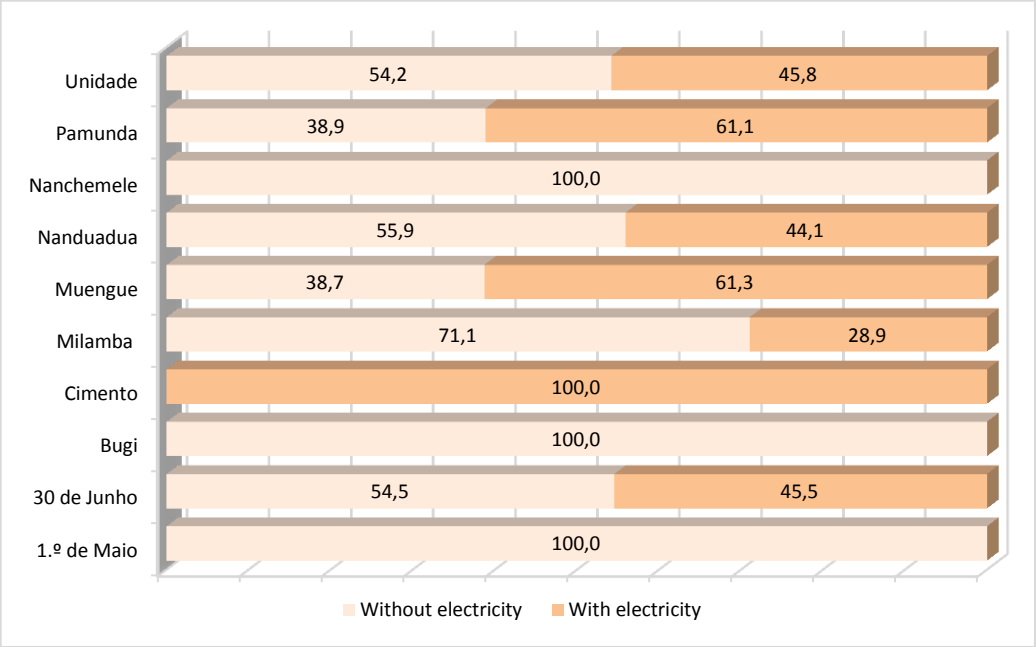
According to the **Figure 6.13**, a significant percentage of the respondents (59.6%) claim not having access to electricity in their homes, confirming the low rate of coverage of this service (43.1%).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.13 – Houses with access to electricity (%)

In the distribution of this indicator per *bairro*, it should be pointed that all the respondents of *bairros* 1º de Maio, Buji and Nanchemele claim not to have electricity in their homes (**Figure 6.14**).



Source: Own elaboration, Questionnaire to the household, 2014

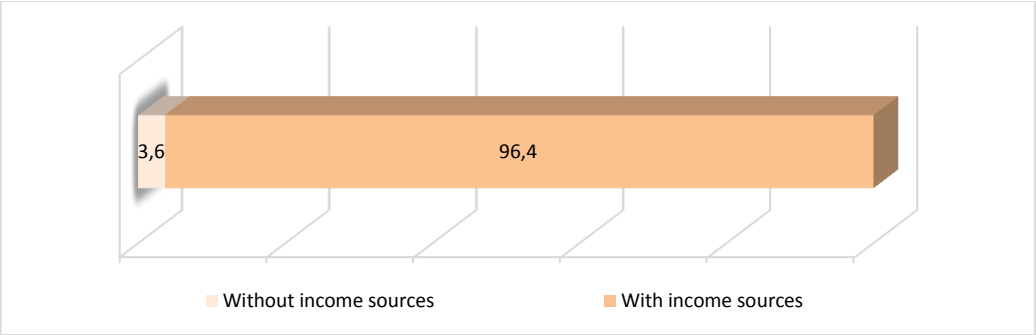
Figure 6.14 - Distribution of the households per *bairro* concerning the access to electricity (%)

6.2.2 Economic condition

The economic characterization subsequently performed took into consideration three indicators: sources of income, Possession of durable goods and acquisition of non-essential food products.

6.2.2.1 Sources of income

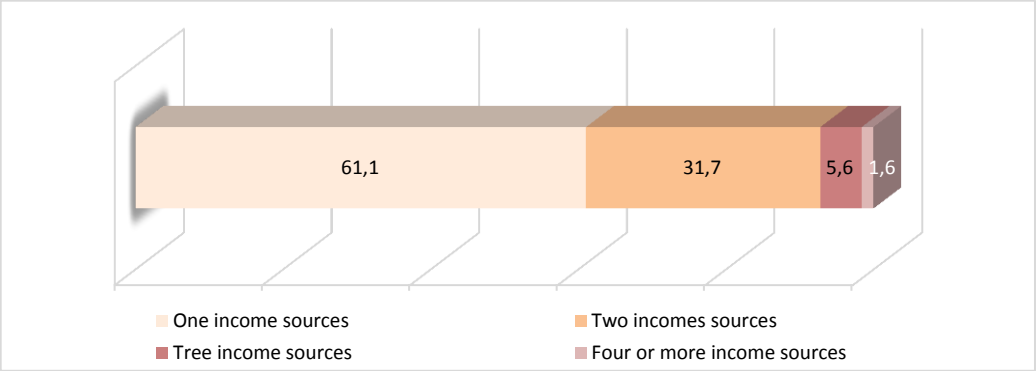
Considering the results shown in **Figure 6.15**, 96.4% of the respondents have at least one source of income. The remaining 3.6% who do not have any type of income, state that their survival depends mainly on the help of relatives.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.15 – Households with sources of income (%)

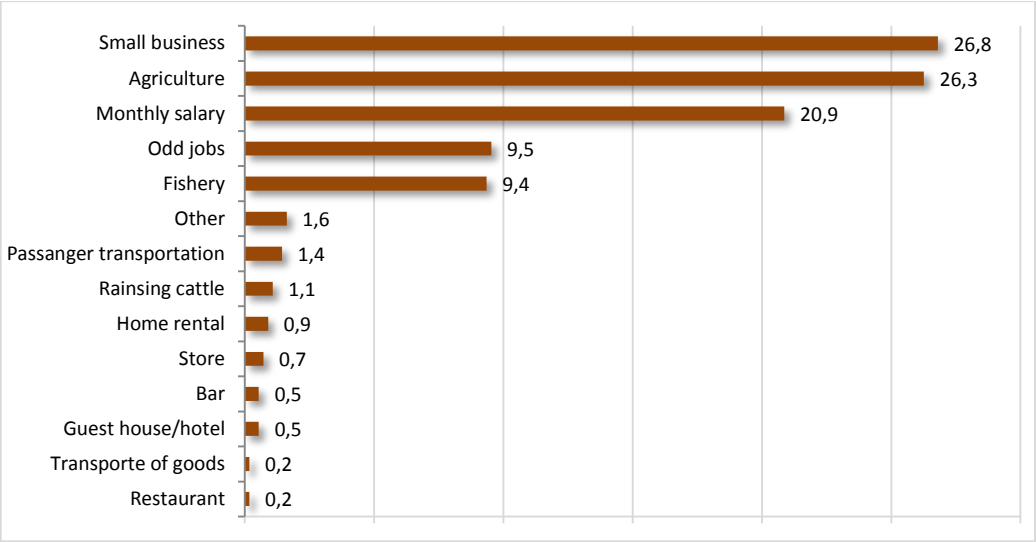
96.4% of the respondents that claim to have income, more than a half (61.1%) has only one source of income, 38.9% of the remainder have two sources of income and 5.6% claim to have three and 1.6% claim to have more than four sources of income. On average, 1.4 sources of income per household were obtained (**Figure 6.16**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.16 – Households with sources of income, according to the number (%)

The small business, the agriculture and the monthly salary are the main sources of income mentioned by the respondents, with 26.8%, 26.3% and 20.9%, respectively. The odd jobs and the fishery also occupy an important position (over 9%), although quite apart from the first three sources mentioned. In category "Other", stand out as major sources of income, the pension granted by the Government, the sale of firewood and carpentry (**Error! Reference source not found.**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.17 – Households with sources of income related to the type (%)

The correlation between the number and type of income sources is presented in a matrix form in **Table 6.3**. The activities previously referenced (the small business, the agriculture and the monthly salary) are, similarly, the three main sources of income, regardless of the number observed.

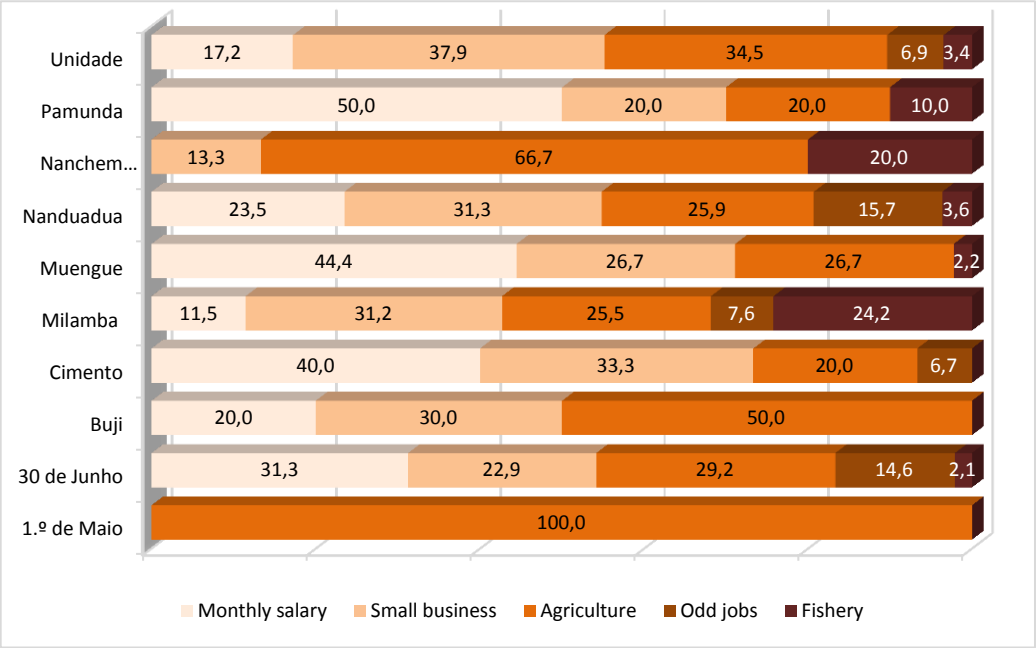
Table 6.3 – Correlation matrix between the number and type of income sources

	One source	Two sources	Tree sources	More than four sources	Sources according to the type
Agriculture	60	65	17	4	**146**
Home rental	1	1	1	2	**5**
Bar	0	3	0	0	**3**
Odd jobs	25	22	6	0	**53**
Raising cattle	0	2	1	3	**6**
Store	2	0	0	2	**4**
Guesthouse/hotel	0	1	0	1	**3**
Small business	61	66	19	3	**149**
Fishery	26	19	7	0	**52**
Restaurant	0	0	0	0	**1**
Monthly salary	49	53	10	4	**116**
Transport of goods	0	0	0	1	**1**

	One source	Two sources	Tree sources	More than four sources	Sources according to the type
Passanger transportation	2	1	1	4	**8**
Other	3	5	1	0	**9**
Sources according to the number	**229**	**118**	**21**	**6**	

Source: Questionnaire to the household, 2014

Considering the five main sources of income mentioned, distributed by *bairros* (**Figure 6.18**) shall be concluded that the most significant disparities are referenced to agriculture, constituting an important source of income to the respondents who live in the *bairros* 1º de Maio, Buji and Nanchemele, and to fishery, that will have a higher incidence in Milamba.



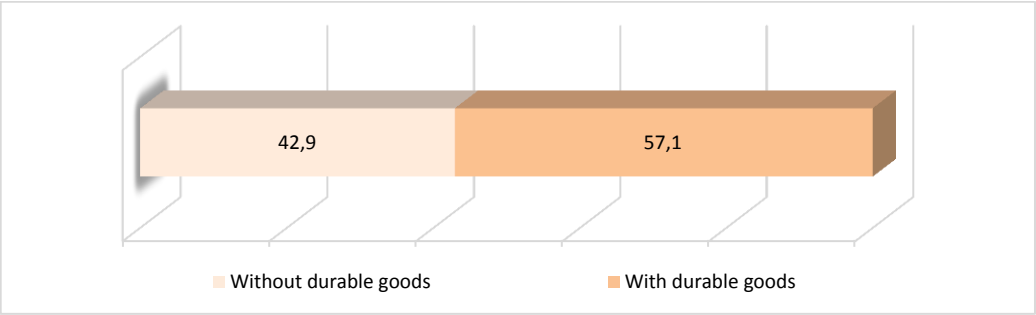
Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.18 - Distribution of the main sources of income by *bairro* (%)

6.2.2.2 Possession of durable goods

The questionnaire also sought to identify the possession of durable goods. It was asked to the respondents if they possess the following household goods: truck, car, motorcycle, bicycle, TV, music device and computer.

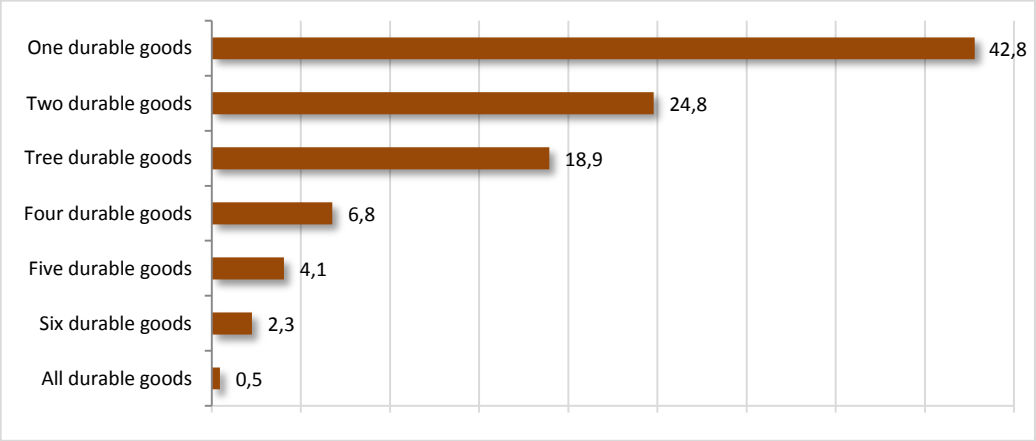
According to the results, 42.9% of the households claim to have no durable goods and 57.1% claim to have at least one of the considered durable goods, which on average is translated into 1.2 durables per household (**Figure 6.19**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.19 – Households with durable goods (%)

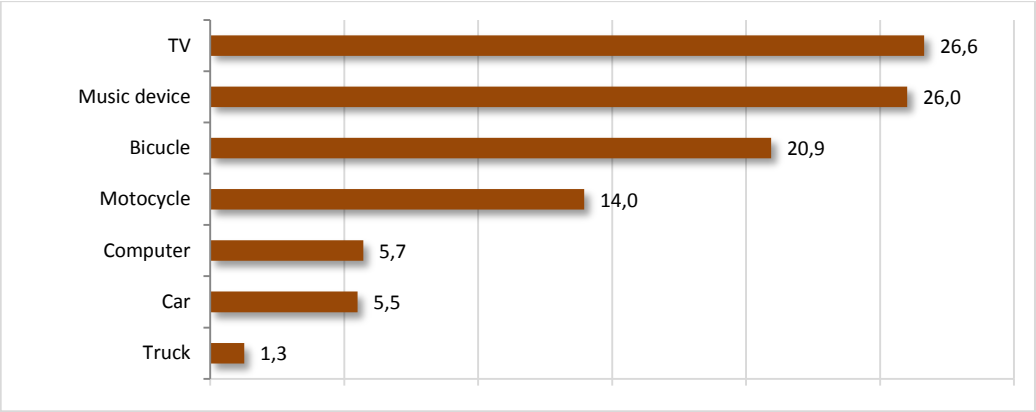
From the 57.1% of the households who claim to have durables goods, the majority (42.8%) has only one durable good, 24.8% have two goods and 18.9% have three. Only 13.5% confirm to have in their possession four or more goods, stressing that only one of the households boast all of the durable goods considered in the questionnaire (**Figure 6.20**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.20 – Households with possession of durable goods according to the number (%)

The TV, the music device and the bicycle are the main durable goods in the possession of the respondents, with 26.6%, 26.0% and 20.9%, respectively. 14.0% of the households claim to have motorcycle and the remaining durable goods (computer, car and truck) have little representative percentages, totaling together, 12.5% of the sample (**Figure 6.21**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.21 – Households with possession of durable goods according to the type (%)

The correlation between the number and type of durable goods is presented in a matrix form in **Table 6.4**. The TV, the music device and the bicycle are the tree main durable goods, independently of the observed number.

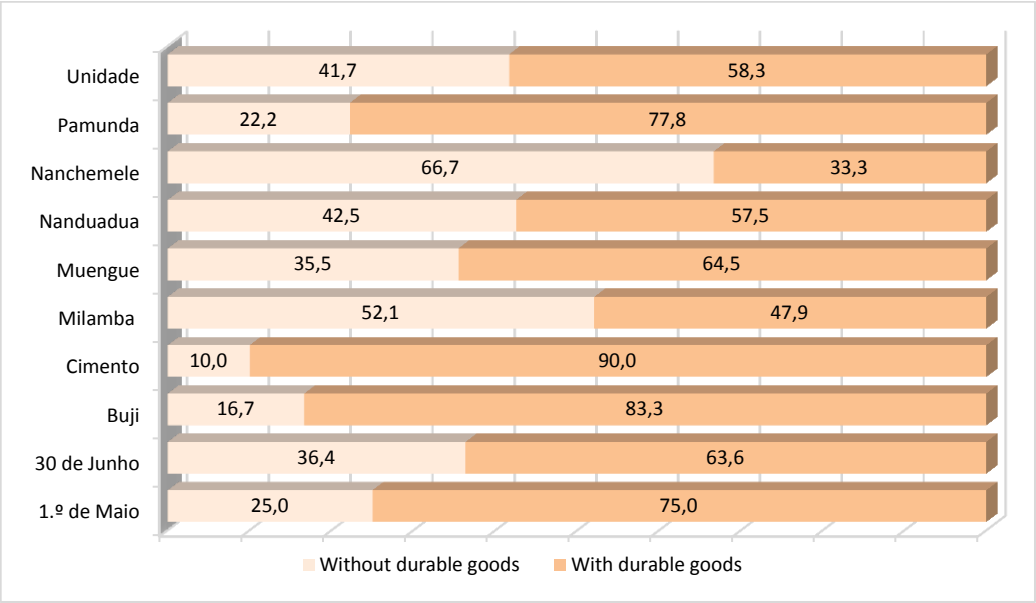
Table 6.4 – Correlation matrix between the number and type of durable goods

	One good	Two goods	Tree goods	Four goods	Five goods	Six goods	All durable goods	Goods according to type
Music device	22	34	38	14	9	5	1	**123**
Bicycle	39	28	12	8	6	5	1	**99**
Truck	0	1	2	0	1	1	1	**6**
Car	2	0	5	7	6	5	1	**26**
Computer	0	1	5	8	7	5	1	**27**
Motorcycle	7	14	25	8	7	4	1	**66**
TV	25	32	39	15	9	5	1	**126**
Goods according to the number	**95**	**55**	**42**	**15**	**9**	**5**	**1**	

Source: Questionnaire to the household, 2014

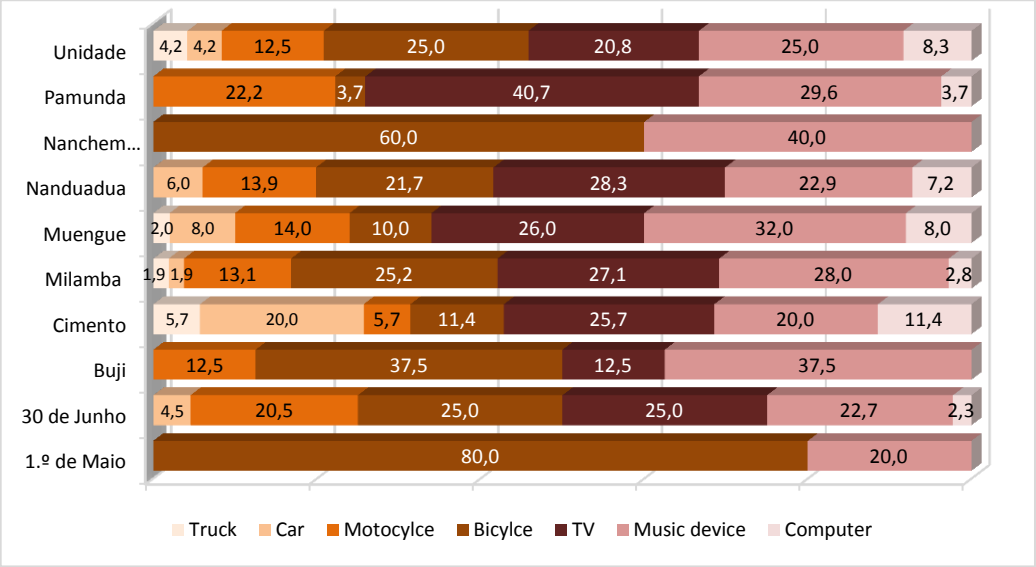
The collected data also allow us to conclude, according to the distribution of possession of these goods by *bairro* (**Figure 6.22**), that Nanchemele, constitute the territorial units with the highest percentages of households without any durable goods, as opposed to the Cimento, 90% of the respondents claim to have in their possession at least one durable good. On the other hand, the households in the peripheral *bairros*, with special emphasis to the 1º de Maio e Nanchemele, only have in their possession more affordable durable goods (music device and bicycle). By

contrast, in the central *bairros* (Cimento e Unidade), the households tend to be in possession of high cost durable goods (truck, car, motorcycle and computer) (**Figure 6.23**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.22 - Distribution of households according to the possession of durable goods by *bairro* (%)



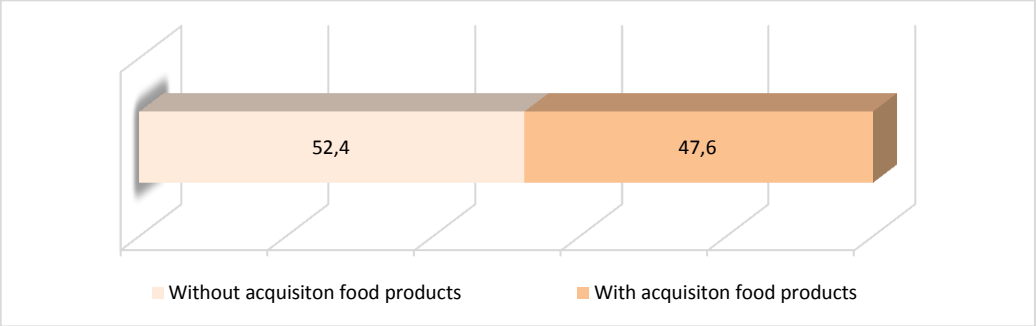
Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.23 - Distribution of households according to the type of durable goods by *bairro* (%)

6.2.2.3 Acquisition of non-essential food products

In the acquisition of non-essential food items, the questionnaire sought to identify whether the household respondent acquires every week beef, chicken and milk.

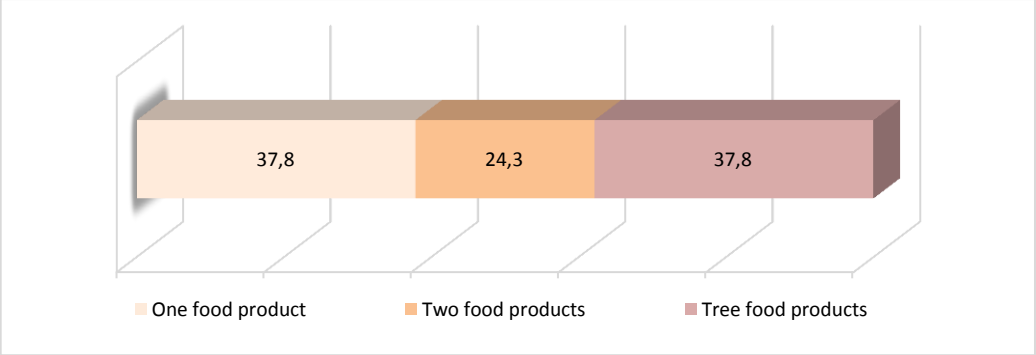
From the obtained results, more than a half of households (52.4%) didn't acquire the food products considered and 47.6% claim to acquire every week at least one, which, on average, represents an essential food product per household (**Figure 6.24**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.24 – Households that purchase non-essential food products every week (%)

From the 47,6% of the households who claim to accquire every week non-essential food products, 37.8% buy only one food product, 24.3% buy two food products and 37.8% confirm to buy, weekly, all the three food products considered in questionnaires (**Figure 6.25**).

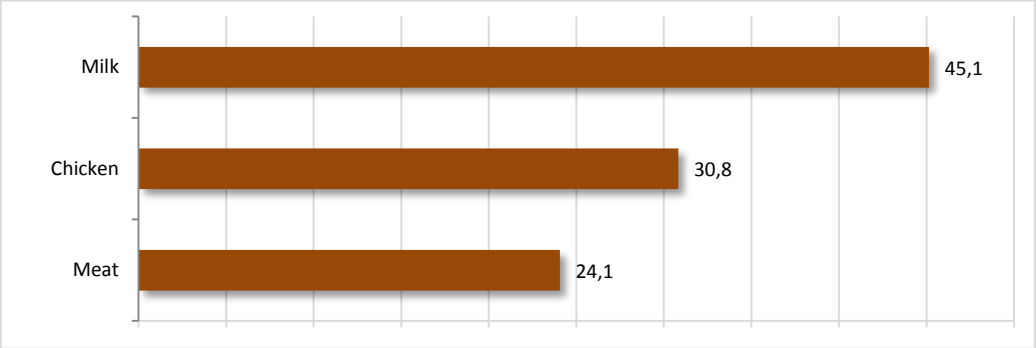


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.25 – Households that purchase non-essential food products every week, according to the number (%)

Milk is the main non-essential food product purchased every week, representing the majority of the sample (45.1%). 30.8% claim to buy chicken and only 24.1% claim to

buy meat, perhaps because of their higher cost (**Figure 6.26Error! Reference source not found.**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.26 – Households that acquire non-essential food products according to the type (%)

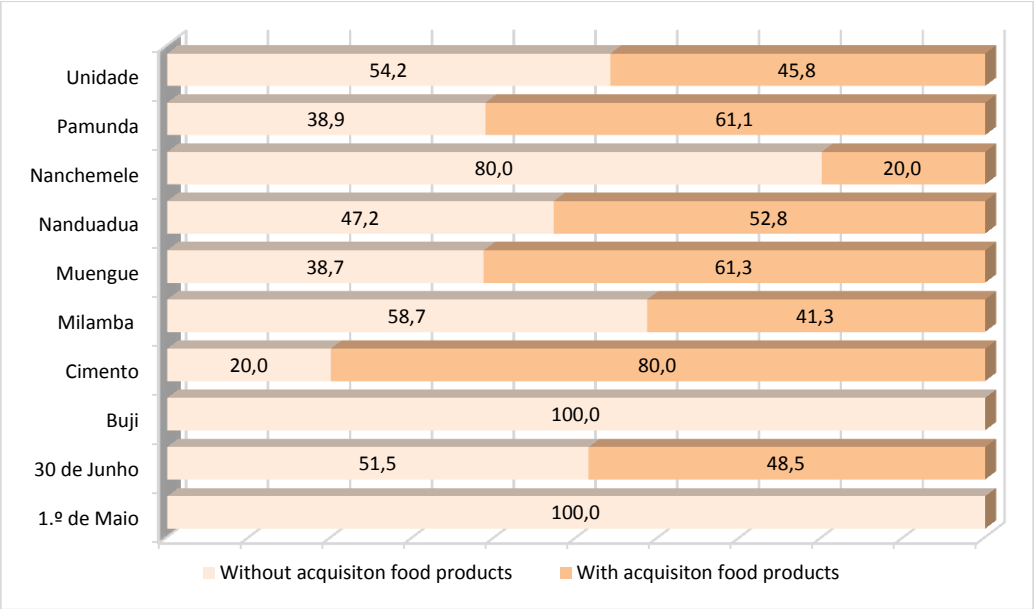
The correlation between the number and type of non-essential food products is presented in a matrix form in **Table 6.5**. The milk is, in general, the most purchased food product, whatever the number of purchased food products.

Table 6.5 – Correlation matrix between the number and type of non-essential food products purchased every week

	One food product	Two food product	All of food prducts	Food products according to type
Meat	8	11	70	**89**
Chicken	9	35	70	**114**
Milk	53	44	70	**167**
Food products according to numberº	**70**	**45**	**70**	

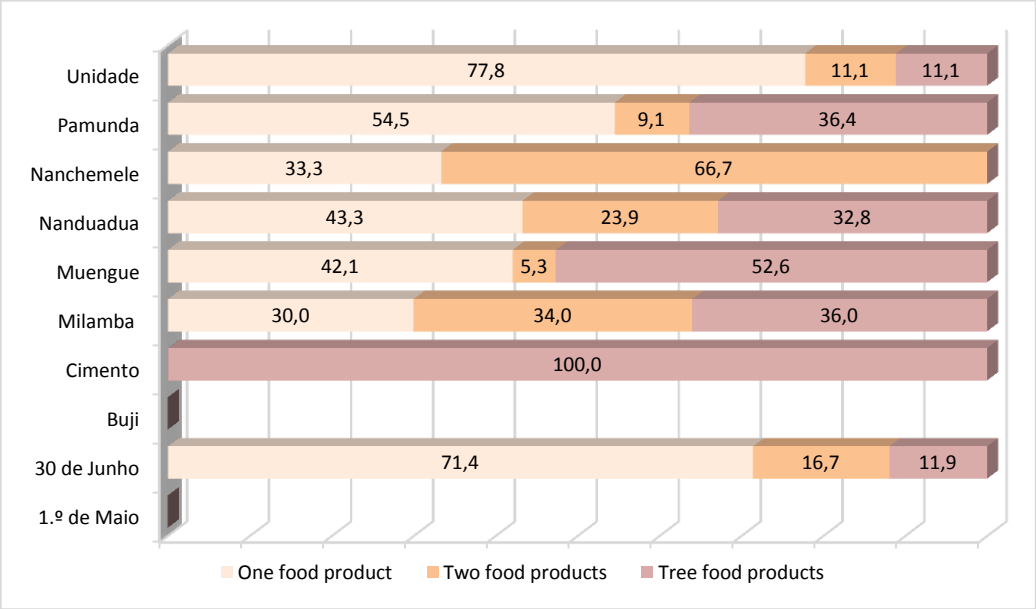
Source: Questionnaire to the household, 2014

In the distribution of the households according to acquisition of non-essential food products, by *bairro*, stand out negatively, the *bairros* 1º de Maio and Buji, followed by Nanchemele, where the determined percentages of households that claim not to acquire any of the considered food products in the questionnaire are substantial. Meanwhile, the b*airro* Cimento is, once again, the territorial unit with the highest percentage of households that claim to acquire at least one of these goods (**Figure 6.27**). Regarding the number of purchased food products, Cimento is the only *bairro* where all the surveyed households claim to acquire a non-essential food product every week. The following is the *bairro* Muengue with 52.6%, although distant from the first (**Figure 6.28**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.27 – Distribution of households that acquire non-essential food products every week by *bairro*



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.28 – Distribution of households that acquire essential food items every week, according to the number, by *bairro*

6.3 Characterization of the sanitation situation of the sample

Access to clean and safe water constitutes a prerequisite for human health, which represents a risk when contaminated with human waste. Indeed, poor sanitation and inadequate hygiene are serious obstacles to development, constituting a major cause of disease in the Mozambican context. In this sequence, and aware of the importance of sanitation holds for achieving the objectives of this study, the questionnaire incorporated a set of questions in order to obtain sufficiently detailed information to allow a gender analysis of the sanitation situation in their four components, with the results shown in the following discussion:

- domiciliary sanitation infraestructures;
- Stormwater;
- Solid waste;
- Hygiene.

6.3.1 Domestic wastewater

In the characterization of the domestic wastewater, we tried to identify, in addition to the type of the existing sanitation infrastructures in the houses of the households, the existence of the open defecation practice.

6.3.1.1 Domiciliary sanitation infraestructures

It is known from the previously performed analysis (**Figure 6.11**) that only 67.4% of the households claim to have, in their houses, access to sanitation. In this sense, we tried to develop this point, identifying the type of sanitation infrastructures involved and the degree of satisfaction of its users.

Types of domiciliary sanitation infrastructures (toilet / latrine)

In order to identify the types of the existing sanitation infrastructures in the houses of the surveyed households, the questionnaire incorporated the following response alternatives:

- Toilet bowl (with or without cistern);
- Improved latrine, which involves the opening of a hole, coated or not, depending on the soil type. The cover is a dome-shaped concrete slab, which has a cap that closes the hole. Also included in this alternative the traditional

improved latrine, which is a grave slab of wood (round or square). These types of latrines are usually accompanied by a deckhouse to maintain privacy;

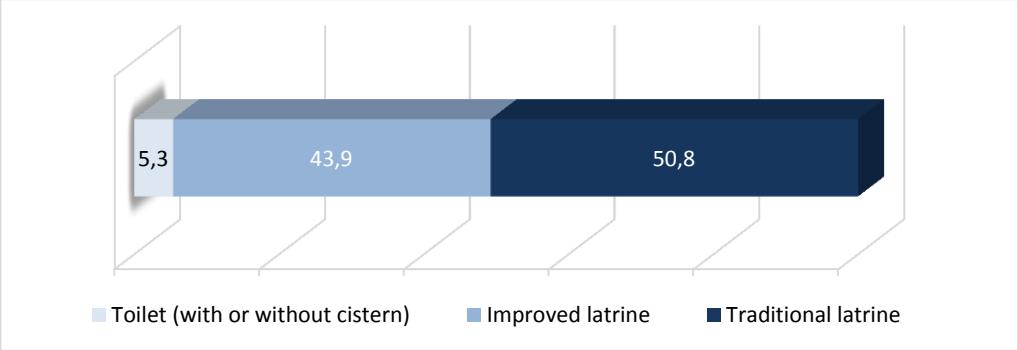
- Traditional Latrine, classified according to the INE documents as "unimproved latrine", and involves the opening of a cave, which may be covered or not depending on the type of soil. The coating is done using local materials. The upper part is crossed by sticks leaving a hole in the center which may or may be not covered. It is accompanied by a shack made from local materials, usually without coverage.

Improved traditional latrine
(Source: Field work, 2014)

Traditional latrine protected by a corrugated plate
(Source: Field work, 2014)

Photograph 6.3 – Traditional latrines

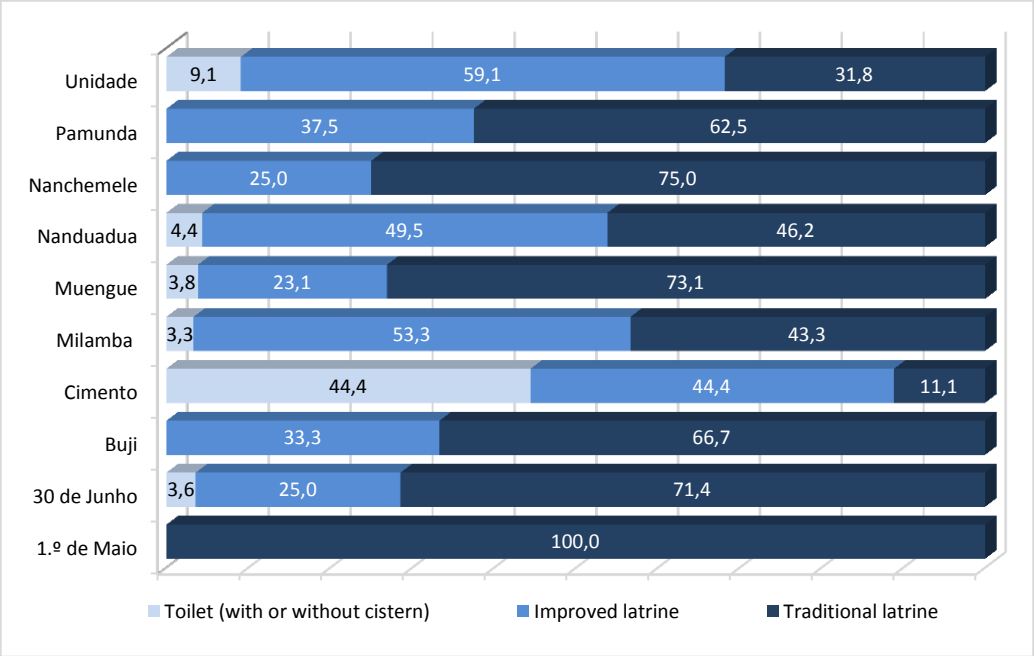
67.4% from the households that claim to have access to sanitation in their houses, more than a half (50.8%), have traditional latrines, considered a sanitation option out of to the minimum standard of access defined by DNA. The houses with improved latrines are the second most frequent choice of sanitation, representing 43.9% of the sample. Only a residual percentage of the households (5.3%) claim to have toilets in their homes, the most part without cistern (**Figure 6.29**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.29 – Type of domiciliary sanitation infrastructures (%)

In the distribution of the sanitation systems by *bairro*, represented in **Figure 6.30**, it appears that, in the majority of the *bairros*, the percentages of households with traditional latrines are very high. This reality tends to be more severe in *bairro* 1º de Maio, where all of the households surveyed claim to have this type of sanitation system in their houses. The houses with improved latrines tend to be observed especially in *bairros* Unidade and Milamba, with 59.1% and 53.3%, respectively. Meanwhile, the higher percentages of households with toilets are recorded mainly in *bairro* Cimento.

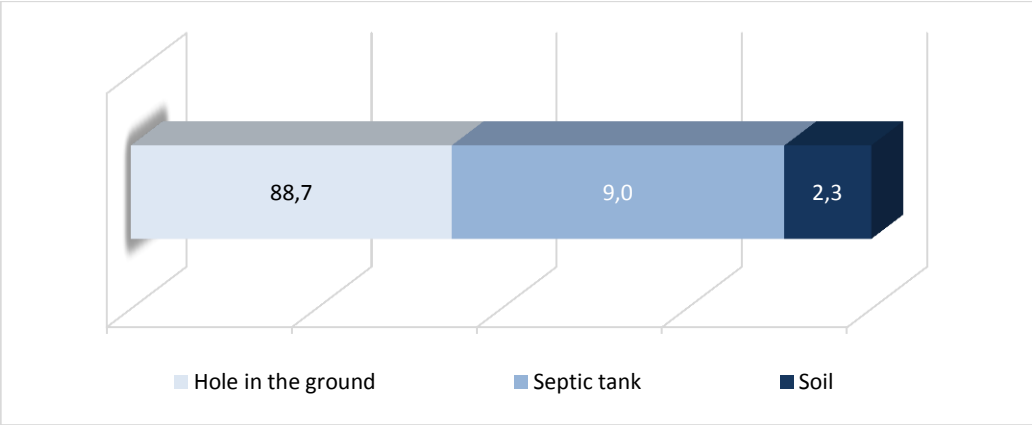


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.30 – Distribution of domiciliary sanitation infrastructures by *bairro* (%)

Destination of excreta

According to **Figure 6.31**, the excreta are nearly always rejected to a hole in the yard under the latrine, representing 88.7% of the sample. This hole once filled is closed, being built another latrine nearby. Only 9.0% of the respondents, that have a domiciliary sanitation infrastructure, have a septic tank, and one of them claim to have already made their emptying, with an associated cost of about 3,000 MT. 2.3% of respondents claim to reject the excreta to the soil / yard (**Figure 6.31**).

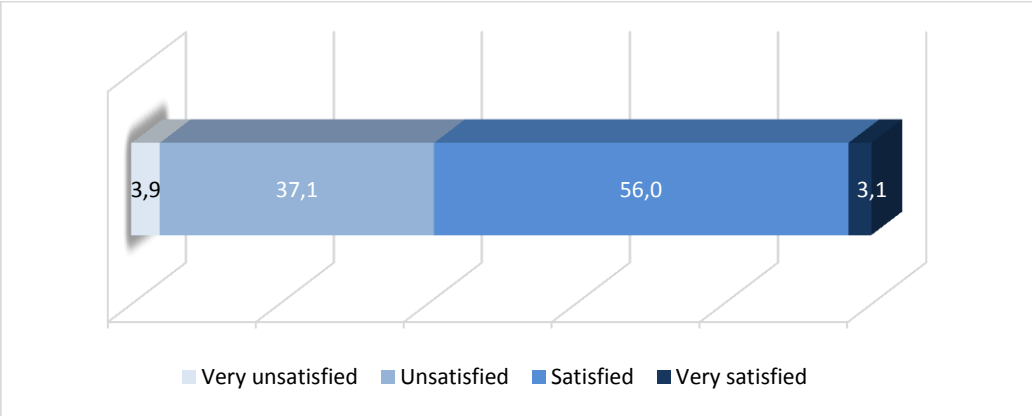


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.31 – Destination of excreta (%)

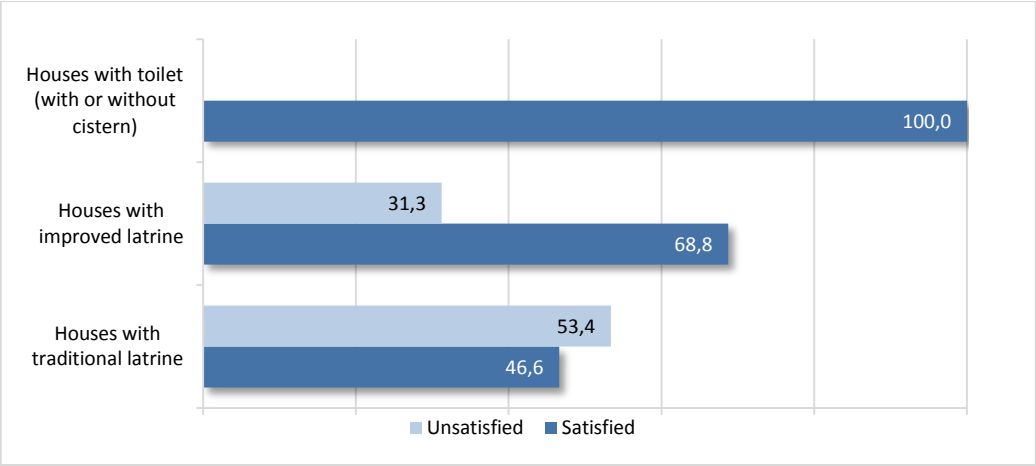
Degree of satisfaction

The questionnaire conducted among households has also sought to determine the degree of satisfaction according to the type of existing sanitation infrastructures in their homes, observing that, based on the results shown in **Figure 6.32**, more than a half of respondents are satisfied (59.1%). The expressed satisfaction tends to increase as the best option for the existing sanitation, essentially associated to privacy, availability and cleanliness that they offer to their users, although all of the respondents who claimed to have traditional latrines in their homes manifest themselves satisfied (**Figure 6.33**). Nevertheless, remains a proportion of respondents (41.0%) that claim to be unsatisfied with the current sanitation infrastructure in their houses, this dissatisfaction are often associated with the quality of the existing infrastructure, mostly manifested in houses with traditional latrines (**Figure 6.33**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.32 – Degree of satisfaction (%)



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.33 – Degree of satisfaction according to the domiciliary sanitation infrastructure (%)

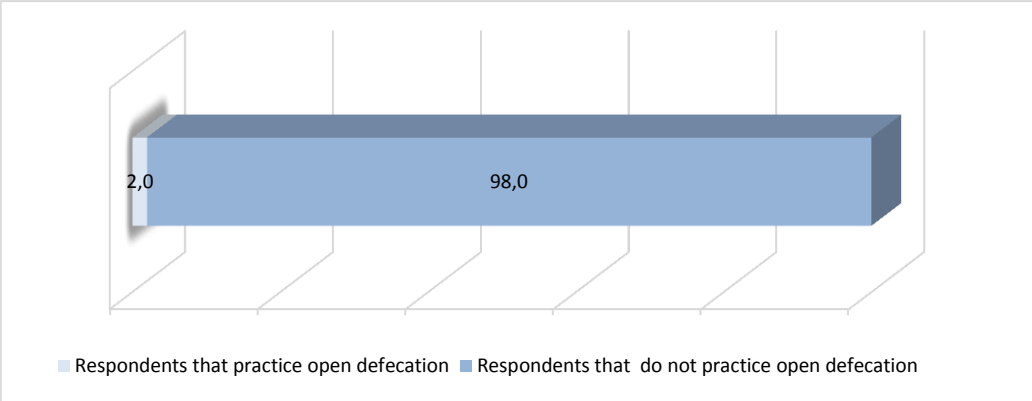
6.3.1.2 Open defecation

The practice of open defecation facilitates the creation of flies and other insects that carry germs from feces to people and / or the food and water that people consume. Diarrhea, cholera, dysentery, typhoid fever, hepatitis A, worms and other intestinal parasites are some of the diseases that are more common in the community and that is directly related to poor hygiene and sanitation. This reality tends to be more severe if the health care were deficient and / or insufficient.

Despite of the continuing efforts of local authorities to eradicate the practice of open defecation, still persist a considerable number of respondents who claim to practice open defecation (25.8% of the representative sample of the municipality). According to the **Figure 6.34**, this practice is strongly related to the lack of private sanitation infrastructures, verifying that more than 80.0% of the respondents who claim to practice open defecation doesn't have the means to build latrines in their homes and 7.4% doesn't have the space for build a latrine in the yard (**Figure 6.35**). This last point may be related to the high water level observed on the ground (**Photograph 6.4**).

The only two cases reported where the household has private sanitation system, the lack of appropriate conditions of their latrine constitutes the main reason to the open defecation practice. It will, therefore, conclude that Islamic religious habits (purification after defecating, by washing), in most cases, will not be linked to the existence of this practice. It is also important to mention that only one respondent claim to be satisfied with this way of doing it.

It should, however, highlight that the results obtained may correspond to a slight distortion of the reality, if we consider that some respondents may be afraid of claiming that are practicing open defecation, a socially practice not accepted and illegal. On the other hand, the reasons given by who claim to practice open defecation may possibly not correspond to reality, serving only as attenuating for those who do.

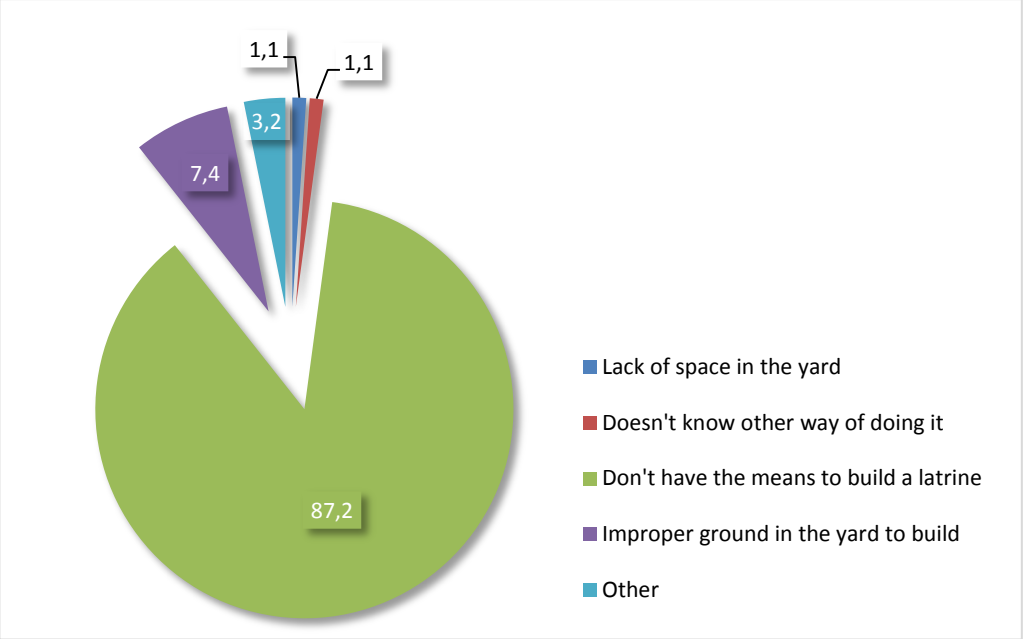


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.34 – Open defecation practice (%)

Source: Field work, 2014

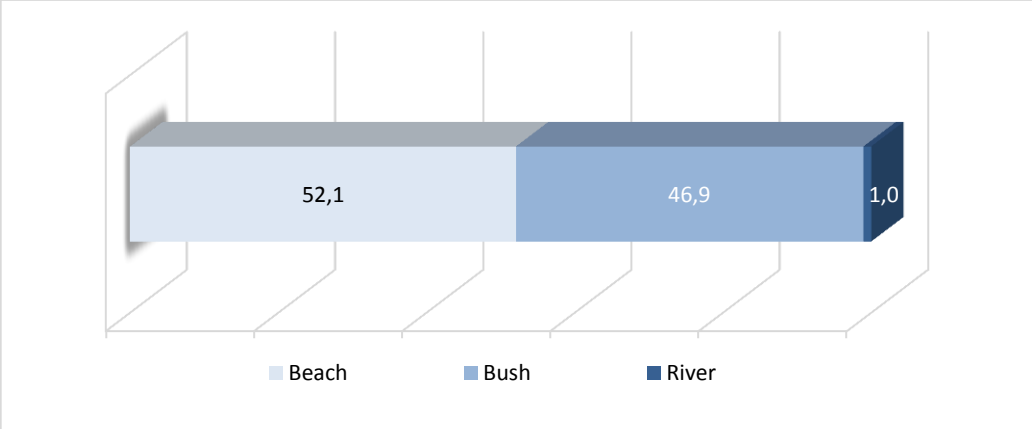
Photograph 6.4 – Groundwater level observed in field



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.35 – Reasons for the open defecation practice (%)

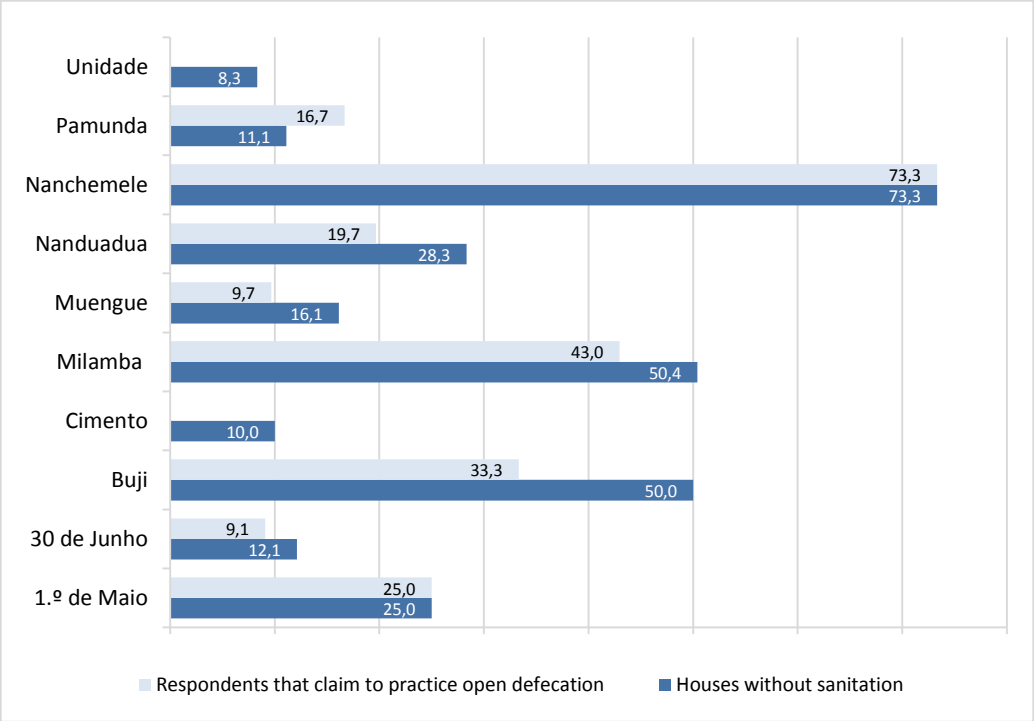
The major part of the respondents who claim to practice open defecation, do it on the beach or in the bush, depending on the proximity to their home, even in the existence of public sanitation system. This fact is indicative that the existence of public latrines has not revealed an alternative to private sanitation system. It should also be noted that 66% of the respondents claim to ignore the existence of public latrines in their *bairro*.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.36 – Place where the respondents practice open defecation (%)

The distribution of the open defecation practice by *bairro*, cartographically represented in **Figure 6.37**, confirm the evidenced before, particularly with regard to the direct relationship between the percentage of households without sanitation infrastructures and the practice of open defecation. In *bairros* where the number of houses without sanitation system is high, greater the number of respondents who claim the practice of opena defecation. This reality is especially onerous in *bairro* Nantchemel, where 73.3% of the respondents claim to practice open defecation. Cimento and Unidade are the only *bairros* where this practice was not recorded.



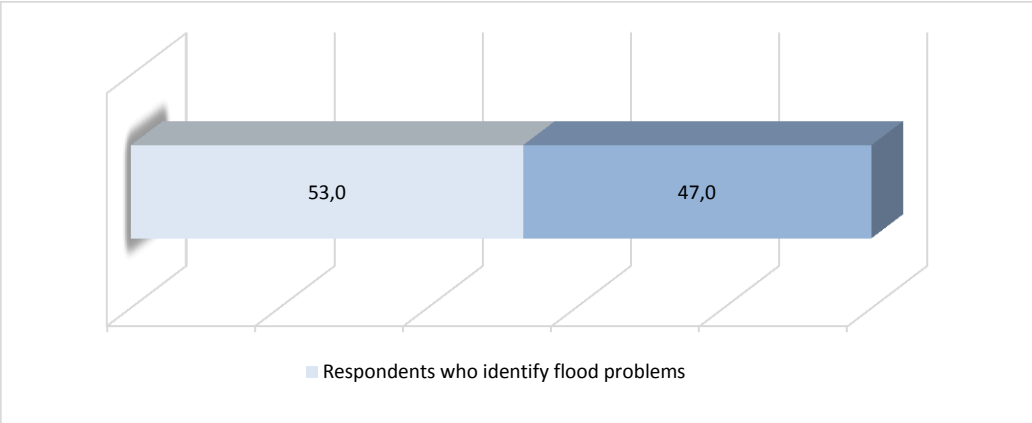
Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.37 – Distribution of open air practice by *bairro*

6.3.2 Stormwater

The existence of accumulation areas of stagnant rainwater is a serious problem for communities, not only for the inconvenience caused by the entry of water into their houses and the property damage, but also because they constitute favorable zones to the growth of insects and other disease vectors. This reality seriously compromises the affected communities by the negative impacts that are inherent economically, socially, public health and welfare, reason why the questionnaire sought to identify, among households surveyed, if the surroundings of their houses are flooded or not in rainy season.

From the obtained results, it appears that 57.0% of the respondents identified problems related to floods, having been reported and observed, in situ, that the stagnant water tends to stay for extended periods of time (**Figure 6.38**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.38 – Households which identified flooding problems (%)

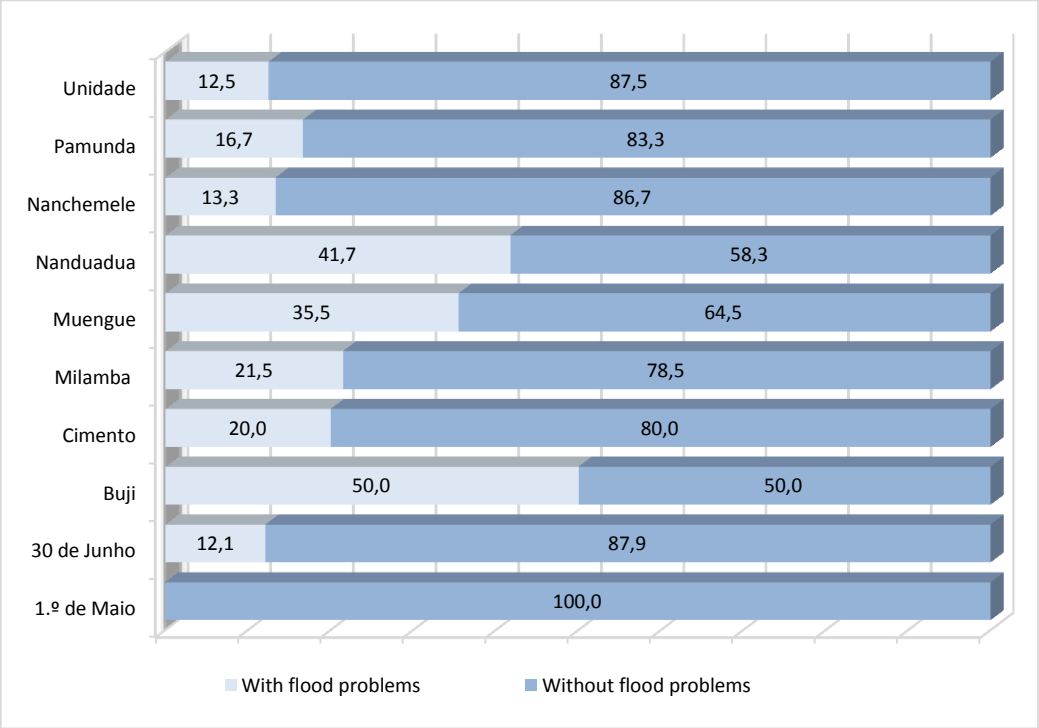
Source: Field work, 2014

Photograph 6.5 – Water accumulation zone after 2 months of the occurrence of rainfall

Source: Field work, 2014

Photograph 6.6 – Material damages caused by stormwater

Considering the **Figure 6.39**, Buji and Nanduadua are the territorial units with the highest percentage of respondents which identified flooding problems in the vicinity of their houses, 50.0% and 41.7%, respectively.



Source: Own elaboration, Questionnaire to the household, 2014

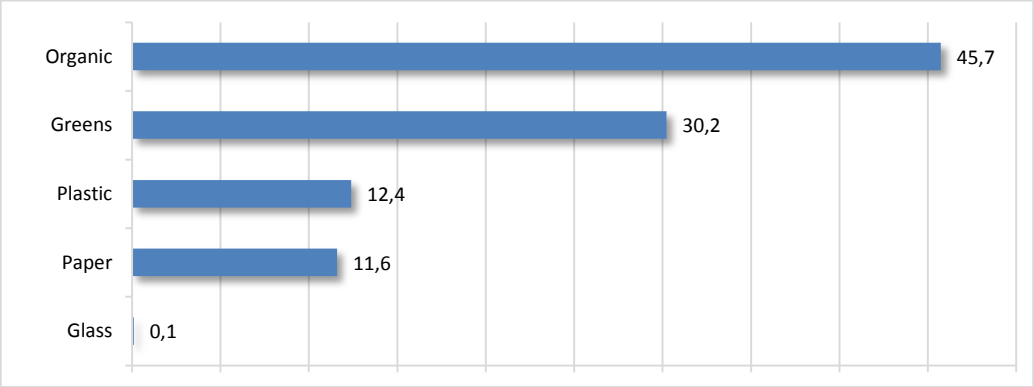
Figure 6.39 – Distribution of the flooding problems identified by *bairro* (%)

6.3.3 Soli waste

The solid waste accumulation promotes the growth of insects and other disease vectors. This reality tends to be particularly severe when injured children play with the waste or when the deposition is carried out in water sources proximity, where the risk of water contamination is higher. In a possible ingestion of contaminated water, the disease occurrence is significantly high. In this sense, we tried to find among households surveyed, the type of waste produced in their homes, the place where the deposition is carried out and their satisfaction with the way that waste is handled in the municipality.

6.3.3.1 Type of waste generated

According to the obtained results in the questionnaires, the majority of the household waste produced is typical of a low-income community, essentially of an organic origin (45.7%), from peels, leftover fruits and vegetables, and animal waste. The green waste produced is mainly associated to leaves and branches of trees, which also represents a significant percentage (30.2% of the responses). The following is the plastic and paper though in a much less representative. The glass is a type of residue that is almost nonexistent, representing only 0.1% of the responses (**Figure 6.40**).



Source: Own elaboration, Questionnaire to the household, 2014

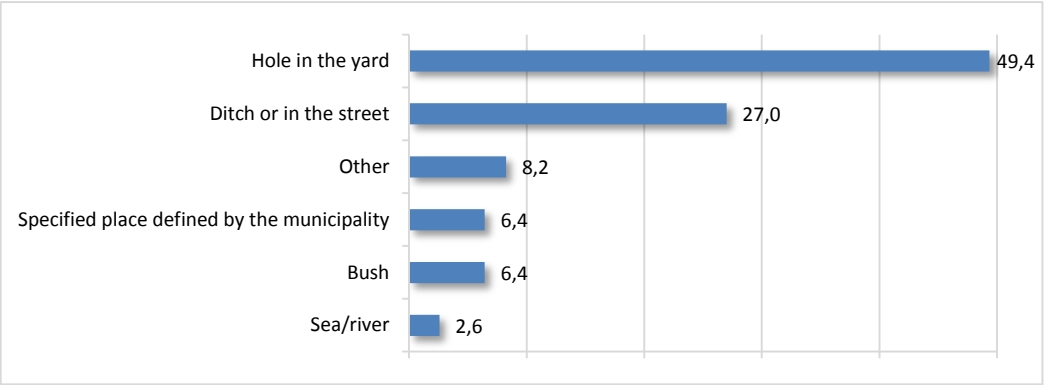
Figure 6.40 – Type of waste generated (%)

6.3.3.2 Disposal sites

The verified data confirm that most of the waste produced by households surveyed is deposited in a hole, in the yard, representing 49.4% of the sample, which admit to manage the solid waste this way because they don't know another way of doing it, but also, according to some identified cases, because they don´t have a specific place to deposit the waste, indicated by the municipality. In spite of not constituting the ideal

form of dealing with waste, depositing the garbage in a hole in the yard, manifest a more viable option than depositing it at open air.

A significant percentage of the households (27.0%) admit to deposit the solid waste in a ditch or in the street, because they don't know another way of doing it, because they need to protect their houses from flooding problems or because they don´t have a specific place to deposit the waste, indicated by the municipality. In spite of not constituting the ideal form of dealing with waste, depositing the garbage in a hole in the yard or burning it, manifest a more viable option than depositing it at open air. In the category "Other", much of the generated waste is either burned or simply deposited in the yard. The lack of space in the yard and the absence of a specific location indicated by the municipality are the main reasons for which 9.0% of the respondents deposit their generated waste in the bush, in the sea or river. Only 6.4% of the respondents admit to deposit the produced waste at a specified place defined by the municipality (**Figure 6.41**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.41 – Waste disposal sites (%)

Waste disposal in a hole in the yard
(Source: Field work, 2014)

Waste disposal at the street
(Source: Field work, 2014)

Waste disposal at the yard
(Source: Field work, 2014)

Waste disposal near a house (protection from the floods)
(Source: Field work, 2014)

Municipal waste disposal site – *bairro* Cimento

Municipal waste disposal site – *bairro* Milamba

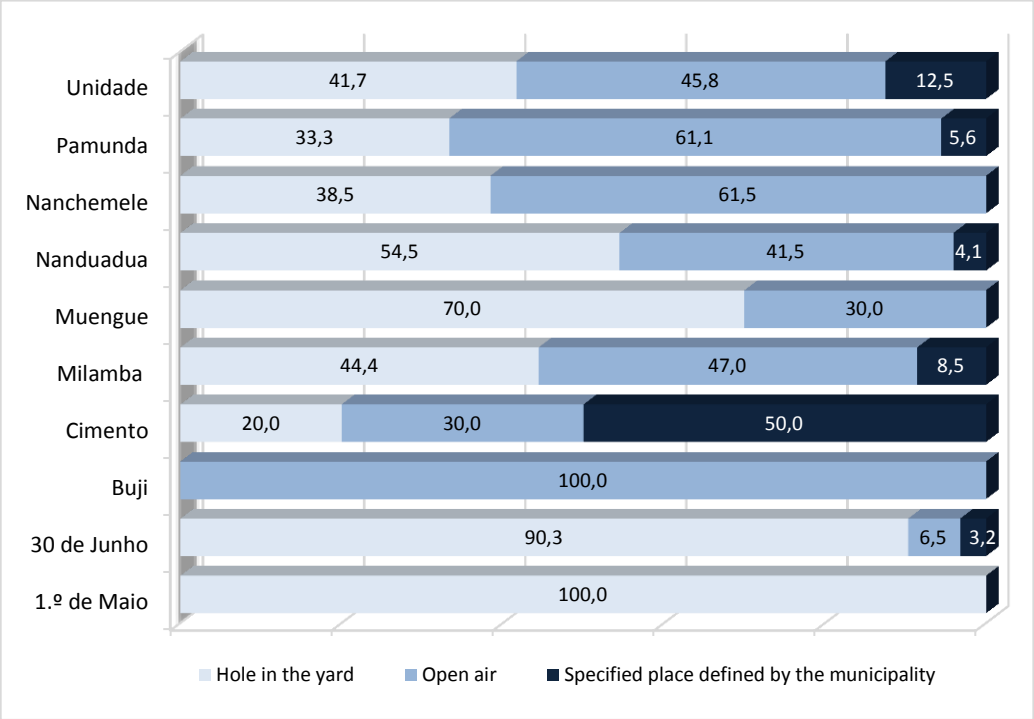
Waste disposal at the beach
(Source: Field work, 2014)

Photograph 6.7 – Waste disposal sites

It should also be noted that 66.6% of the respondents claim of not having waste collection in their *bairro*, other 25.4% responds that do not know. The remaining responses (8%) are very variable and compared within the same *bairro*, are incongruent. This conclusion is perhaps indicative of failures in awareness / communication with communities on this subject.

In the distribution of the main points of waste disposal (**Figure 6.42**) by *bairro*, the waste disposal at open air (ditch, street, bush, river, beach or yard) is significant in most of the *bairros*, verifying that the deposition of waste in the municipal deposition sites is only carried out in the *bairros* Unidade, Pamunda, Nanduadua and 30 de Junho, considering, however, that this percentages obtained are insignificant, except for

bairro Cimento (50.0% of the sample).The verified data confirm that most of the produced waste by households surveyed is deposited at open air.

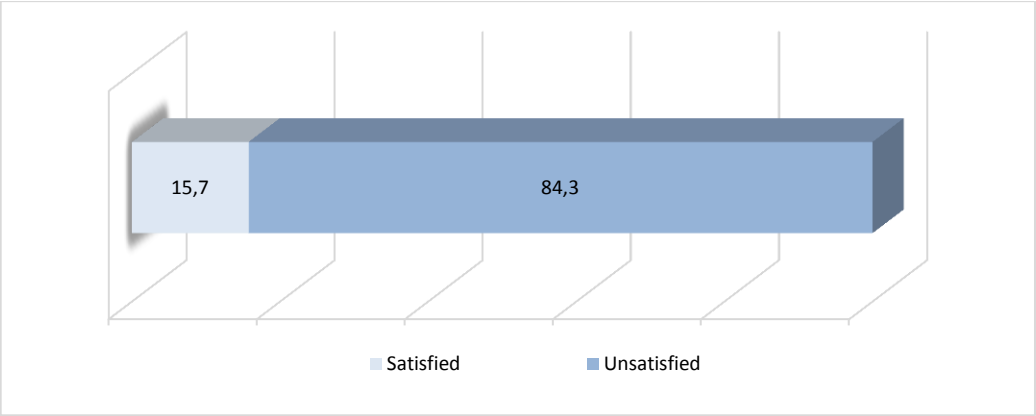


Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.42 – Distribution of the main waste disposal sites by *bairro* (%)

6.3.3.3 Degree of satisfaction

Similarly to the questionnaire made to the domiciliary sanitation infrastructures, we tried to determinate the level of satisfaction of the households according to the way that waste is handled in the municipality, observing, based on the results shown in **Figure 6.43**, that only 15.7% of the respondents expressed themselves satisfied, a relatively low percentage.



Source: Own elaboration, Questionnaire to the household, 2014

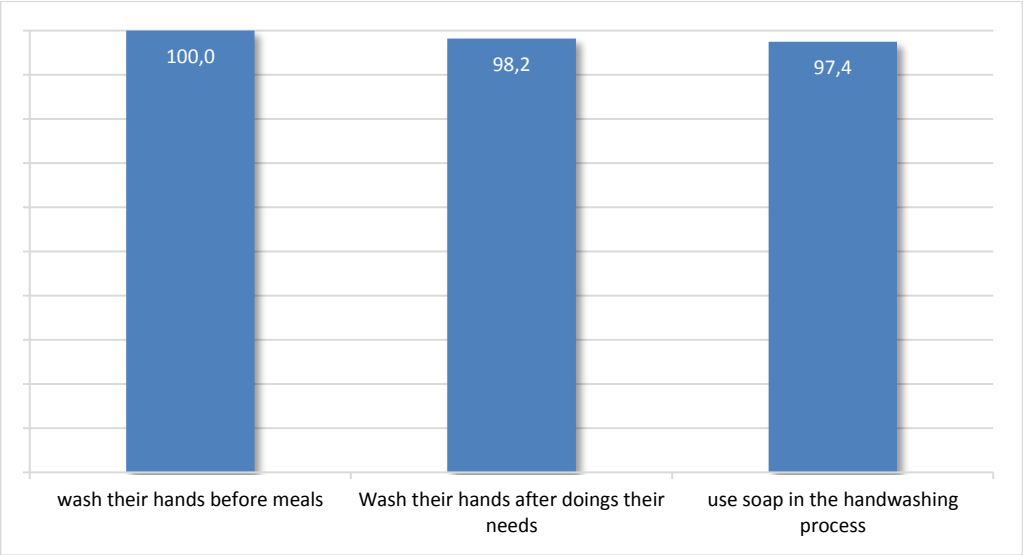
Figure 6.43 – Degree of satisfaction (%)

6.3.4 Hygiene

Access to sanitation can greatly reduce the incidence of diarrheal diseases and other related excreta. However, experience shows that it's the combination of improved hygiene behavior (through the promotion of good hygiene practices) and improving access to sanitation that may have the maximum effect on health. In this sense, the questionnaire sought to obtain a set of information in order to identify hygiene habits, including menstrual hygiene habits.

6.3.4.1 Hygiene habits

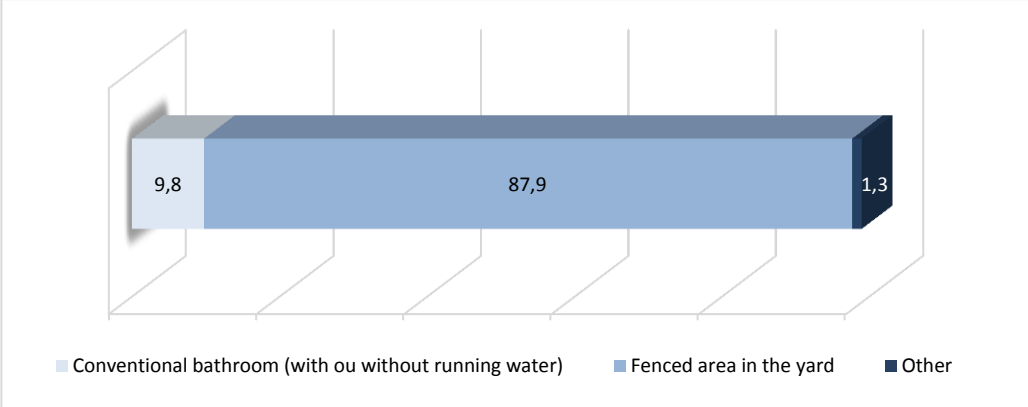
The determined results show that 100% of respondents wash their hands before meals, 98.2% wash their hands after doing the physiological needs and 97.4% use soap in the handwashing process (**Figure 6.44**).



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.44 – Hygiene habits – Handwashing (%)

We tried to find out which are the most common places where the households have their bath, verifying that 87.9% of the respondents claim to bathe in a fenced area in their yard and 9.8% in a conventional bathroom, mostly without running water (**Figure 6.45**), being the resultant white waters, in most cases, rejected into the street or into the yard (95.1%).



Source: Own elaboration, Questionnaire to the household, 2014

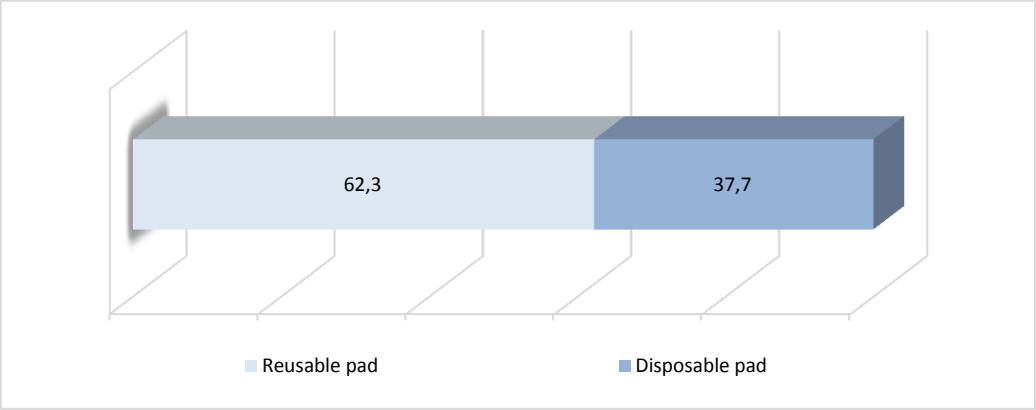
Figure 6.45 – Hygiene habits – Place where the households take their bath (%)

Source: Field work, 2014

Photograph 6.8 – Fenced area in the yard

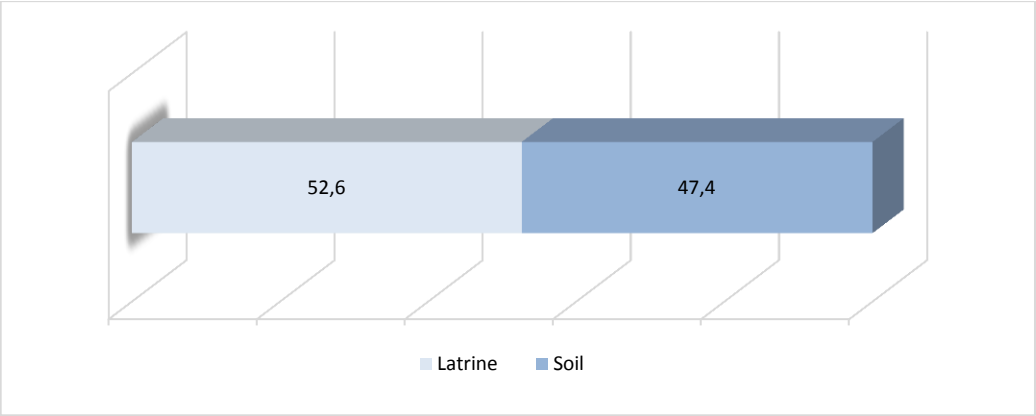
6.3.4.2 Menstrual hygiene habits

Despite the discomfort that the questions could raise among respondents, especially in females, it was able to obtain 26.2% of responses. Within this universe, 62.3% of the respondents claim to use reusable pads in their menstrual hygiene, being the resulting water from their washing discharged in most cases to a latrine (52.6%). The 47.4% of the respondents, who claim to dump the water in the soil, do this due to the fact of lack sanitation infrastructures in their houses (latrine or toilet).



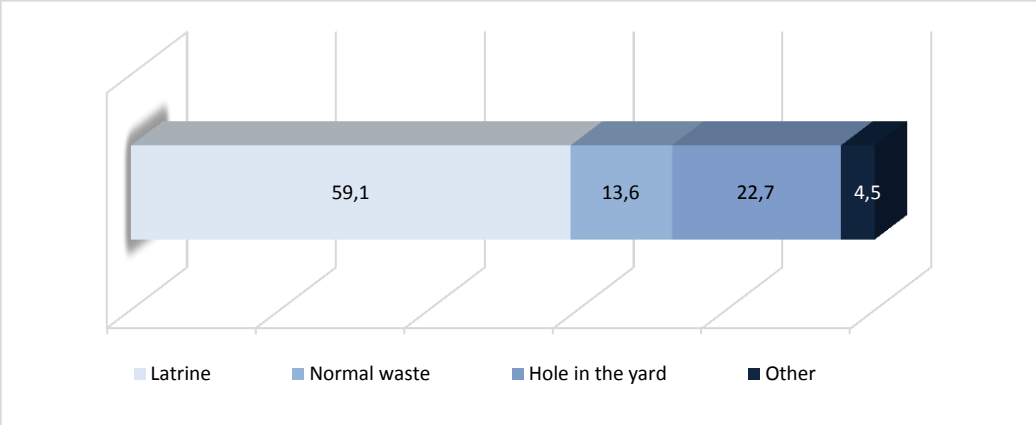
Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.46 – Menstrual hygiene – type of pads used (%)



Source: Own elaboration, Questionnaire to the household, 2014

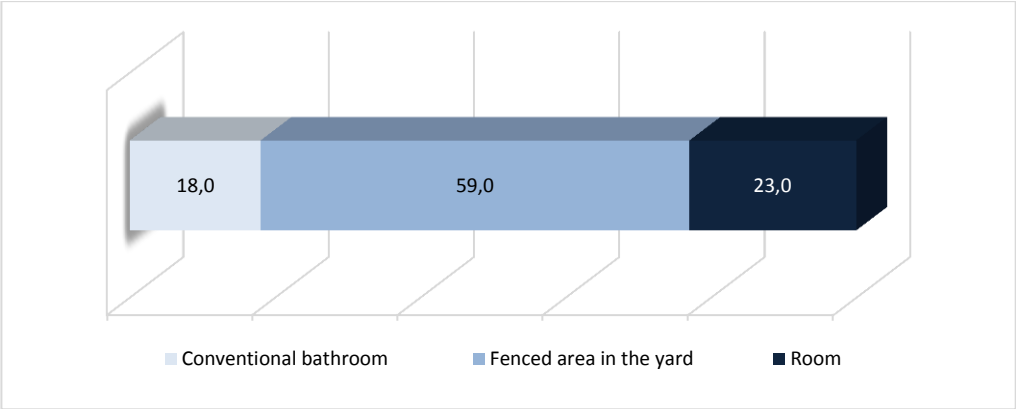
Figure 6.47 – Destination of the used water to wash the reusable pad (%)



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.48 – Deposit location of the disposable pads (%)

According to **Figure 6.49**, it appears that most of the women surveyed claim to make their menstrual hygiene in a fenced area in their yard representing 59.0% of the sample. Only 23.0% os the respondents use the room to make their menstrual hygiene and 18.0% claim to use a conventional bathroom.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.49 – Location where the menstrual hygiene is made (%)

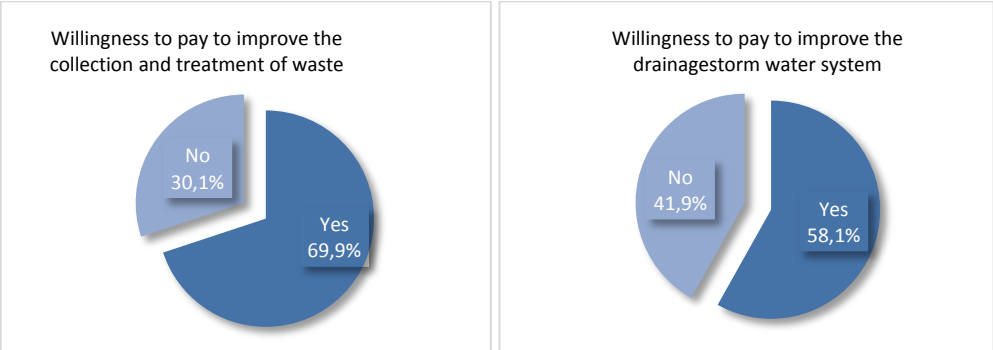
6.4 Willingness and ability to pay

As it was considered essential this analysis to the objectives of the present study, the questionnaire also sought to obtain a set of information in order to identify their willingness and ability to pay to improve the existing conditions of sanitation in Mocímboa da Praia municipality.

6.4.1 Willingness to pay

The willingness to pay of the households was obtained by their willingness to pay to improve the collection and the treatment of waste and drainage of stormwater.

The results, expressed graphically in **Figure 6.50**, shows that the majority of the surveyed households demonstrated willingness to pay to improve the collection and the treatment of waste and drainage of stormwater.



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.50 – Willingness of the households to pay (%)

6.4.2 Ability to pay

Whereas the willingness isn't always indicative of ability, was evaluated, in the following analysis, the ability of the households to pay to improve the existing conditions of sanitation. For that purpose, given the limitations in the accurate determination of this indicator, was defined an index, called Economic Development Index (EDI), which was able to differentiate the economic level of the households surveyed, distinguishing, in turn, the *bairros* according to their economic level.

Constituting only an informative indicator, EDI only serves to evaluate the economic level of the study area, criteria that may be indicative of the ability to pay and shouldn't be used for any other purpose.

This indicator resulted from the ponderation of the obtained results in the questionnaires from the following variables previously analyzed:

- Type of housing, according to the type of construction material used, whose higher ponderation was given to the households with block walls;
- Source of water supply, whose ponderation was assigned according to the security it offers in terms of public health, even benefiting from a public or a private source;
- Domiciliary sanitation infrastructures, with the respective ponderation considered the access or not to sanitation and the type of system concerned when existent;
- Sources of income, whose ponderation took into account the number and the type of income sources, giving more importance to households with more sources and whose type isn't self-subsistence;
- Possession of durable goods, whose ponderation was assigned based on the number and type of Possession of durable goods, having been assigned more importance to households that have more than one durable good and whose type requires a higher cost in its acquisition;
- Acquisition of non-essential food products, whose ponderation was greater the more essential food products purchased, assuming that households with ability to buy expensive food goods such as fresh milk and meat, weekly, constitute a group with the capacity to pay for an improved sanitation service;

- Willingness to pay, whose ponderation was higher if manifested the availability of the household to pay to improve sanitation.

Based on these variables, we established a ranking among the 10 *bairros* under observation, and the results are presented in **Table 6.6**. According to their interpretation, is clearly visible that the first position, according to the analyzed variables, is occupied by *bairro* Cimento, and the last position is alternately occupied by *bairros* 1º de Maio, Buji and Nanchemele.

Taking into account the rankings established for each of the considered variables, we calculated the EDI of each *bairro* (**Table 6.7**), allowing the distribution of this indicator by *bairro* (**Figure 6.51**) to define three distinct areas tending to be distinct among them:

- A more central area composed by the Cimento *bairro*, clearly distancing himself from the remaining *bairros,* where the houses tend to have better conditions, with access to piped water, most of them with toilets, whose economic condition allows to the households the purchase of a greater number durable goods and non-essential food products every week;

- A transition area, which includes the adjacent *bairros* to Cimento, namely Nanduadua, Pamunda, Milamba, and Muengue and 30 de Junho, in which the condition of housing and economic condition deserve some emphasis on the economic development of the households, despite the heterogeneity that exists in some of the considered variables;

- A peripheral area, which includes the *bairros* Nanchemele, 1º de Maio and Buji, where the houses are usually from “straw huts” type, many of those with no access to safe water sources and sanitation, where the only source of income is, in most cases, subsistence agriculture, making difficult to the households the acquisition of durable goods and non-essential food products.

It should also be mentioned that the EDI obtained is quite disparate, varying between 39 in Nanchemele and 93 in Cimento, which on average translates into an EDI of 62 of all the territorial units under analysis. This fact is indicative of an undeveloped economic level, where can be concluded that the households surveyed will have, in general, a low ability to pay for the improvement of the sanitation system.

Table 6.6 - Ranking of *bairros* based on the considered variables

Type of housing		Source of water supply		Domiciliary sanitation infraestructures		Sources of income		Possession of durable goods		Acquisition of non-essential food products		Willingness to pay	
Cimento	1	**Cimento**	1	**Cimento**	1	**Cimento**	1	**Cimento**	1	**Cimento**	1	**Cimento**	1
Unidade	2	Unidade	2	Unidade	2	30 de Junho	2	Muengue	2	Muengue	2	1.º de Maio	1
Muengue	3	Pamunda	3	Pamunda	3	Muengue	3	Pamunda	3	Pamunda	3	Buji	3
Nanduadua	4	Nanduadua	4	Nanduadua	4	Unidade	4	Nanduadua	4	30 de Junho	4	Nanduadua	4
Pamunda	5	Muengue	5	30 de Junho	5	Buji	5	Unidade	5	Nanduadua	4	30 de Junho	5
Milamba	6	Nanchemele	6	Muengue	6	Milamba	6	30 de Junho	6	Milamba	6	Milamba	6
30 de Junho	7	30 de Junho	7	Milamba	7	Nanduadua	7	Buji	7	Unidade	7	Muengue	6
1.º de Maio	8	Buji	8	1.º de Maio	8	Pamunda	8	Milamba	8	Nanchemele	8	Unidade	8
Nanchemele	8	Milamba	9	Buji	9	Nanchemele	9	1.º de Maio	9	1.º de Maio	9	Pamunda	9
Buji	8	1.º de Maio	10	Nanchemele	10	1.º de Maio	10	Nanchemele	10	Buji	9	Nanchemele	10

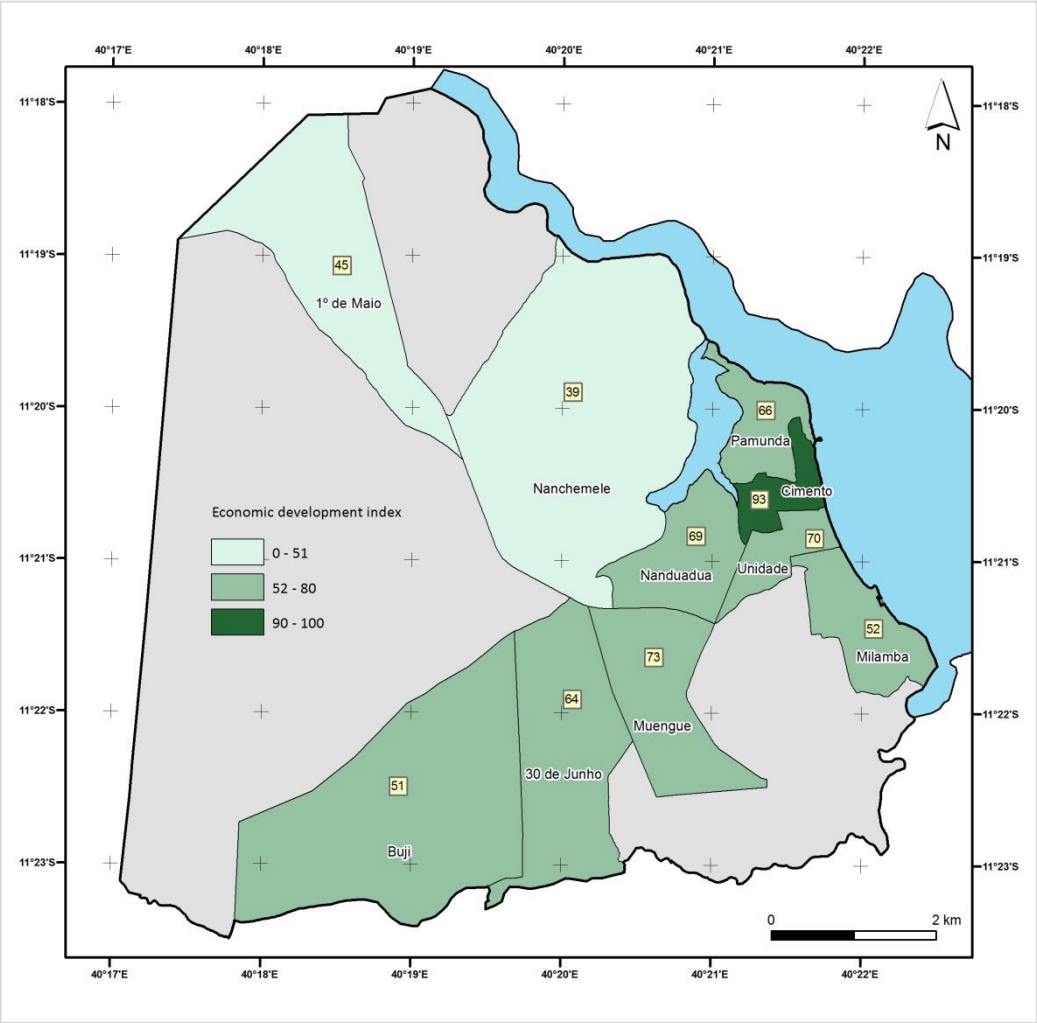
Source: Questionnaire to the household, 2014

Table 6.7 – Economic development index (IDE)

	Type of housing	Source of water supply	Sanitation System	Sources of income	Possession of durable goods	Acquisition of non-essential food products	Willingness to pay	Index
Cimento	1	1	1	1	1	1	1	93
Muengue	3	5	6	3	2	2	6	73
Unidade	2	2	2	4	5	7	8	70
Nanduadua	4	4	4	7	4	4	4	69

	Type of housing	Source of water supply	Sanitation System	Sources of income	Possession of durable goods	Acquisition of non-essential food products	Willingness to pay	Index
Pamunda	5	3	3	8	3	3	9	66
30 de Junho	7	7	5	2	6	4	5	64
Milamba	6	9	7	6	8	6	6	52
Buji	8	8	9	5	7	9	3	51
1.º de Maio	8	10	8	10	9	9	1	45
Nanchemele	8	6	10	9	10	8	10	39

Source: Questionnaire to the household, 2014



Source: Own elaboration, Questionnaire to the household, 2014

Figure 6.51 – Economic Development Index (EDI)

7 BASELINE CONDITIONS

As mentioned above, the characterization of baseline conditions referring to a universe of observation of all Mocímboa da Praia municipality, considered in Chapter 3. This characterization reflects the data obtained through research of varied literature complemented with the results of the questionnaires (Chapter 6), interviews with key stakeholders and *in situ* observation.

The information was treated to provide the basic inputs to observe the environmental and socio-economic dynamics of the municipality, focusing on a set of biophysical and socioeconomic dimensions, which formed the starting point for identifying key problems and dysfunctions of the territorial system in sanitation level.

For a better understanding of the presented results, it is suggested to consult the photographic report of the municipality presented in the Annex 4 of this document.

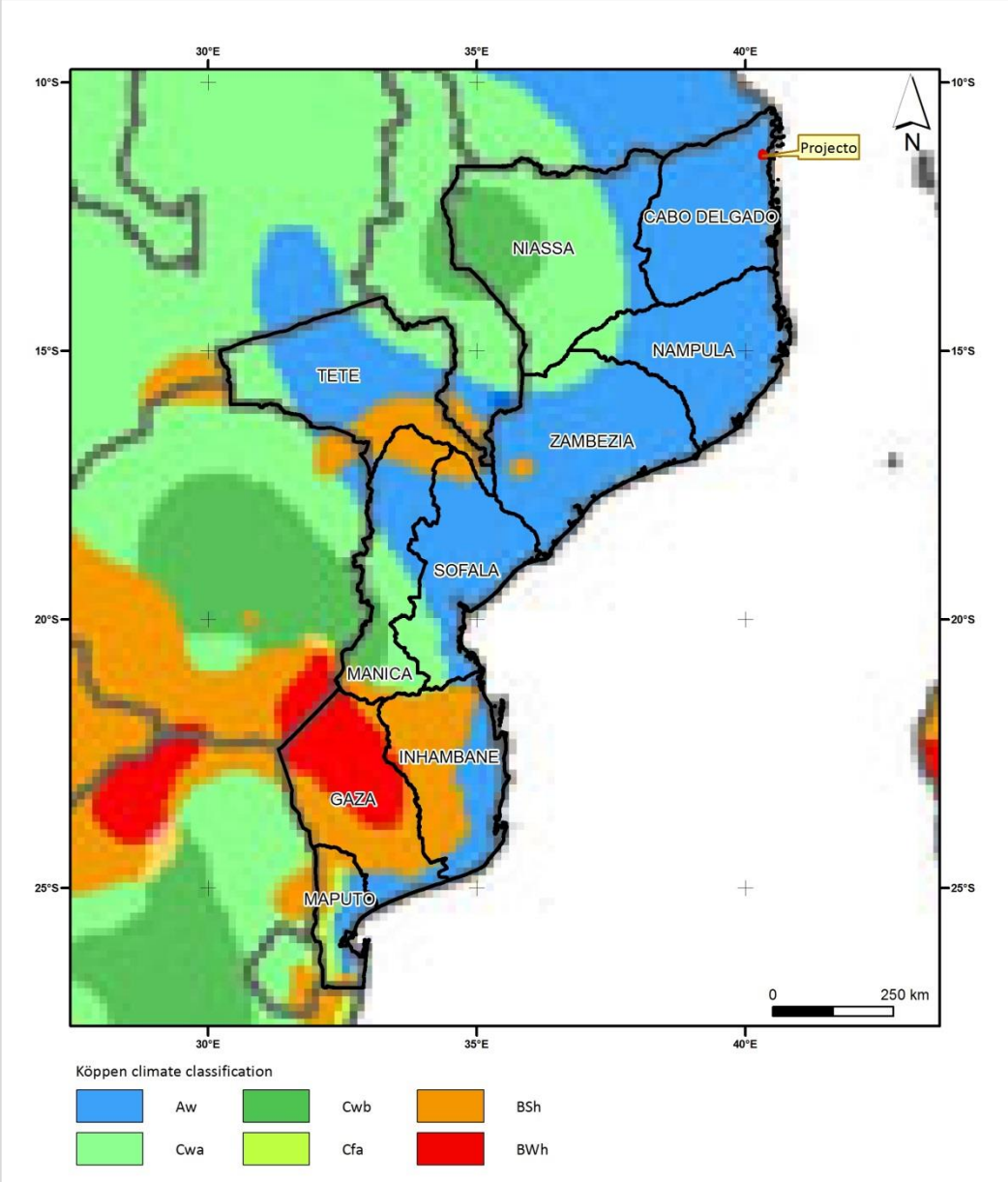
7.1 Biophysical Characterization

7.1.1 Climate

The territory of Mozambique is situated between the 10 ° S and 27 ° S parallels, between the equatorial valley of low pressure (to the North), known as the Intertropical Convergence Zone (ITCZ) and tropical anticyclones region (to the South). The climate in the north of the country is, in general, influenced by the monsoon regime.

Still widely accepted today, the Koppen system, developed in the early twentieth century by German climatologist Wladimir Koppen (1846-1940), was elected to the climatic characterization of Mozambique for his Weather service in 1965. It is a classification according to quantitative criteria based on the correlated distribution of mean values of air temperature and the amount of precipitation for the year. In this sense, and according to the classification used for Mozambique (**Figure 7.1**), it appears that Mocímboa da Praia municipality is part of a territory of rainy tropical savannah climate e (Aw), a mega thermal climate proper of tropical and subtropical regions, usually dominated by masses of foggy air and precipitation of convective origin, but cyclonic also, characterized by a monthly average temperature above 18 °C, even in the coldest month. It is also characterized by a high amount of annual rainfall, although there is a dry season. [3]

[3] It is considered a dry season when the average monthly rainfall is below 60 mm.



Source: Own elaboration, adapted from *World map of Koppen-Geiger Climate Classification*, 2014

Figure 7.1 – Types of climate according to the Koppen classification

Based on monthly values measured at the Weather Station of Mocímboa da Praia, whose location is shown in **Table 7.1**, we obtained the average monthly rainfall and temperatures in the study area for the last 10 years. The series used, provided by INAM is relatively short, but it is sufficient, and reliable, for a correct climate characterization of study area.

Table 7.1 – Location of the Weather Station of Mocímboa da Praia

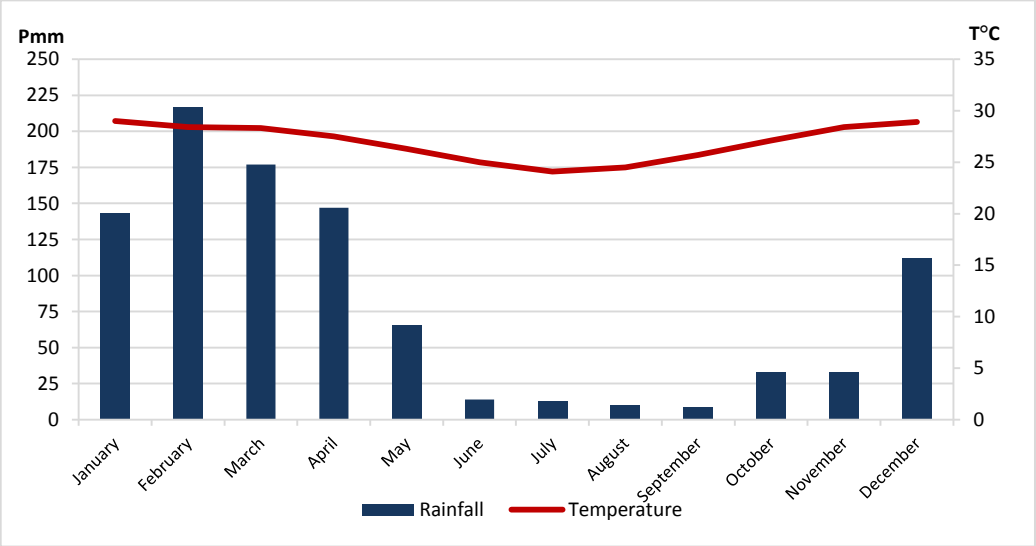
Weather Station	Latitude (S)	Longitude (W)	Altitude (m)	Records Period
Mocímboa da Praia	11° 21' S	40° 22' W	27	2004-2013

Source: INAM, 2004-2013

7.1.1.1 Thermo-pluviometric regime

According to thermo-pluviometric rhythms of that station (**Figure 7.2**), there is the presence of two well-marked seasons of the year: a hot rainy season from December to April, opposes a dry and cooler season from May to November.

In terms of **rainfall**, the observed data show great irregularity, with records to vary between 216.4 mm (in February) and 8.7 mm (in September), assuming an average annual rainfall of 972.1 mm. Considering the temperature monthly averages, there is an annual average temperature of 26.9°C, where the coldest monthly average temperature is 24.1°C (July) and the hottest month is January with an average temperature of 29.0°C. These observations result into a low annual temperature range of 4.9°C.



Source: Own elaboration, INAM, 2004-2013

Figure 7.2 – Thermo-pluviometric chart from Mocímboa da Praia weather station

7.1.1.2 Relative Humidity

The relative humidity registered in Mocímboa da Praia municipality is assumes higher values, varying its monthly average between 70% (July) and 81% (March), as presented on **Table 7.2**.

Table 7.2 – Average monthly Relative Humidity (%)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
RH (%)	78	80	81	79	76	75	70	75	77	77	75	77

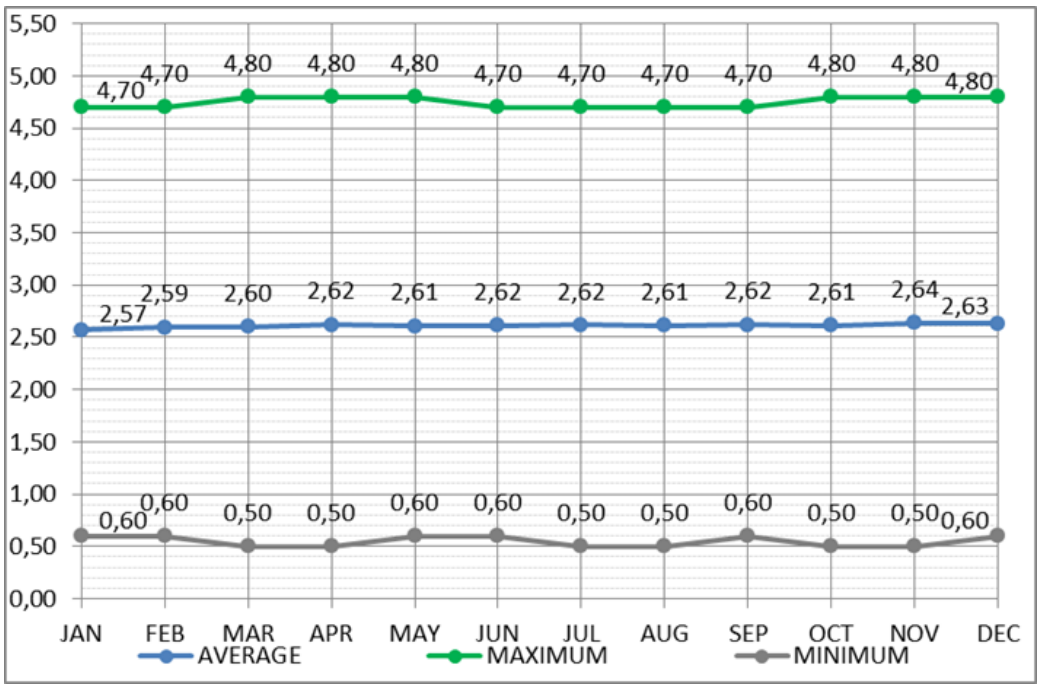
Source: INAM, 2004-2013

7.1.1.3 Wind

As for the wind, the direction of this parameter is predominant from East, from May to September, turning NE in October, in order to maintain a North wind system, initially dry during the month of November, and then hot and humid, connected to the monsoon system from the Indian Ocean, between December and March.

7.1.1.4 Tides

The tides on Mocímboa da Praia are characterized by a period of approximately 12 hours, with amplitudes varying between 0.5 and 4.8 m, with an average annual value of about 2.6 m. The height of the tide varies between 0.5 and 2.3 m, while the height of the tide varies between 2.8 and 4.8 m.

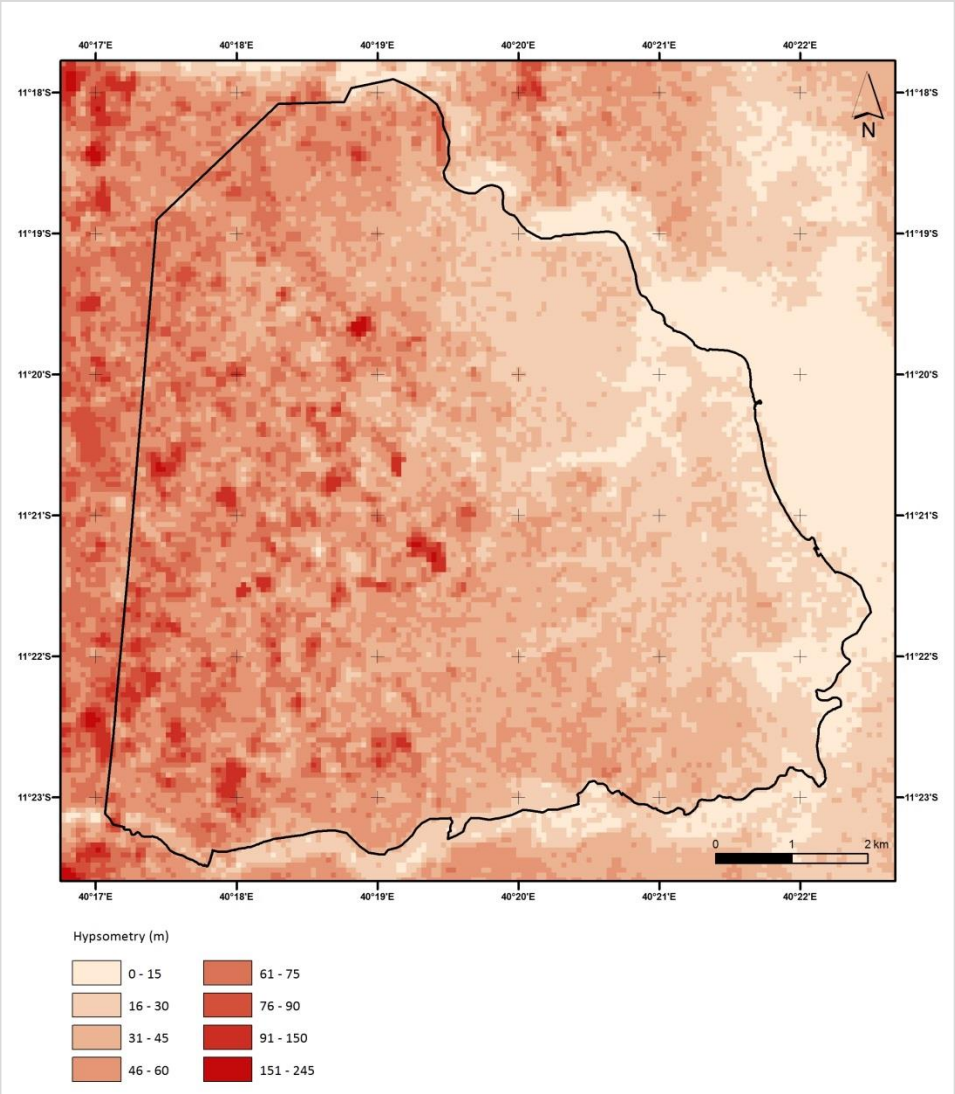


Source: Own elaboration, INAM

Figure 7.3 – Tides

7.1.2 Hypsometry

Mocímboa da Praia municipality is located in the designated coastal plain, which stretches along the coast of Mozambique and is characterized by a certain uniformed altimetry, which tends to increase as one goes west. Essentially, with a low altitude, this plain reaches a maximum elevation of 200 m, and set a relatively flat topography, presenting sometimes variable ripples responsible for the formation of valleys upon which performs the surface water runoff, from inland to coast line. It presents, in morpho-structural terms, in the form of strands, valleys and bottoms of rivers, according to the geomorphological classification of Mozambique.



Source: Own elaboration, Thermal Emission and Reflection Radiometer - Global Digital Elevation Model, NASA and Japan Economic Ministry, 2011

Figure 7.4 –Hypsometry

7.1.3 Hydric Resources

7.1.3.1 Surface Water

Mocímboa da Praia municipality is located in an area covered by tree national watersheds: the basins of the rivers Uncondi, Nangu and Meranvi, where the hydrographic network (**Figure 7.5**) is sparse, mainly represented by small seasonal streams, highlighting the Sinheu (or Quinhevo), Uncondi and Lucom rivers.

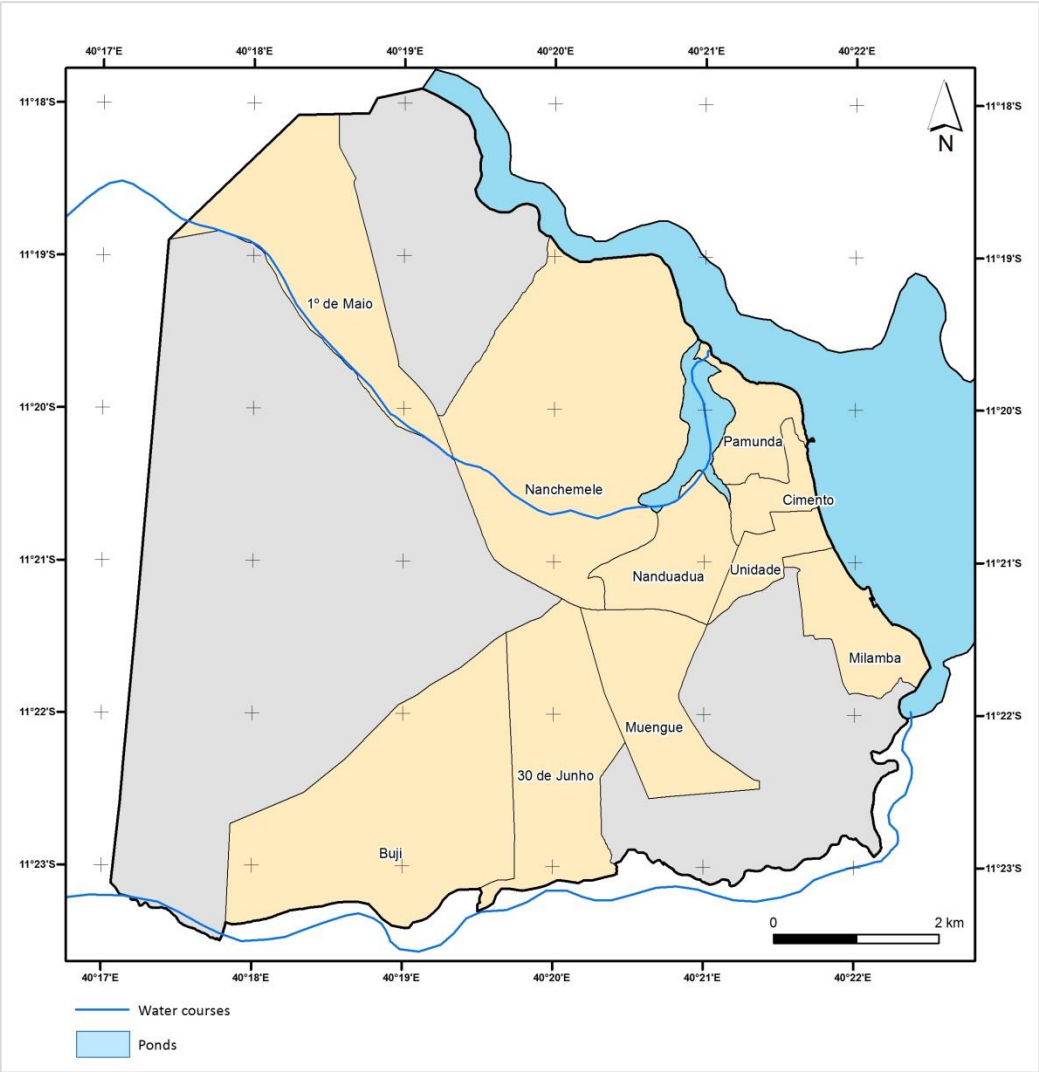
Was also measured *in situ,* the existence of a permanent pond in *bairro* Milamba*,* supplied by superficial water that flow in the population cluster located in the east of the aerodrome runway. When the pond fills up, the remaining water is rejected to the coastal zone of Milamba through informal channels and some streets.

Source: Field work, 2014

Photograph 7.1 – Small stream without identified designation in Nanduadua

Source: Field work, 2014

Photograph 7.2 – Existent pond in Milamba



Source: Own elaboration, adapted from CENACARTA

Figure 7.5 – Hydrographic network

7.1.3.2 Groundwater

According to Ferro and Bouman (1987), Mocímboa da Praia municipality covers only a hydrogeological province in the Rovuma Sedimentary Basin, characterized by being an unfavourable region for the exploitation of groundwater, where the occurrence of groundwater is limited (or local) or inexistent.

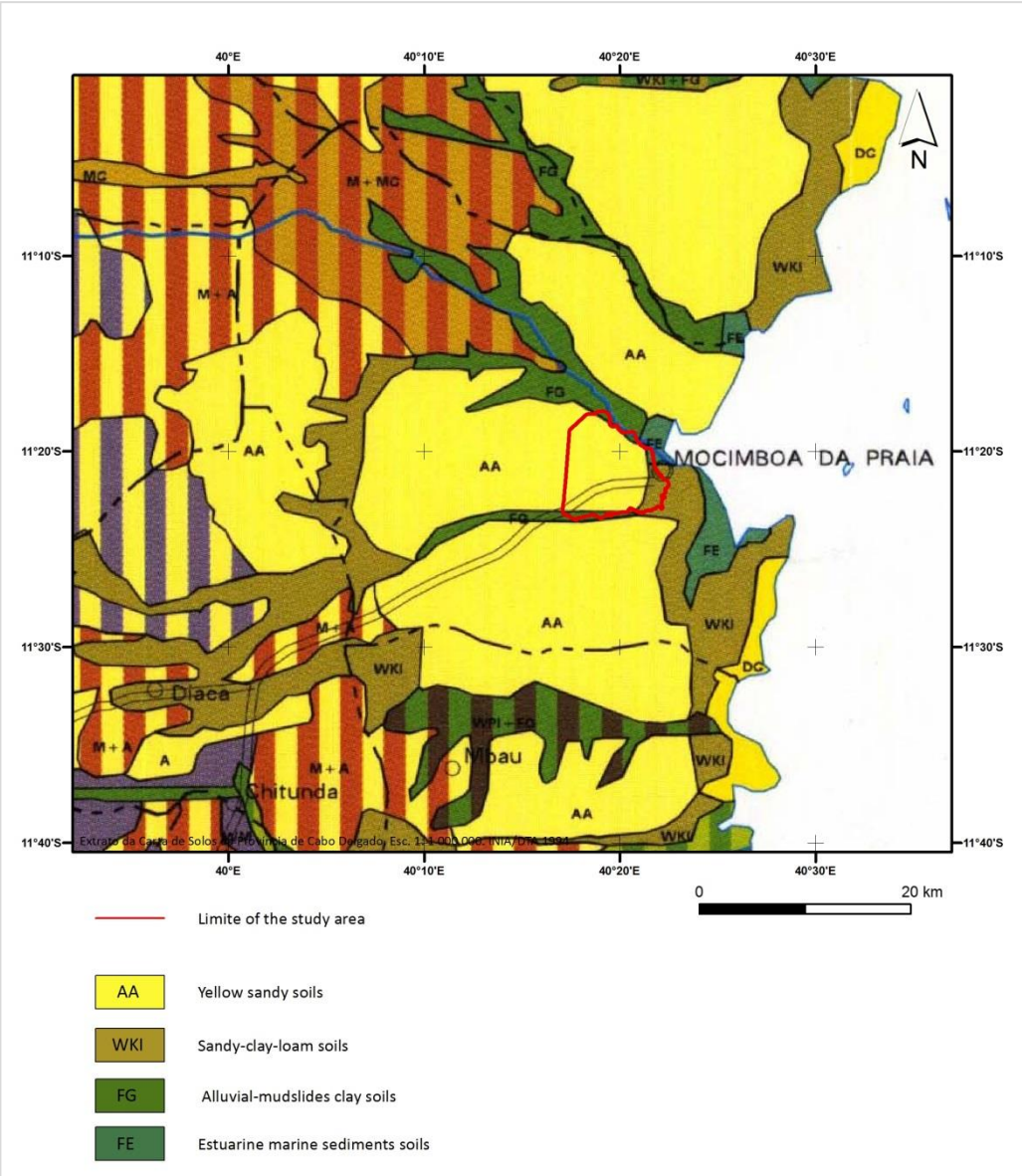
Despite this general limitation, and with reference to the results obtained in the questionnaires, it was found that the main water supply source of the communities is from groundwater catchments (mostly traditional wells).

7.1.4 Soils

According to the Soil Charter of Cabo Delgado Province (INIA/DTA, 1994) (**Figure 7.6**) occur in Mocímboa da Praia municipality unconsolidated soils composed of sedimentary formations of the Quaternary, in association with some of the Tertiary formations and Cetacean. Soils are, in their majority interspersed with sandy clay fractions near the river mouths.

Predominate the **yellow sandy soils** (**unit AA**), of brown, yellowish sand, very deep, associated with sandy plains, with texture varying from sandy to sandy-floam, soils with a good drainage. Along the coast, the soils presented are the **estuarine marine sediments soils (unit FE), grey clay**, deep and often saturated, poorly drained, verifying sometimes problems of salinity and sodicity. In the intermediate zone, occur the **reddish clay loam-sandy soils** (**unit WKI**), not very deep, based on a not calcareous rock and characterized by low water retention. In the recent fluvial sediments of streams, are present the **alluvial-clayey soils** (**unit FG**), occupying a very small physical area. The alluvial-clayey soils are generally deep and well drained.

Generally, the organic matter is relatively low in the identified soil types, constituting soils with a low fertility. An exception to the above mentioned, the alluvial soils, which by their very dynamic process of formation, are holders of high fertility. It should also be noted that the dominant type of soil does not always facilitate the drainage or the rainwater infiltration, which originates in the rainy season, the appearance of some ponds.



Source: Own elaboration, adapted from INIA/DTA, 1994

Figure 7.6 – Soils – Mocímboa da Praia

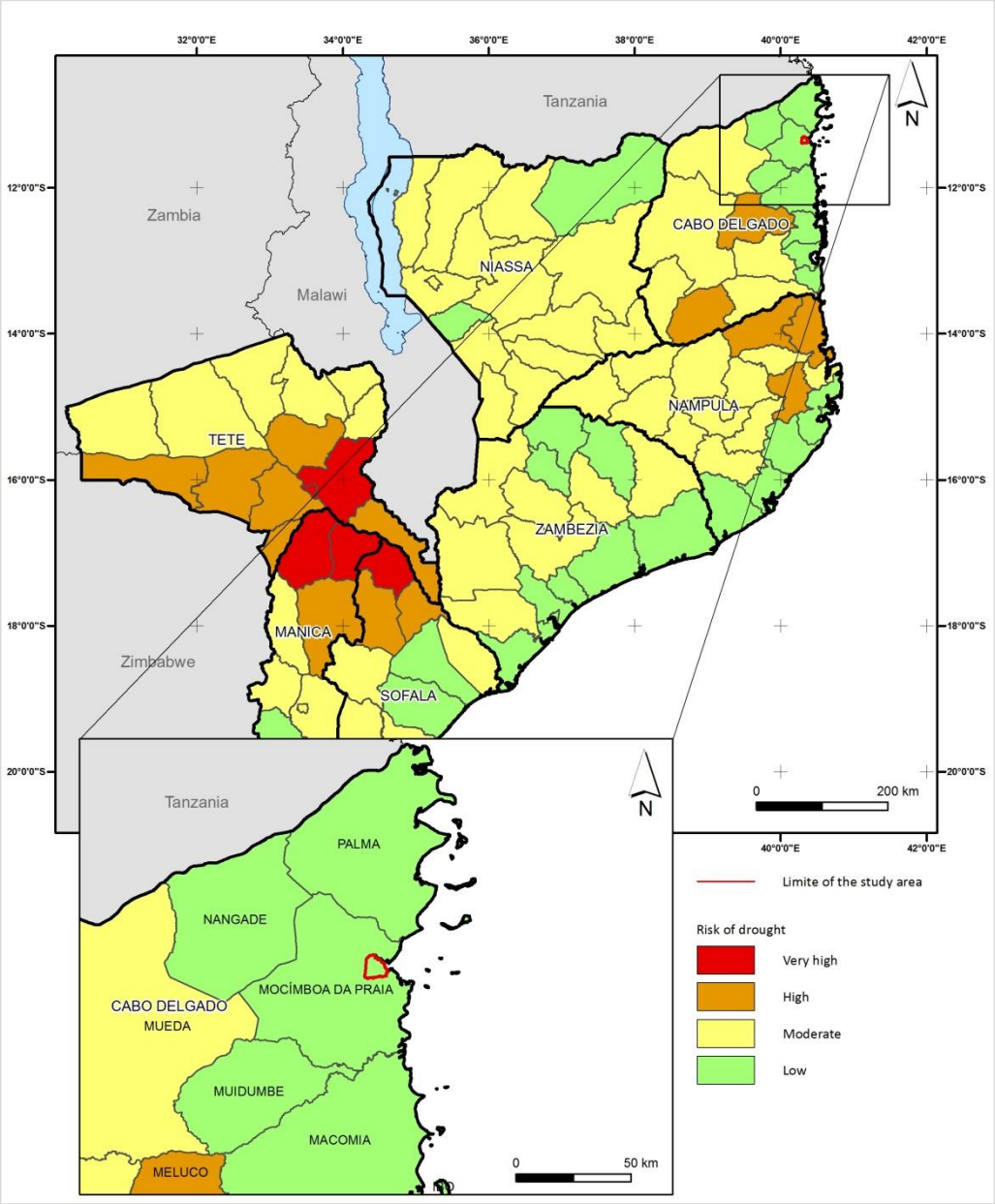
7.1.5 Natural Hazards

7.1.5.1 Extreme meteorological events

According to the World Disasters Report, published by the World Bank, Mozambique is the third country most affected by natural disasters in the African continent, and to conclude, as the following sub chapters, the main phenomenon to affect Mocímboa da Praia municipality, are floods.

Drought

According MICOA (2007), the severe drought in Mozambique, has occurred cyclically 7-11 years. In these sense and using as reference the risk areas of drought (**Figure 7.7**) it is verified that the Mocímboa da Praia municipality is located in a region of low risk of this phenomenon. This fact will be associated with high levels of precipitation.



Source: Own elaboration, adapted from MICOA, 2007

Figure 7.7 – Drought risk

Floods

The bibliography indicates precipitation, cyclonic activity and the flow of water from dams discharges on upstream countries as the most likely cause of floods in the Mozambican territory. Several episodes of flooding have been recorded in recent years, especially in areas surrounding the international rivers, and South and Centre of the country. Considering the areas of flood risk cartographically represented **Figure 7.8**, it is concluded that Mocímboa da Praia municipality is a susceptible area to the occurrence of this phenomenon, to be located in a moderate-risk zone, especially associated with high precipitation rates.

Despite the moderate risk identified it was reported *in situ* by the respondents (53.0%, and by the representatives of communities regarding the occurrence of this phenomenon, with especially emphasis on the floods occurred in April of this year, as a result of intense and abnormal drops of precipitation, with material damages associated (**Photograph 7.3**).

Flooded houses in the *bairro* Muengue
(Source: Municipal Council, 2014)

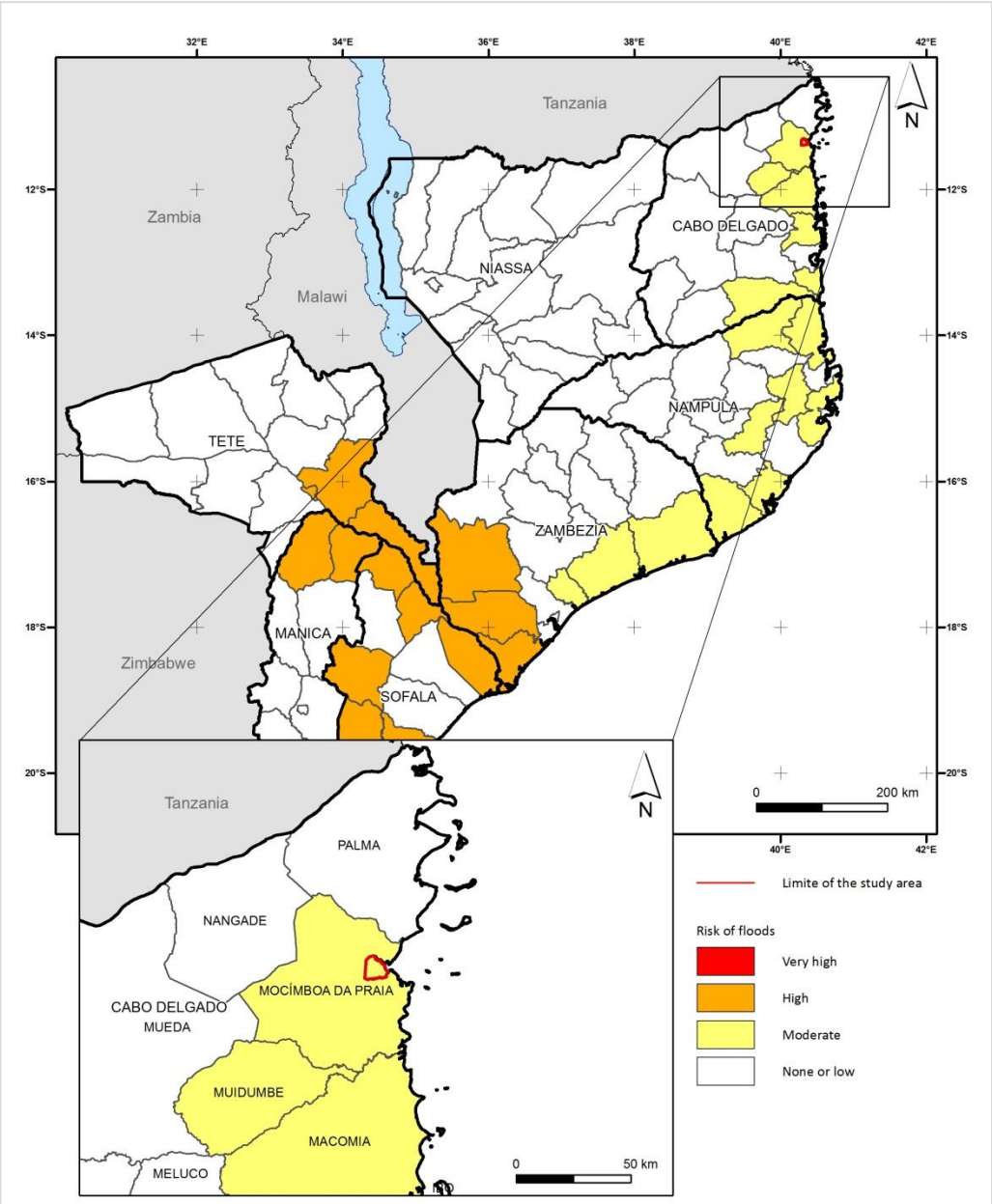
Material damage caused by the floods
(Source: Municipal Council, 2014)

Houses protection against flooding
(Source: Field work, 2014)

Photograph 7.3 – Flood occurred in April of 2014

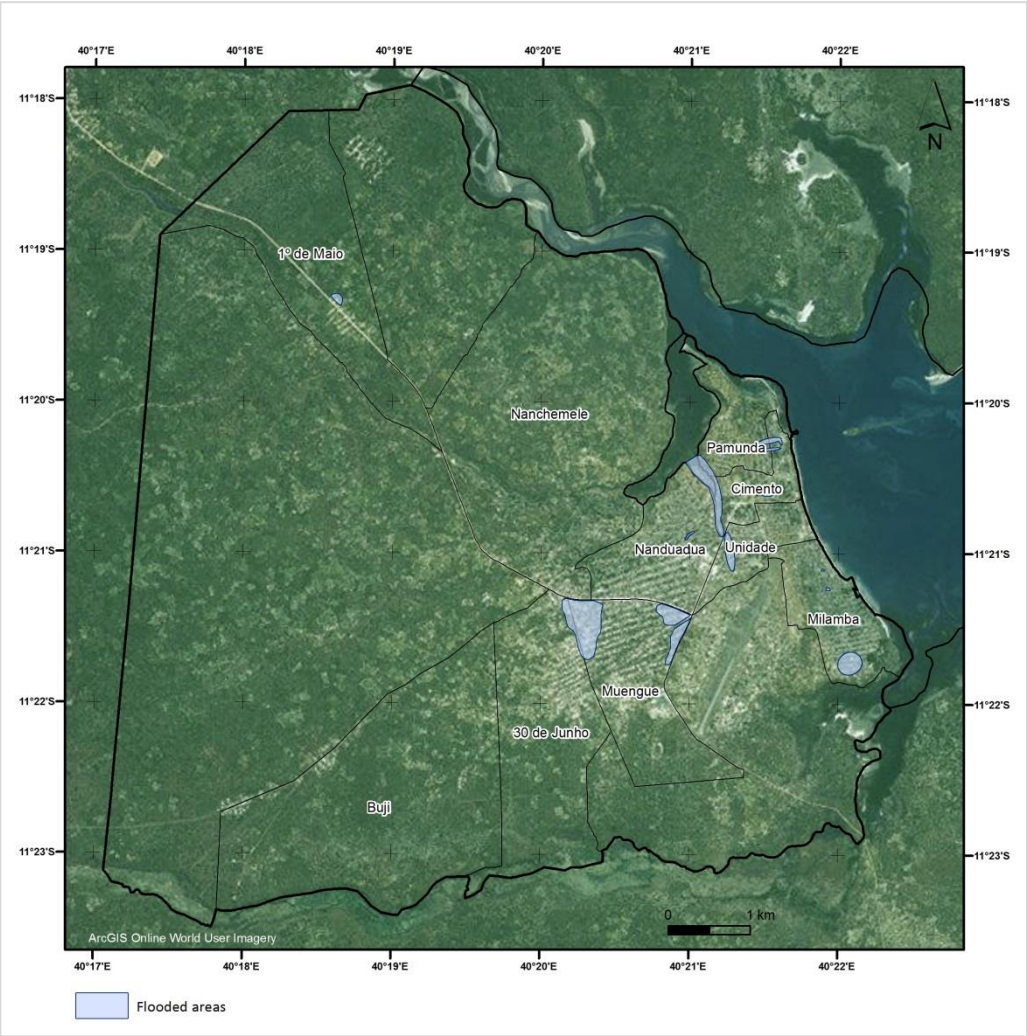
The field team was able to confirm that the affected *bairros* by this phenomenon were 1º de Maio, Cimento, Milamba, Muengue, Nanduadua, Pamunda and Unidade, in the areas showed in **Figure 7.9**. The main reasons for its occurrence are:

- The construction and / or rehabilitation of streets and roads, built on embankment, without any type of longitudinal drainage infrastructure and inadequate or non-existent culverts, been referred by the local community that the severity of flooding has increased considerably after the implementation of the new road lines;
- The existence of different water basins, natural or artificial, with depressions without any water outlet to the sea or water line;
- The lack of drainage devices in the urban area, resulting in an increased superficial flow, and lack of discharge points to the ocean to function efficiently;
- The urban growth in some *bairros* that has increased the impervious areas and associated soil characteristics (with poor drainage) which leads to an increased flow rate for the same rainfall event.



Source: Own elaboration, adapted from MICOA, 2007

Figure 7.8 – Flood risk



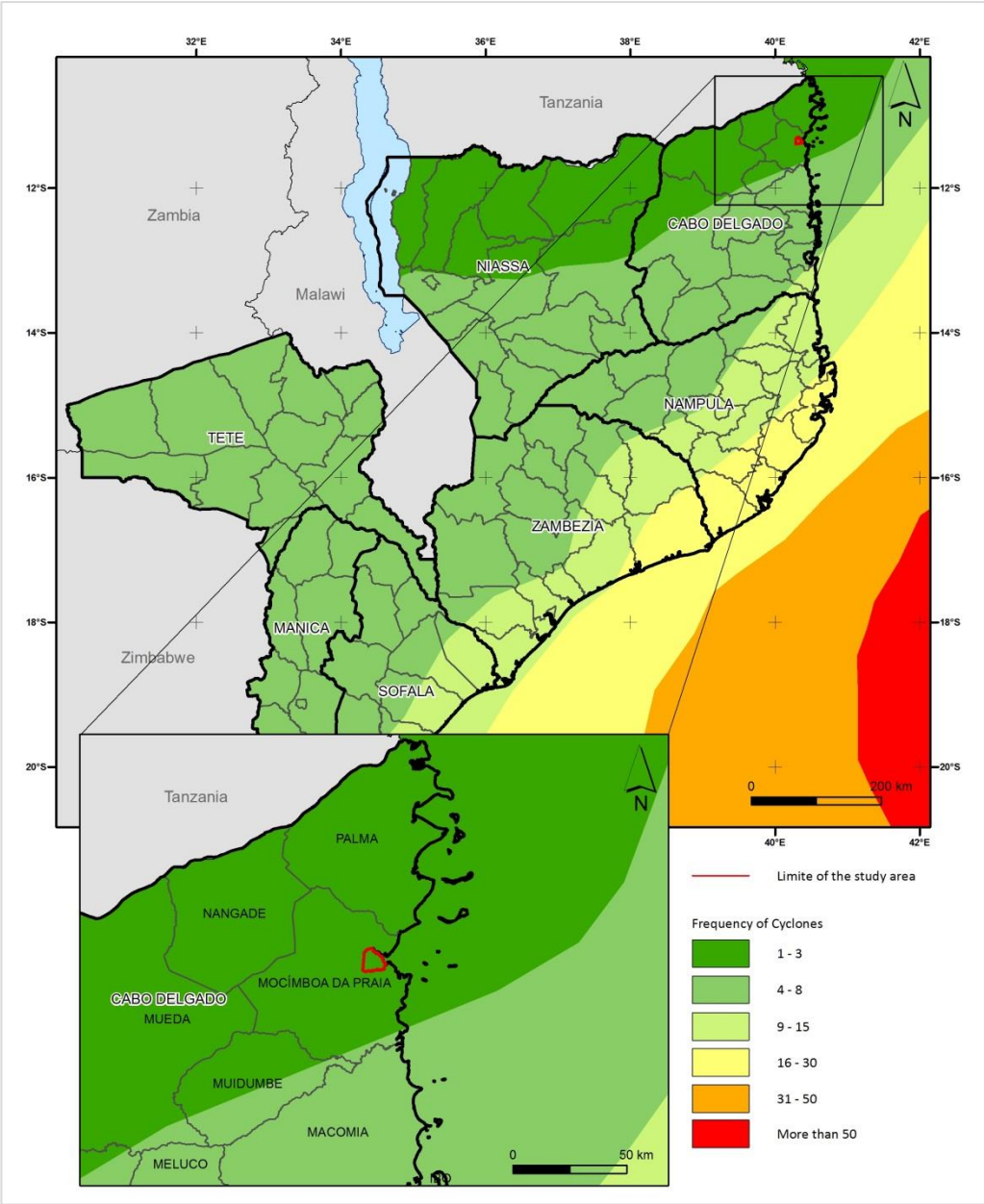
Source: Own elaboration, Field work, 2014

Figure 7.9 – Flood prone areas

Cyclones

The cyclones that hit Mozambique usually between November and April are formed in the Eastern of Madagascar or in the Mozambique Channel, being this region responsible for about 10% of all cyclones registered worldwide (MICOA, 2007).

The **Figure 7.10** shows the frequency of cyclones occurrence over the last 75 years in the Southern African region constituting Angoche the more frequently affected area in Mozambican territory.

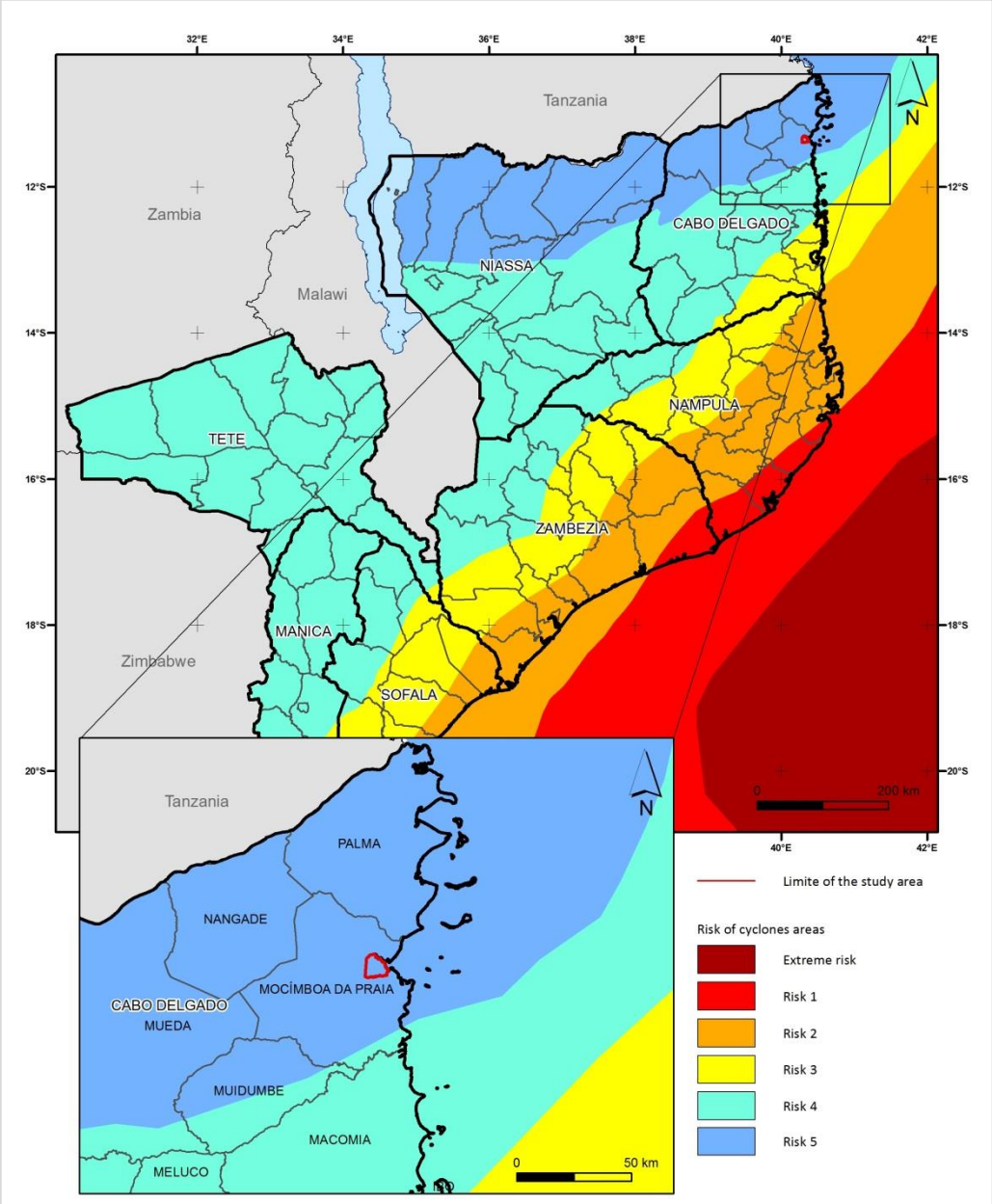


Source: Own elaboration, adapted from MICOA, 2007

Figure 7.10 – Cyclone frequency over the past 75 years

Of several cyclones that passed through the Mozambique Channel, between 1994 and 2008, 12 struck the coast of Mozambique, of which four reached the Northern provinces, 6 in Centre and two the Southern provinces. Constituting one of the most powerful and destructive phenomena of the climate system, all recorded cyclones are example of the enormous social and economic consequences.

Based on the risk of cyclone areas cartographically represented **Figure 7.11**, it appears that the city under study is in a territory low susceptible to the occurrence of this phenomenon, to be located in an area of risk 5.



Source: Own elaboration, adapted from MICOA, 2007

Figure 7.11 – Cyclone risk

7.1.5.2 Erosion

Water, air and soil are the *sine qua non* condition of life support on Earth. Any change observed in these elements has serious implications for all forms of life.

There has always been and will be an intrinsic degradation of natural transformations of the biosphere, where the slow erosion, processed over time, often out of human scale, has always been a natural phenomenon to establish a new equilibrium state.

Although it is an old and well-known phenomenon, erosion takes disastrous consequences for the natural environment, when processed in a very short time in taking such proportions that lead to sudden rupture in the balance. This type of erosion, commonly known as accelerated erosion, attributed solely to the action of man, has its associated soil loss.

We are witnessing throughout the world, a violent deterioration of soils, where billions of tons of soil are removed, constituting a major problem in many parts of Africa, as a result of high population pressure and the overuse of pastures, that has enhanced this issue year after year.

Coastal erosion

It is understood by coastal erosion, retreat of the shoreline and the loss of territory emerged in a linear or discontinuous manner over a sufficiently long time horizon that overlaps the inter-annual variability.

Its intensity and frequency which it manifests have originated constant situations of risk to communities and property located on the coast line. Although the Mocímboa da Praia municipality is located on a coast where the presence of coral reefs tends to protect it from erosion zone, the field team was able to observe hazardous conditions, especially in the coastal cliffs of *bairro* Milamba, been pointed out one of the main inducing factors, the natural one (**Photograph 7.4**).

Source: Field work, 2014

Photograph 7.4 – Coastal erosion in *bairro* Milamba

Soil erosion

Of various active agents that contribute to soil erosion, this chapter refers to the erosion caused by rain being the most common and with largest effects phenomenon.

The empirical model usually used for water erosion is the Universal Soil Loss Equation (USLE), 1965, revised over time, originating in 1975, the Modified Universal Soil Loss Equation (MUSLE) and in 1993 the Revised Universal Soil Loss Equation (RUSLE). This model allows to provide, during a given period, the average annual loss of soil erosion involving six factors: i) average precipitation; ii) soil erodibility; iii) Length of hillside; iv) slope; v) vegetation cover, and vi) agricultural practice or erosion control measures.

The limitations experienced by the real absence of baseline data, associated with temporal constraints, however, did not allow the strict application of this model to the study area. Despite this adversity, it was possible to identify the risk of erosion and the main factors that provide, taking into account the Erosion Risk Map of Mozambique (Mazambique Erosion Hazard Map), published by the SADCC - Southern African Coordination Conference Development.

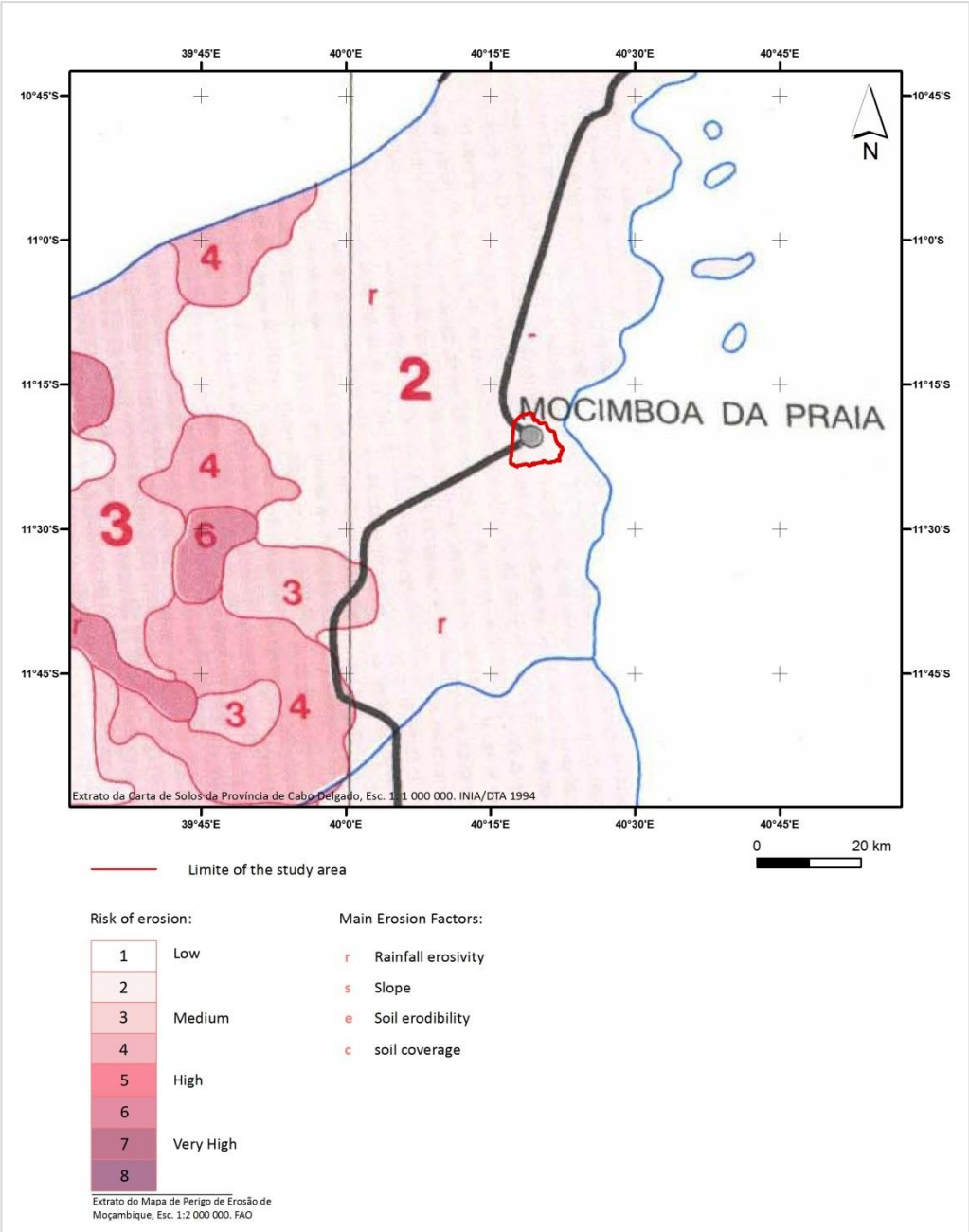
The phenomenon associated with water erosion is considered by most researchers as an important environmental problem, involving three phases: wear or breakdown of particle, transport and deposition of sediments. According to the bibliography, the intensity which erosion manifests depends on a number of factors, which also depends on the amount of available material capable of being broken down and the ability of transportation agents (JULIAN, 1998; LIMA et al. 2000) (**Table 7.3**).

Table 7.3 – Erosion factors

Natural factors	Climate	Erosivity (determined by the intensity, duration and amount of rainfall, and the size, speed and shape of the water drops as well as their frequency and seasonal distribution).
	Relief condition	Slopes (the higher the slope, the greater the flow velocity and the consequent increase of water erosion).
	Soils characteristics	Erodibility of the soil (soil susceptibility relative to the wear particles during precipitation events, and their subsequent transport, and reciprocal of its resistance to erosion: the higher the erodibility of a soil, the greater its susceptibility to erode).
Anthropogenic factors	Land use	Vegetation cover (soils well supplied of vegetation offer greater impact resistance of the water drops, increase infiltration and reduce runoff, being much larger, the smaller is this vegetation cover

Considering the biophysical characterization performed in earlier chapters and the Mozambique. Erosion Hazard Map (**Figure 7.12**), where the risk of erosion, spread over four classes [low, medium, high and very high], is associated with natural factors listed above in the previous table, draw the following conclusions:

- The study area has a low risk of erosion, mainly attributed to rainfall erosivity;
- The characteristics and physical properties intrinsic to the soils present in the area of study, make the same fragile soils, with little capacity to drain, and absent of organic matter, and therefore susceptible to erosion.

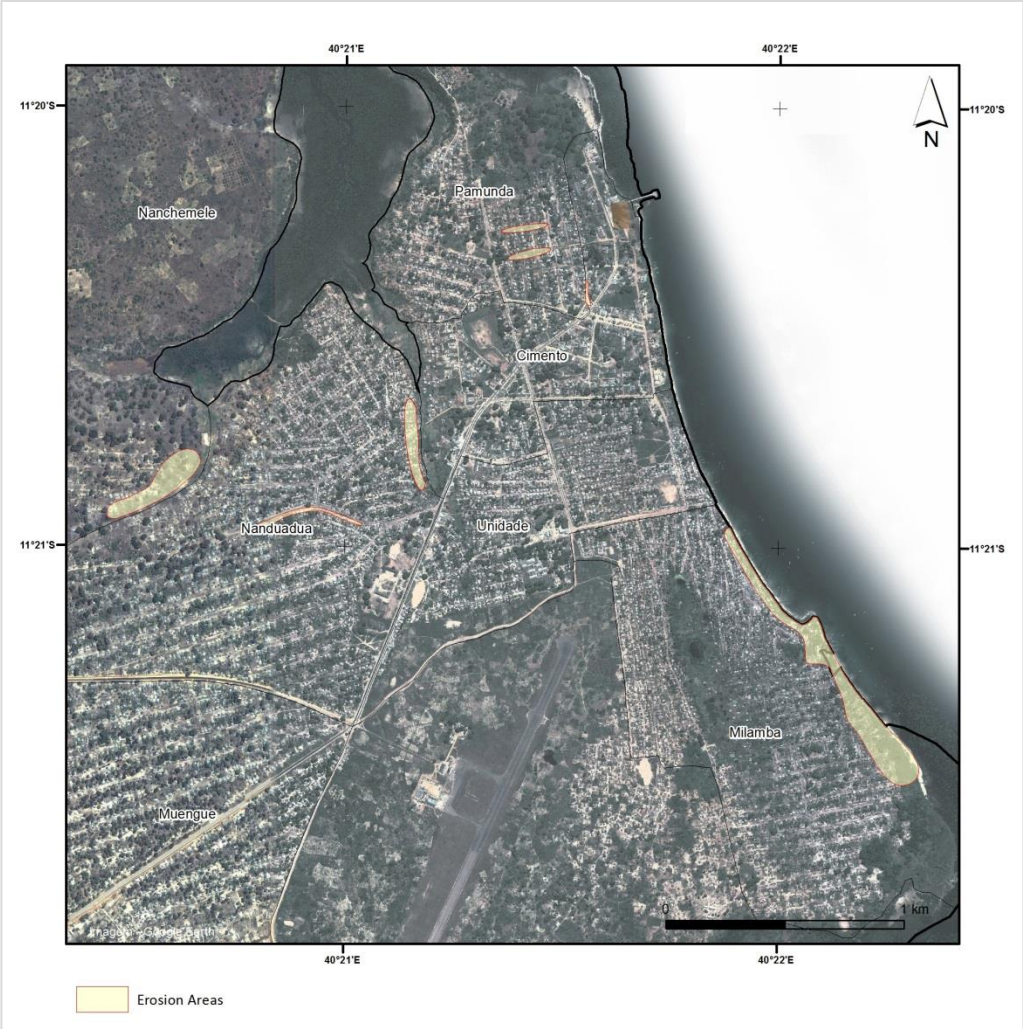


Source: Own elaboration, adapted from Mazambique. *Erosion Hazard Map*

Figure 7.12 – Risk of erosion

Despite of this low risk, there were several erosive evidences reported by the representatives of communities and observed *in situ*, where the main forms of erosion are manifested mainly to the formation of ravines (fissures in the soil, caused by massive amounts of water that are transported in a short period of time). The most worrying cases were identified in bairros Milamba, Nanduadua, Nanchemele and

Pamunda, in the shown areas in **Figure 7.13**. The inductor factor of this risk is especially natural (rainfall erosivity), whose frequency and intensity has increased, originated by human actions, such as roads improvement without any drainage system or settlements located in areas of natural water lines which impedes its natural course.



Source: Own elaboration, Field work, 2014

Figure 7.13 – Erosion areas

Eroded areas in *bairro* Milamba
(Source: Field work, 2014)

Eroded areas in *bairro* Nanduadua
(Source: Field work, 2014)

Eroded areas in *bairro* Nanchemele
(Source: Field work, 2014)

Eroded areas in *bairro* Pamunda
(Source: Field work, 2014)

Photograph 7.5 – Erosion areas

7.1.6 Climate change

Climate change is one of the greatest current challenges to humanity. The most frequent occurrence and severity of natural disasters, changing weather patterns, the receding glaciers, rising sea levels and droughts are some of the consequences that are already being felt. These records associated with the sources of climate observations and projections, which has shown that Mozambique is a vulnerable to climate change country, with significant impacts on human societies and infrastructures, circumstances justify the consideration of this issue in the this Strategic Sanitation Plan of Mocímboa da Praia municipality.

It is, though, noted that the full consideration of the impacts of climate change in the current planning cycle, is subject to the difficulty of quantifying the horizons for short-term projects. This difficulty stems from the high degree of uncertainty associated with the observation and climate modelling process, which hinders firm conclusions about the different climate scenarios.

7.1.6.1 Characterization of the phenomenon

Although a common consensus on the definition of climate change does not exist, it adopts within the context of this study, the default setting in the Intergovernmental Panel on Climate Change (IPCC), which associates this concept to any change in climate over time, regardless of their being natural or anthropogenic causes.

The main conclusions from the latest assessment of climate change on the planet (Fifth Assessment Report "Climate Change 2013", hereinafter AR5), released in 2013, the IPCC confirmed that the global climate is changing originated by anthropogenic activities. Worldwide:

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented for decades to millennia: the temperature of the atmosphere and ocean has increased the amount of snow and ice has decreased, the overall level average sea has increased and increased GHG concentrations.

- Each of the last three decades has been successively warmer in land surface than any previous decade since the 1850s. In the Northern Hemisphere, the period from 1983 to 2012 was probably the warmest in 1400 years.

- The oceans have come to constitute the largest energy storage of the climate system, representing more than 90% of the energy accumulated between 1971 and 2010. This reality is reflected in their heating.

- Over the past two decades, the ice sheets of Greenland and Antarctica have lost mass. A blanket of ice have been shrinking in almost all over the world and the Arctic sea ice and ice cover in the northern spring continued to decline in extent.

- The average sea level rose, worldwide, 19 cm, between 1901 and 2010 (an average of 1.7 mm per year). This increase has accelerated to 3.2 mm per year between 1993 and 2010.

- Changes in many extreme weather events have been observed since 1950 the number of cold days and nights decreases and the number of hot days and nights increased. It is likely that the frequency of heat waves has increased in large parts of Europe, Asia and Australia. Recent changes in precipitation on a regional scale, with an increased frequency of episodes of intense precipitation were observed.

- Atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) have increased to unprecedented levels. The concentrations of CO_2 have increased by 40% since pre-industrial times. The ocean absorbed about 30% of anthropogenic CO_2 emitted, causing acidification.

For **Mozambique**, the results in the report "Synthesis report. INGC Climate Change report: Study on the impact of climate change ", published in 2009 by the *Instituto Nacional de Gestão de Calamidades* (INGC - National Institute for Disaster Management) shows, for the Northern region of the country (region which includes Mocímboa da Praia municipality), within 45 years (1960-2005) the following trends:

- The maximum temperatures increased by approximately 1.1°C during the months of March-April-May and September-October-November. The average annual maximum temperature was often below 30°C before 1990, and consistently above 30°C thereafter. The number of hot nights grew by 25% in December-February season and the number of hot days increased by 17% in the September-November season.

- The average duration of the dry period during June-August was 7 days longer in 2005 than in 1960, rising to 20 days at specific locations during September-November (probably reflecting a delay at the end of the dry season). During the same period, the beginning of the rainy season was delayed up to 45 days in certain places.

- Some of the biggest changes in the observational records during this period, both in terms of temperature increases observed as delays in rain (heading east), occurred in this region.

- A rise in the number of disasters was observed in the region, being more conducive to the occurrence of tropical cyclones.

7.1.6.2 Climate projections

Made aware this problem, it was started at the international level, the scientific contribution effort directed to the perception of the future, having developed climate models, which allow, by simulations on a global scale, to interpret the behaviour of the climate through a set of variables, amongst which GHG emissions, usually measured in CO_2, and thus obtain future climate scenarios, in turn, obtained from models that simulate the climate system. These models are able to simulate the global evolution of a set of climate variables are used to assess climatic consequences of choices made throughout the planet. The number of teams that have been producing with regularity climate scenarios is relatively small, highlighting in this context, the contribution of the IPCC, while pioneering group in the development of global emission scenarios of greenhouse gases (GHG) long term.

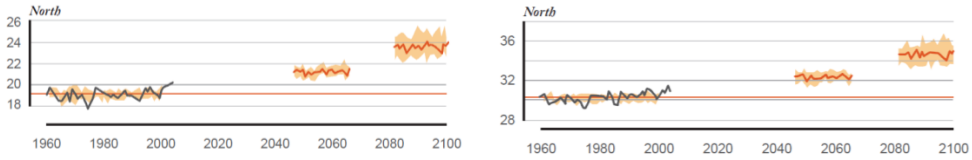
On a global scale, the patents in AR5 climate projections reflect the following conclusions:

- The maintenance of GHG emissions will cause further warming and changes in all components of the climate system;
- The temperature change of the overall surface to the end of the twenty-first century will likely be greater than 1.5°C, compared to 1850 to 1900. The warming will continue to present inter-annual variability and inter-decades and will not be uniform regionally;
- The contrast in rainfall between regions and between rainy and dry seasons will increase, although there may be regional exceptions;
- The global ocean warming will continue during the XXI century, affecting ocean circulation;
- It is very likely that the ice cover continues to decline further;
- Average global sea level will continue to rise during the twenty-first century, most likely higher than during the period of 1971-2010, the resulting heating of the oceans and increased loss of ice cover;
- Climate change will affect the processes of carbon cycle in a way that will aggravate the increase in atmospheric CO_2. Also carbon uptake by the ocean increases its acidification;
- The cumulative CO_2 emissions, largely determine the global average surface warming by the end of the XXI century. Most aspects of climate change will persist for many centuries even if emissions of CO_2 ceases entirely.

For **Mozambique**, the projections made in the report cited above, published by INGC (Synthesis report. INGC Climate Change report: Study on the impact of climate change) show the following future changes in the region which includes Mocímboa da Praia municipality:

Temperature

Around 2046 and 2065, the maximum and minimum temperatures will rise above 2°C. Between 2081 and 2100, forecasts point to an increase in temperature of + 5°C to 6°C. There will also be an increase in the probability of extreme daily maximum temperatures above 35°C (**Figure 7.14**).



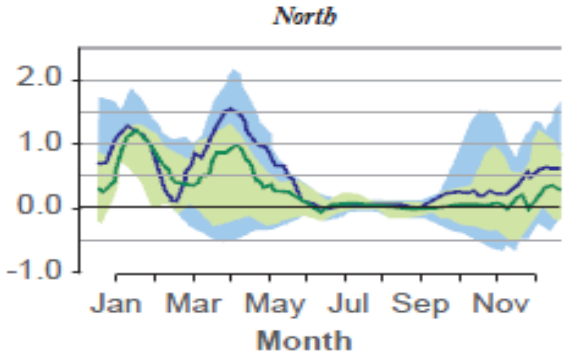
Temperaturas mínimas Temperaturas máximas

A linha negra mostra as tendências observadas (1960-2005), as linhas vermelhas mostram as alterações futuras (período 2040-2060 e 2080-2100) (Source: INGC, 2009)

Figure 7.14 – Climate projections of temperature in the North Mozambique

Rainfall

The **Figure 7.15** shows an increase in rainfall, it is uncertain whether the changes will be minimal or localized. The rains tend to be more unpredictable.



The green shading indicates the variation (the dark green line the average) for the period 2046-2065, the blue shade variation (dark blue line the average) for the period 2080-2100.

Source: INGC, 2009

Figure 7.15 – Climate projections of temperature in the North Mozambique (mm/day)

Sea level rising

The northern region will be less vulnerable to rising sea level, it is expected that few areas along its coast, are at risk and it fits these characteristics the low islands located off the coast, near the border with Tanzania.

7.1.6.3 Expected impacts in sanitation infrastructures

Climate changes have always been registered over the thousands of years that the Earth has. The problem relates, therefore, to the fact that in the last century, the pace of these climatic variations has suffered a sharp acceleration: a rise of 2°C over the next decades, in Mozambique, may seem little, but it is sufficient to affect the hydrological cycle, with serious implications for the climate system. Given the projected climate scenarios, by INGC for the region which includes Mocímboa da Praia

municipality, it is expected that these implications are primarily associated with rainfall changes: the hypothesis of increased precipitation, more frequent rainfall and / or intense, tend to lead to extreme events and any occurrence may indicate an increased risk of flooding to the area of study.

In addition to the negative impact on the affected populations and the environment, the realization of this scenario can cause damage to the existing infrastructure, synthesizing in **Table 7.4** the main impacts to be expected on the infrastructure which constitutes the sanitation system.

Table 7.4 – Main Impacts of floods on sanitation infrastructures

System	Possibles impacts
Wastewater	**In networks**: the hypothesis of an increase in rainfall could lead to an increase of the underground water table and consequent infiltration of groundwater into the sewer network. This increase may, in addition to compromising the ability of infrastructure, causing the internal reflux of the effluent in domiciled facilities and internal pressures on networks. Increased biological activity in the networks may lead to septical problems, the release of bad odors, creating toxic atmospheres within the infrastructure and an increased risk of corrosion. **In septik tanks**: Another possible consequence of the rise in the water level would be the impracticability of using septic tank systems.
Stormwater	Achieving the scenarios of increased risk of intense rainfall will cause an increase in flow of stormwater generated in the basins served that may exceed the drainage capacity. As a result, flooding situations may occur and si expeting the increasing of the residence time of these situations.

In a scenario of realization of the cited impacts in the sanitation system, it could be added that some negative effects they may have on affected populations:

- The increase in faecal coliform and other physicochemical parameters may cause contamination of groundwater and soil scarf. Meanwhile, the ingestion of contaminated water and / or existing contact with excreta can induce proliferation diseases such as polio, hepatitis A, cholera, typhoid, etc.). Some of these have high potential for spread, with transmission from person to person, increasing its spread in communities. According to the World Health Organization (WHO), these diseases result in 1.5 million deaths each year, mainly affecting children;

- In a context of floods, may increase the risk of diseases transmitted by mosquitoes / vectors that develop in stagnant water, such as malaria, dengue, yellow fever and some encephalitis. According to WHO, more than 1 million people die each year due to mosquito-borne diseases.

7.1.6.4 Vulnerability

The vulnerability, understood as a concept that explains the reason of the consequences of natural disasters are not felt equally by all, must be analysed taking into consideration three main components:

- Fragility (or exposure): Physical and environmental component, which defines the extent to which a population group is likely to be affected by a dangerous phenomenon in terms of its location and because of the absence of physical resistance to spreading;
- susceptibility (or sensitivity): socio-economic and demographic component that determines the disposition of a population group to suffer damages against a dangerous phenomenon;
- Resilience (or adaptive capacity): behavioural component, community and politics, that determines the ability of a population group undergoing a dangerous phenomenon absorb shock and adapt to return to an acceptable state (Matavel, 2012).

Considering that Mozambique is a country historically affected by major natural disasters where the most part of the population is poor, surviving on forest and agricultural resources, and lacking basic infrastructure, it puts the country among the most vulnerable ones to climate change.

For the purpose of this study, vulnerability analysis is carried out given the susceptibility of Mocímboa da Praia municipality to be affected by a dangerous phenomenon (fragility or exposure). Absence, though, accurate enough projections to classify this same weakness, the analysis developed in the previous subchapter, particularly with regard to extreme weather events, as well as the projections by INGC point already more prone to the occurrence of floods (excluding extreme polar melt), where climate change will only exacerbate this extreme event.

Despite its less vulnerable exposure to extreme events, when compared with the national context, the study area should, still, considered vulnerable to the effects of climate change, justified by the absence of physical propagation resistance when affected by extreme events; already predisposed by socioeconomic and demographic conditions *per si* being damaged face extreme events; and the behavioural habits that influence people's ability to absorb shock and adapt to return to an acceptable state.

7.2 Social Characterization

7.2.1 Cultural and Religious

According to the bibliography, most of the inhabitants of the Mocímboa da Praia municipality belong to the Maconde and Kimwane ethnical groups The *Macondes* inhabit within the municipality, making agriculture the main economic activity, also dedicating themselves to the raising of cattle and small animal species. Corn flour, peanuts and beans are the staple diet of this ethnic group. In turn, the Kimwane, as they lived in the coastal zone, have the fishery as the main economic activity, followed by the trade. Agriculture is also carried out but in a low scale, represented by the production of cassava and rice.

Maternal languages cover a wide range of dialects, especially the Kimwane (in coastal districts), the Maconde (with special focus on the most peripheral *bairros*) and the Swahili with a small representation. A minority speaks Portuguese, principally focusing on *bairro* Cimento.

The leadership of the *bairros* is ensured by the respective *Secretários* and *Chefes de Bairro*, whose function is to represent and mobilize communities for social and economic tasks.

By the strong influence of Arab people who established trade ties in the municipality, most of the Mocímboa da Praia community is a follower of the Muslim religion. Only a minority follow the Christian religion, being the same the native religion of Macondes (Ministério da Administração Estatal, 2005, Administração do Distrito de Mocímboa da Praia).

7.2.2 Demographic structure

According to the latest Census of Population and Housing of Mozambique (Census), dated 2007, resided in the Mocímboa da Praia municipality 39,010 individuals, representing 43.1% of the total population of the respective district and 1.8% of the province. Of the total registered population, there were 18,953 men and 20,057 women, representing a masculinity index of 94.5 men for every 100 women.

Compared to the 1997 Census, this number showed an increase of 13,504 inhabitants, corresponding to an annual growth rate of 4.8%, exceeding the positive demographic trend that has characterized the territory of the respective district, province and even at the national context.

Table 7.5 – Population evolution, 1997-2007

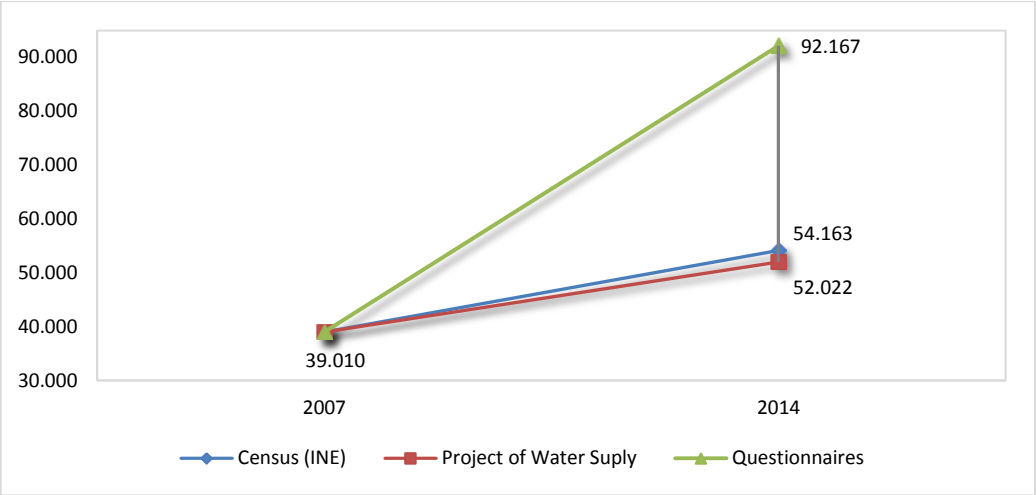
Territorial units	Population		Variation 1997-2007	Annual growth rate (%)
	1997	2007		
Mocímboa da Praia municipality	25,506	39,010	13,504	4.8
Mocímboa da Praia district	75,001	90,421	15,420	2.1
Cabo Delgado Province	1,287,841	1,605,649	317,808	2.5
Mozambique	16,099,246	20,579,265	4,480,019	2.7

Source: INE, 1997 e 2007

It is noted that Mozambique has a deficit of recent disaggregated statistics at a municipal and *bairro* level, reason why the population projection took into consideration various sources, for the reference year of 2014:

- Data collected in the Census, with an estimated population gauged according to the calculation of the annual growth rate between the intercensal period of 1997 - 2007;
- Projections made under the Project Design and Construction of the Expansion of Water Supply of Mocímboa da Praia, conducted in 2012, integral part of the WASIS Project;
- Data collected in the conducted questionnaires under this study, where was possible to estimate the population based on the number of households and on the average household composition obtained.

The obtained results, shown in **Figure 7.16** , point to non-consensual values. Taking INE data as reference, the quantitative estimate of population in 2014 is 54,163 inhabitants, stressing out, however, that this quantitative excludes the *bairros* 1º de Maio and Buji, *which were* not included in the INE estimation. In turn, the estimates made under the Project of Water Supply of Mocímboa da Praia, point to a quantitative population of 52,022, in the same period. Based on the 2007 Census and on the information provided by the municipal authorities, particularly with regard to the population of the *bairros* 1º de Maio and Buji, it was assumed a growth rate of 3.69%. Finally, considering the number of houses provided by the municipal services and the average household size, obtained from the sample of the present study (6.6), the estimated population for 2014 will be around 92,167 inhabitants, varying significantly from the remaining estimations.



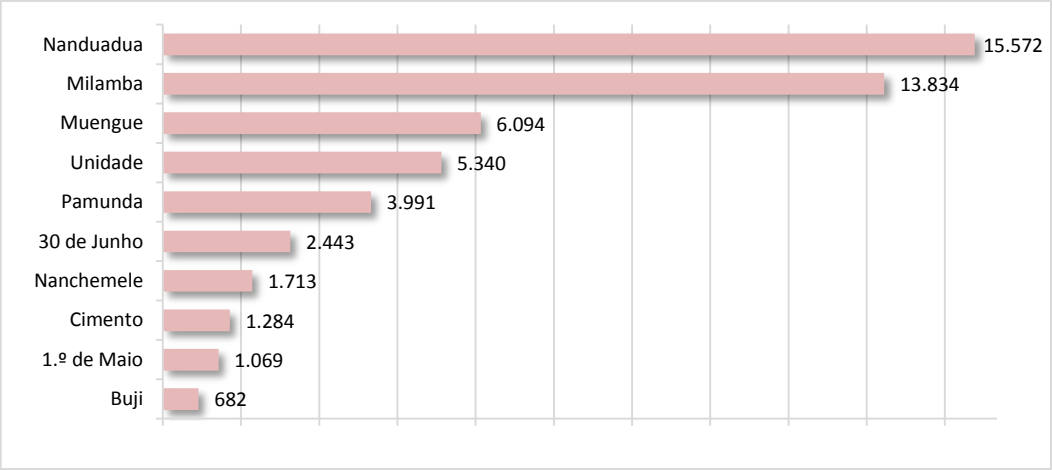
Source: Own elaboration, INE, Questionnaires and Project Design and Construction of the Expansion of Water Supply of Mocímboa da Praia

Figure 7.16 – Estimated population in the Mocímboa da Praia municipality, 2014

Faced the scenarios presented, and constituting the water supply a matter directly related with sanitation, it is assumed, for the purposes of this study, a quantitative population of **52,022** inhabitants, for the reference year of 2014, estimated under the Project Design and Construction of the Expansion of Water Supply of Mocímboa da Praia.

In the distribution of the estimated population, for the reference period considered, shown in **Project Design** and Construction of the Expansion of Water Supply of Mocímboa da Praia

Figure 7.17, Nanduadua and Milamba constitute the territorial units with higher quantitative of population.

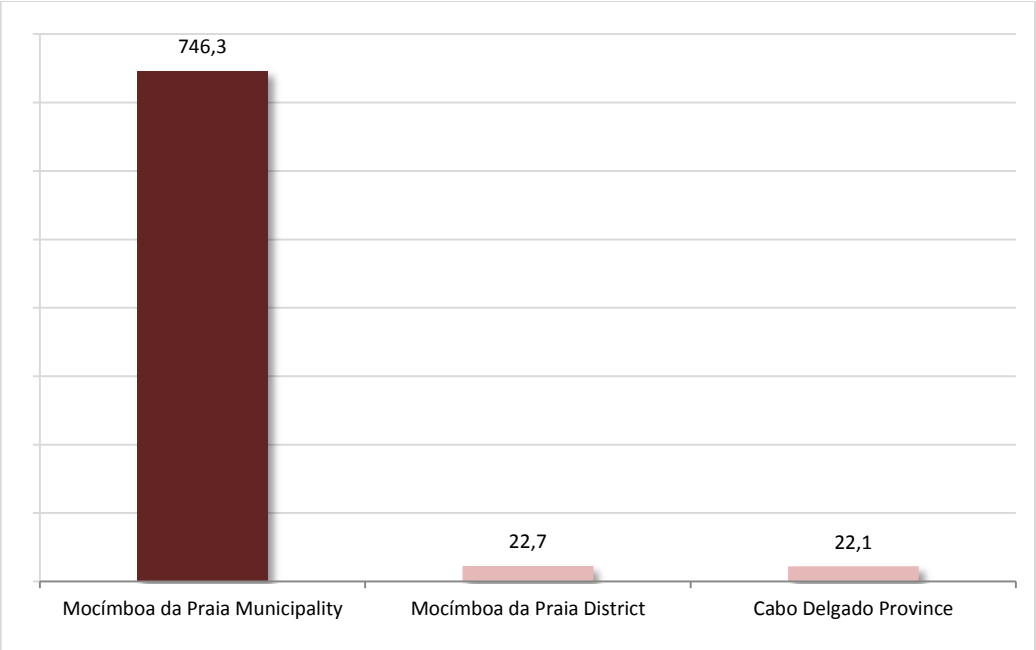


Source: Own elaboration, Project Design and Construction of the Expansion of Water Supply of Mocímboa da Praia

Figure 7.17 – Distribution of the estimated population by *bairro*, 2014

7.2.3 Distribution of population

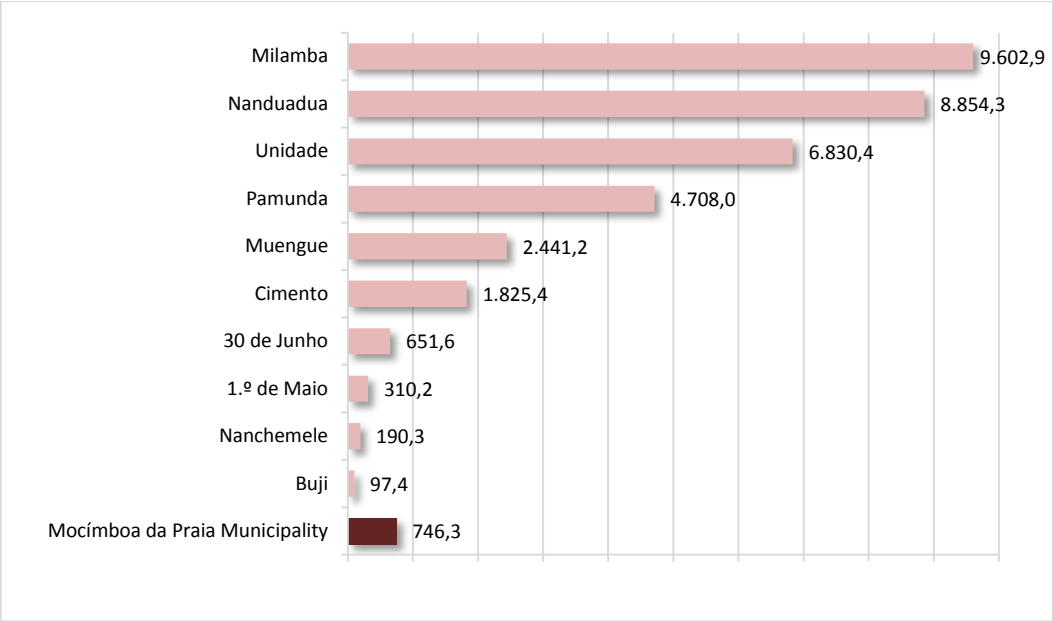
Considering the relationship between the population with the administrative area of the territorial units analysed, reflected in the Figure 7.18, the first conclusion to be drawn is, of course, the high population density that the municipality has in relation to the respective district and province. According to estimates, in 2014, would register about 746 inhabitants per square kilometre (746.3 inhab./km^2) while the population density in the province would be only by 22 people.



Source: Own elaboration, INE, 2010

Figure 7.18 – Estimated population density of the municipality (inhab./km2), 2014

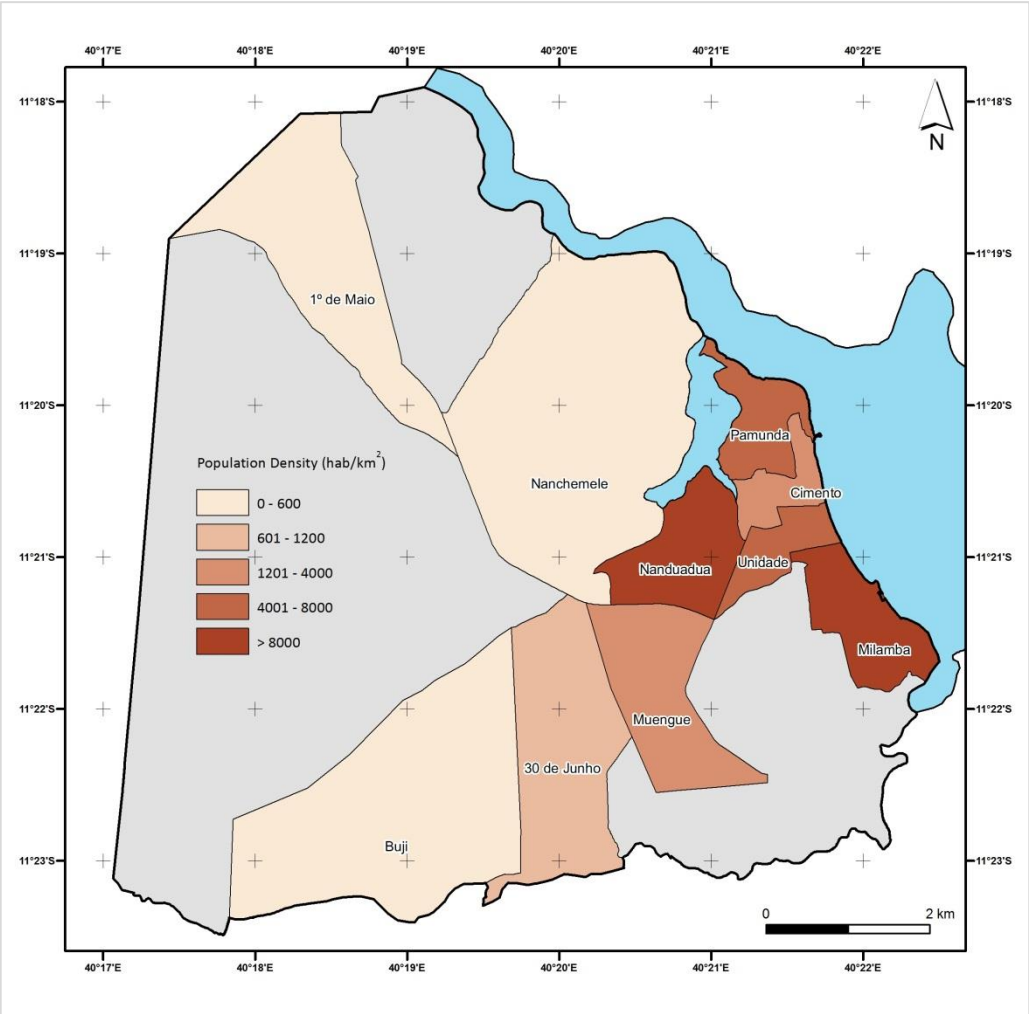
The distribution of this indicator by *bairro*, there is a rather disparate population density, varying between 97.42 hab./km^2 in Buji, and 9,000 inhab./km^2 in Milamba. When compared to the density of the municipality, the majority of *bairros*, except Buji, Nanchemele, 1º de Maio and 30 de Junho, have a higher number of inhabitants per square kilometre (**Figure 7.19**).



Source: Own elaboration, 2014

Figure 7.19 – Estimated population density by bairro (hab./km^2), 2014

Taking into account the spatial distribution of this indicator, represented in **Figure 7.20**, is clearly visible an imbalance, reflected in macro cephalization of the coast line, with higher densities, where the disorderly construction of houses reigns in Milamba. In contrast, the most peripheral *bairros* have some extensions of sparsely populated territory.



Source: Own elaboration, 2014

Figure 7.20 – Distribution of estimated population density by *bairro*, 2014

7.3 Economic characterization

According to the enquiries carried out with representatives of the communities, activities are still characterized by the primary sector of the economy, where agriculture and fishing are the main source of food supply for communities (particularly low income), and, if exist any surplus, of income source.

Indeed, the coastal location of the municipality is propitious to the marine **fishing practice**, assuming higher expression in Milamba *bairro,* where most of the fishing community is concentrated. Exercised in the traditional manner, using methods and tools for low catch, the fishery is characterized by its low yield. The marketing of fish is

done by several formal and especially informal channels, being, anyway, the angler the least benefited in activity due to its limitations concerning the conservation of fish.

Source: Field work, 2014

Photograph 7.6 –Fishing boats used in the marine fishing practice

In general, **agriculture** is practiced manually in small family farms, especially under rainfed conditions. It is not always successful due to the low moisture capacity that characterizes most of the existent soils. The production system is composed mainly of rice (especial for trading), cassava, beans, maize and sorghum. Although agriculture constitutes a source of food supply in most of the municipality *bairros*, it must be observed that it is only practiced in Nanduadua, where the rice is cultivated in the alluvial plains of an existing water line, and in most of the peripheral *bairros*, particularly 30 de Junho and 1º de Maio. In the remaining *bairros*, it is common the cultivation of the land by the community, but outside the municipality, often traveling long distances to the most fertile areas (Interviews to the Secretários de Bairro, 2014).

At a district level (and in the absence of disaggregated statistical data at a municipal level), the importance of agriculture tends to decrease. In fact, it appears that 17,177 of the livestock farms featured in the district represent only 5.1% of the farms of the respective province (INE, 2013).

Constituting the fishing and agriculture seasonal and risky activities, the raising cattle, especially of small species, tends to be a complementary activity for family subsistence, not always carried out at best conditions.

Rice crops in the alluvial plains of an existing watercourse, in Nanduadua
(Source: Field work, 2014)

Intercropping of several cultures
(Source: Field work, 2014)

Photograph 7.7 – Agriculture

Source: Field work, 2014

Photograph 7.8 – Raising cattle

According to the observation made on the field, is also noted the important role of forest resources in the construction of boats and houses.

Boats construction
(Source: Field work, 2014)

Wood used in the construction of *Matope* houses
(Source: Field work, 2014)

Photograph 7.9 – Use of forest resources

The industrial sector is almost inexistent, highlighting the DIAMANTE Company, dedicated to the production of canned fish products. Similarly, and considering the available statistics, this sector is represented at the district level, only by two units, which employ a total of four people (INE, 2013).

In the tertiary sector, trade, mostly in the informal way, is also an important source of income, as shown in the questionnaires to the households, where about 27% of the respondents claim to get from the small business their sustenance. If compared with provided data by INE, trade (retail) is, at the district level, an important activity, represented by 30 units, employing 52 people (INE, 2013).

Wood sale
(Source: Field work, 2014)

Bakery
(Source: Field work, 2014)

Odd jobs
(Source: Field work, 2014)

Nanduadua market
(Source: Field work, 2014)

Pamunda market
(Source: Field work, 2014)

Milamba market
(Source: Field work, 2014)

Photograph 7.10 – Trading and services

Poorly promoted, the Mocímboa da Praia municipality offers a reduced tourist offer with no encouragement by the economic actors to invest. It is noted that although the improvements that have been made on roads and the prime location of the municipality near the points of hydrocarbon exploration in the Northern Province, could be a starting point for the development of the offer.

7.4 Facilities and services

7.4.1 Social facilities

7.4.1.1 Education

According to the information provided by the Municipal Council, there are currently 18 schools in Mocímboa da Praia municipality, from primary school to secondary school, the first being divided into two levels: the primary education 1st degree (EP1, the 1st

to 5th class) and the primary teaching degree 2 (EP2 or EPC, 6th and 7th grade) (**Table 7.6**).

Table 7.6 – School network, 2014

	Primary Schools			Secondary Schools	Total
	EP1	EPC	Subtotal		
2014	3	5	**8**	2	10

Source: Interviews with the responsibles for the schools, 2014

Of the nearly 13,786 students, determined through the interviews on campus, 10,286 attend the primary education and 3,500 attend the secondary education (**Table 7.7**).

Table 7.7 – Number of students enrolled, 2014

	Primary Schools			Secondary Schools	Total
	EP1	EPC	Subtotal		
Number of students	135	10,151	**10,286**	3,500	**13,786**

Source: Interviews with the responsibles for the schools, 2014

In the distribution of the school network, shown in **Figure 7.21**, Pamunda and Unidade are the only *bairros* without school, forcing school age children to move to the neighboring *bairros*. In the field of sanitation, the management of the produced waste is carried out by the schools, burying or burning the generated waste. Concerning the sanitary conditions, only a few schools have bathrooms, forcing students and teachers to make their physiological needs, near the schools or in neighboring houses. When featured, the number of toilets does not cover the population that should serve:

- The tree EP1 are located in the more peripheral *bairros*, one in Nanchemele, other in Buji and the third in 1º de Maio, none of them with bathroom.

- According to the five identified EPC in the municipality, two are located in *bairro* Cimento and the remaining schools are distributed by Nanduadua, 30 de Junho and Milamba. In *bairro* Cimento, the EPC de Mocímboa Sede, actually with 810 students, is served by latrines, which due to its poor condition, are unused. In turn, the EPC III Congresso has three improved latrines for a school population of 1,889 students. In Nanduadua, the existing EPC, where 3,152 students are studying, has no sanitation system. The EPC in 30 de Junho, have only two improved latrines: one to serve 2,800 students and another to serve 34 teachers. Finally, in EPC de Milamba, with about 1,500 students and 25 teachers, the two featured latrines were destroyed by floodings.

- From the two featured secondary schools: one in the *bairro* Cimento and another in the *bairro* Muengue, only in the secondary school of ES Januário Pedro (*bairro* Muengue) was gathered some information. This school has 3,500 students and 75 teachers. In terms of health, were identified 5 bathrooms, one designed for teachers and the four remaining for students. All the bathrooms have running water systems, although it was found that the student bathrooms were closed because of the inexistence of water supply therein.

EP1 of Buji
(Source: Field work, 2014)

EPC of 30 de Junho
(Source: Field work, 2014)

EPC of 30 de Junho – latrine for students and teachers
(Source: Field work, 2014)

Escola Secundária Januário Pedro
(Source: Field work, 2014)

Bathroom of the *Escola Secundária Januário Pedro*
(Source: Field work, 2014)

Photograph 7.11 – Schools

7.4.1.2 Health

According to the conducted enquiries, the epidemiological situation of Mocímboa da Praia municipality is dominated mainly by diseases caused by poor sanitation and inadequate hygiene behaviours, with special emphasis on malaria and diarrheal diseases, the latter constituting the first cause of morbidity and mortality, especially among children.

The collected data allow us to assert the existence of a small number of deaths (less than one per day), and many of those could be avoided if the proper treatment were given in time. Indeed, there is evidence of several cases in which the ill person prefers to use other traditional medicinal practices (not always the most appropriate and efficient).

The network of health care in the municipality is composed by a rural hospital and two health centres, according to the location cartographically shown in **Figure 7.21**. The Rural Hospital has 67 beds, distributed by maternity, an operating room, an emergency unit and three wards (pediatrics, male and female). The human resources totaling 72 persons employed, 9 of which are administrative, 46 service agents, 18 nurses and 2 doctors. Only 5 of this total have an university degree. From health point of view, this unit has 5 toilets with cistern and running water for staff and improved latrines to service users. The common and infectious wastes are collected and burnt, and the anatomical waste is deposited at a specific site defined for this purpose. Its area of influence goes far beyond the limits of the municipality, including, in addition to all districts of Mocímboa da Praia and Palma, part of the district of Muidumbe,

constituting a reference unit in the province. According to the gathered data, are attended on average 150 patients per day, of which about a third are hospitalized (Interview with rural hospital Director, 2014).

Rural Hospital
(Source: Field work, 2014)

Emercency unit of the rural Hospital
(Source: Field work, 2014)

Maternity of the rural Hospital
(Source: Field work, 2014)

Photograph 7.12 - Rural hospital

The health care center, located in *bairro* Nanduadua offers an external service care (screening adults and children), immunizations, hygiene and cleanliness, and weight. The staff is constituted by, in addition to a service agent (basic level), a technician of medicine, a technician of preventive medicine and a pharmacy technician, all with an intermediate level. In health terms, this health unit is serviced only by an improved latrine to the service personnel. The produced waste, generally common waste, is redirected to the trash and then burned. The most serious cases are forwarded to the rural hospital (Interview with the District Director, 2014).

Source: Field work, 2014

Photograph 7.13 – Nanduadua health care center

In turn, the health care center, located in Milamba offers an external service care (screening adults and children), immunizations, hygiene and cleanliness. The staff is constituted by, in addition to a service agent (basic level), an agent of curative medicine (basic level) and a pharmacy technician (intermediate level). Similarly to the observed in the health care center of Nanduadua, this health unit is serviced only by an improved latrine to the service personnel. The produced waste, generally common waste, is redirected to the trash and then burned (Interview with the District Director, 2014).

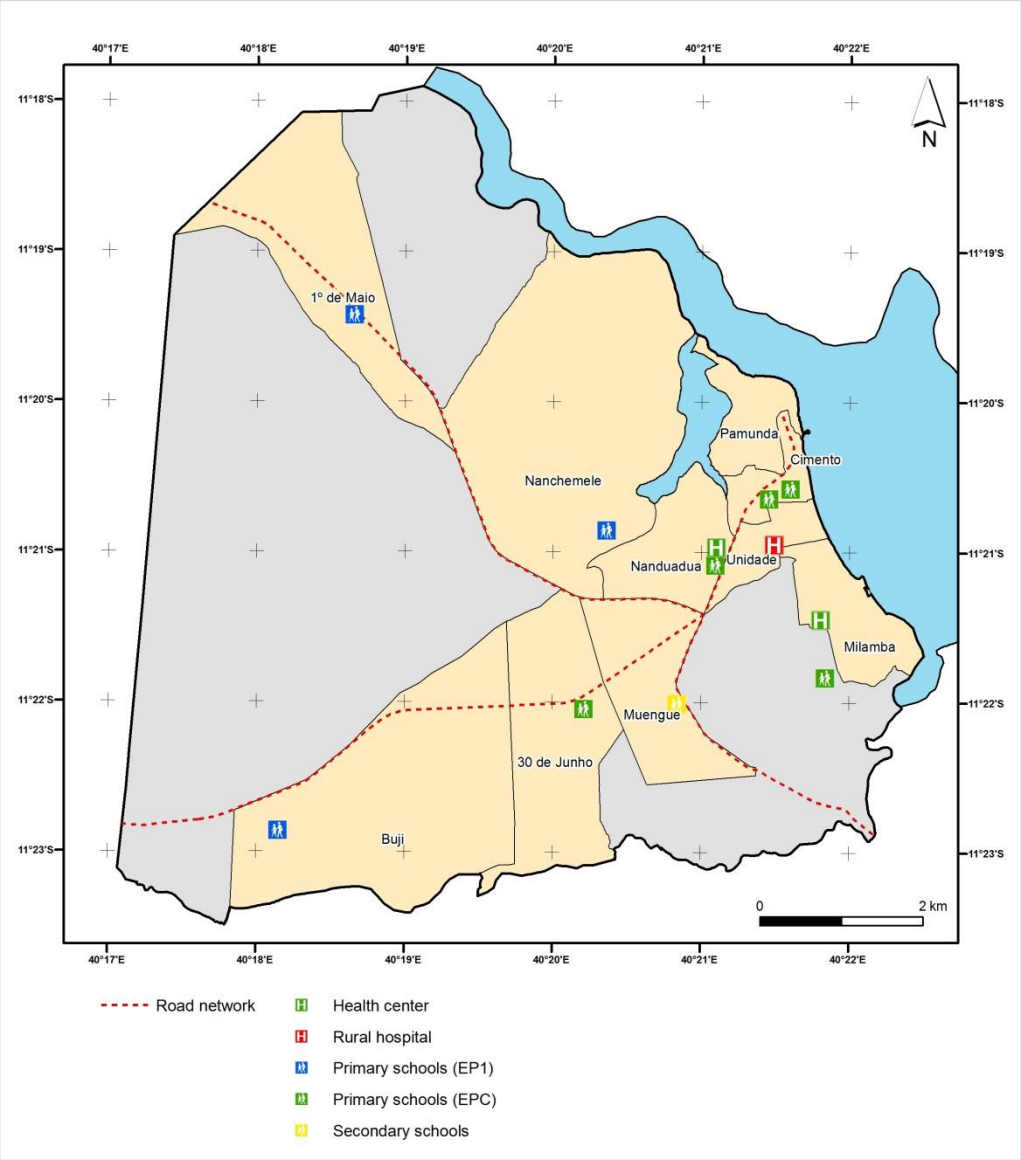
Source: Field work, 2014

Photograph 7.14 –Milamba health care center

Considering the ratios listed below, it is suggested there is a lack of basic services and health professionals to meet the needs of communities.

- One health care centre for 26,011 inhabitants;

- One bed for 776 inhabitants;
- One doctor for 26.011 inhabitants;
- One medical technician for 26.011 inhabitants;
- One pharmacy technician for 26.011 inhabitants.



Source: Own elaboration, Field work, 2014

Figure 7.21 – Distribution of social facilities by *bairro*, 2014

7.4.2 Services

7.4.2.1 Water supply

In terms of water supply, the municipality aren´t benefiting from a public network at home, deducting that, according to the obtained results in the carried out questionnaires, the communities are supplied mainly through wells and fountains. It is known, however, that the new water supply system of Mocímboa da Praia, designed under the Project Design and Construction of the Expansion of Water Supply, is at the final stage of its construction, foreseeing, in addition to the installation of approximately 100 fountains scattered uniformly in each *bairro*, that in a first phase, 40-50% of the households are supplied by this new network, through yard taps or house connection.

Given that at the date of preparation of this study, the new water supply system isn´t yet in operation, the results expressed here do not reflect the impact of its holding, expecting that in the short term they become outdated.

7.4.2.2 Sanitation

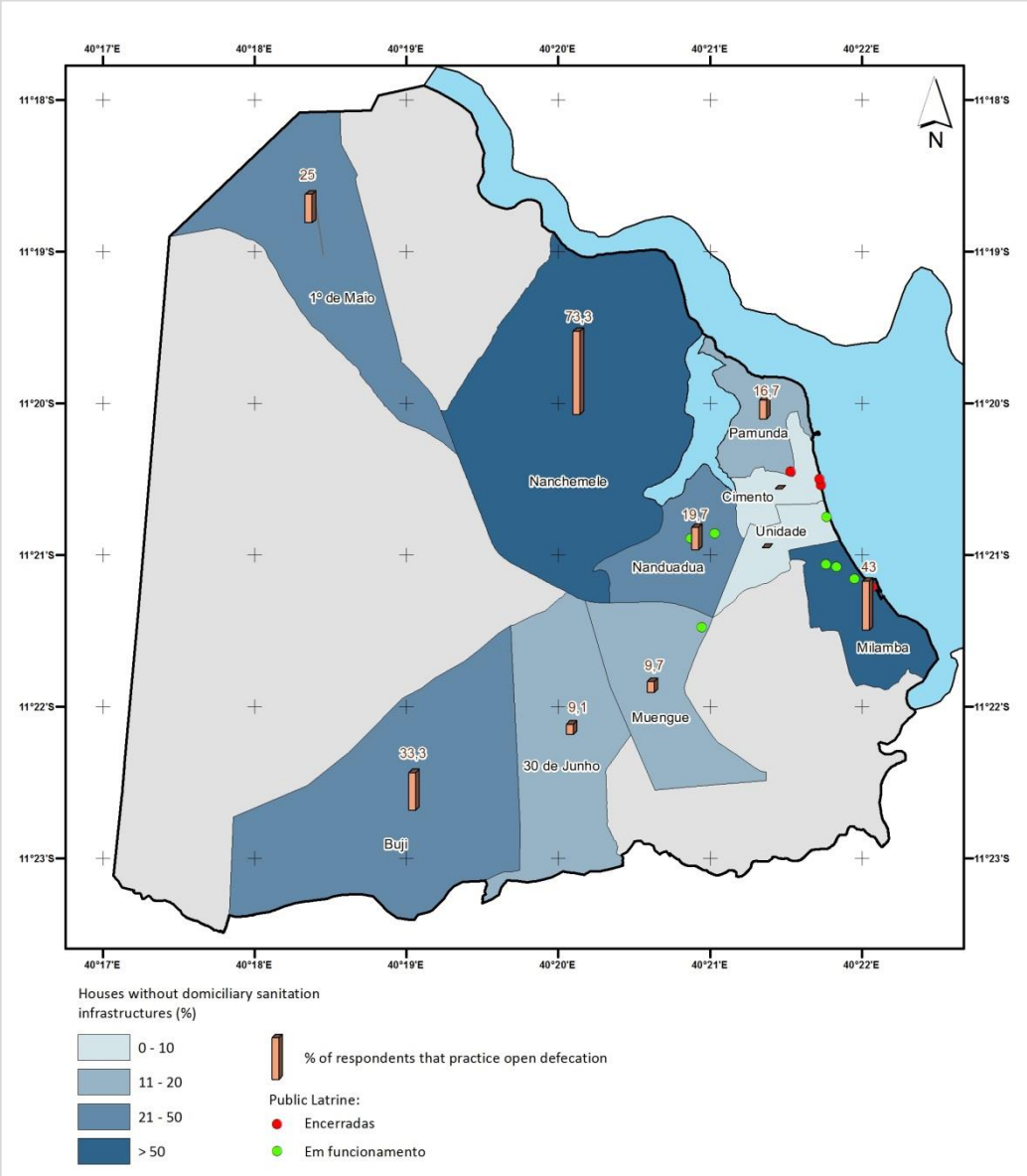
Domestic wastewater

Similarly to the water supply, the Mocímboa da Praia municipality is not served by any domestic wastewater system, deducting that, according to the obtained results in the carried out questionnaires, a significant percentage of communities have access to latrines (improved, but mostly traditional). Only a residual part of the respondents claim to have toilets with septic tanks, mostly recorded in the *bairro* Cimento.

Despite of the mentioned above, there are still significant records of communities without access to sanitation, verifying, even with the existence of public latrines, the practice of open defecation. This finding suggests that the system of public sanitation is not an alternative to this practice, which may contribute to such a reality some factors:

- Large geographical dispersion of public latrines, making communities to travel over long distances, translating into the search for more affordable alternatives;
- Lack of maintenance and cleaning of public latrines that discourages their use. Indeed, the team was able to observe in situ, many cases of closed public latrines, due to lack of maintenance;

- Ignorance of the existence of public latrines. According to the results reported in the questionnaires, there were several respondents who assert the lack of public toilets in their *bairro*, despite of its existence been confirmed by the team on site.



Source: Own elaboration, Field work e Questionnaire to the household, 2014

Figure 7.22 – Open defecation *versus* domestic sanitation infrastructures public or private

Stormwater

Currently, the stormwater drainage system of Mocímboa da Praia integrates only three ditches parallel to the streets 25 de Junho (which separates the *bairros* Milamba and Unidade), Josina Machel (which separates the *bairros* Cimento and Unidade) and 7 de Março (in *bairro* Cimento), which clearly manifested insufficient to face the flooding problems that the municipality note. The existence of some informal drainage devices, improvised by local communities, in order to minimize the impacts of stormwater, was observed *in situ*. These devices were identified in the districts where floods are more frequent, particularly in Milamba and Nanduadua.

Drainage Ditch in 7 de Maio street
(Source: Field work, 2014)

Drainage Ditch in 25 de Junho street
(Source: Field work, 2014)

Ditch built by the community for the stormwater drainage – *bairro* Milamba
(Source: Field work, 2014)

Concrete culvert near the Nanduadua market
(Source: Field work, 2014)

Photograph 7.15 – Stormwater drainage system (formal and informal)

Solid waste

It is known, according to the municipal services of Mocímboa da Praia, that the management of solid waste is performed by the Municipal Council, which is responsible for the collection and final transportation.

For that purpose were indicated 36 points of waste disposal, including 7 formal points (silos and metallic containers) and 29 informal points (where the waste is deposited in the ground). Its collection and transportation service, held every day of the week, between 07:00 and 15:00, is from the conventional type, without any selection of waste prior to the final deposition, performed by three tractors. In turn, the final deposition is performed in a dumpster located at about 8 km from the center of the municipality.

Formal point of deposition (silo)
(Source: Field work, 2014)

Informal point of deposition (waste disposal in the ground)
(Source: Field work, 2014)

Mean of transport used for the waste collection/final deposition
(Source: Field work, 2014)

Photograph 7.16 – Deposition and collection points – solid waste

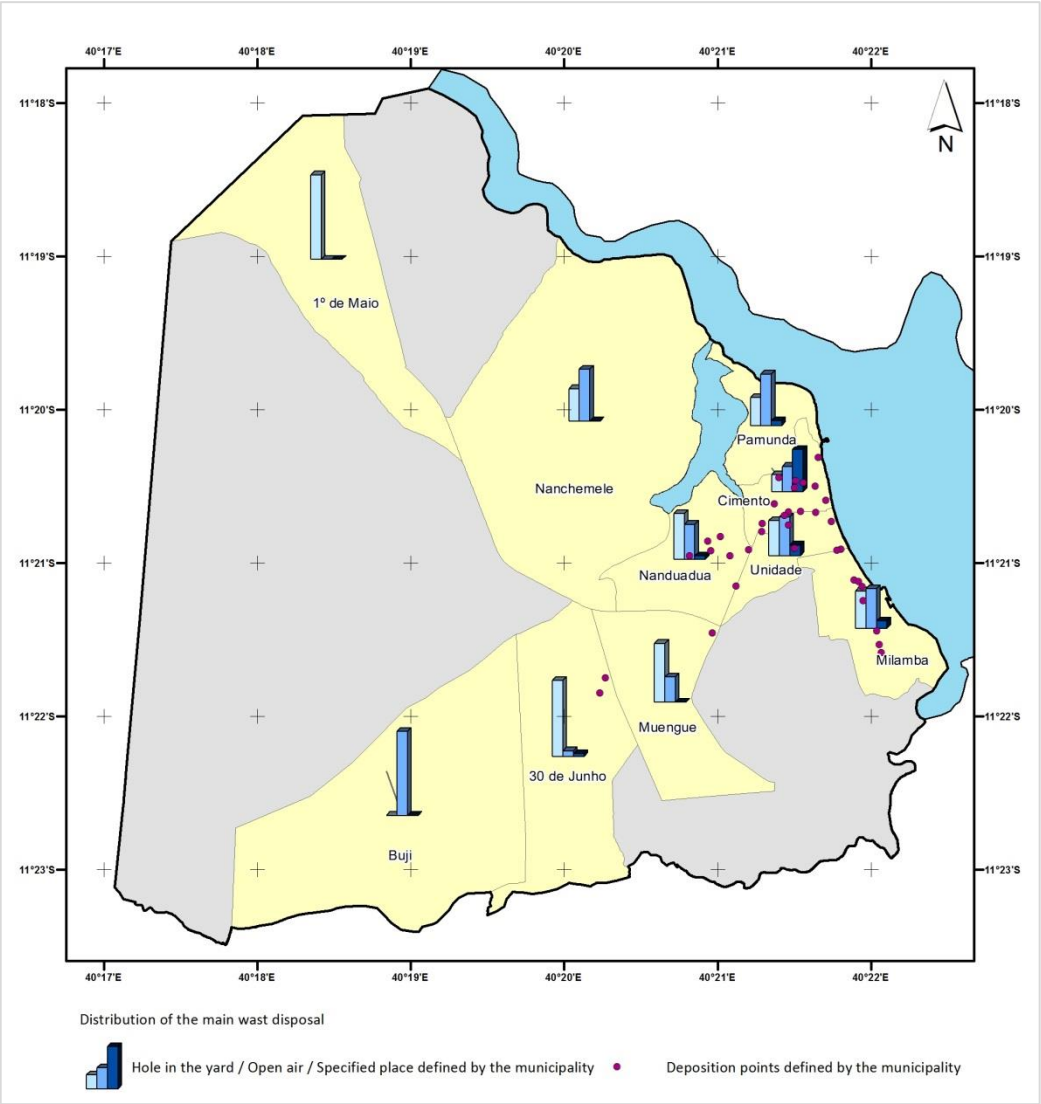
Considering the **Figure 7.23**, it appears that the deposition points in question were distributed by most of the *bairros*, except in the most peripheral ones, particularly in

1º de Maio, Buji and Nanchemele. Comparing the obtained results in the carried out questionnaires, the percentage of households who claim to deposit the produced waste in a designated place by the municipality is clearly reduced, suggesting failures in the practiced management. It is pointed out the main causes:

- Inequitable geographical distribution of the deposition points, making communities to travel over long distances, resulting in the search for more affordable alternatives. This reality is reflected in the questionnaires done, where most of the respondents confirm deposit their waste in a hole in the yard and at open air;

- Ignorance of the existence of these deposition points. According to the results reported in the questionnaires, there were several respondents who claim the inexistence of waste collection in their *bairro*, despite of its existence been confirmed by the team on site.

The registered failures may be the cause of a high percentage of unsatisfied respondents (84.3%) with the way that waste is handled in the municipality.



Source: Own elaboration, Field work e Questionnaire to the household, 2014

Figure 7.23 – Inadequate deposition points versus adequate deposition points by the municipality

7.5 Accesses

According to the performed field reconnaissance, Mocímboa da Praia has a port and an airport that would make it strategically more accessible, but isn´t the case. Indeed, the harbor, located in the Northwest sector, in *bairro* Cimento, is currently underutilized, with a low use, and only being used by a private company for their logistics. In turn, the aerodrome was built before 1972, also has a low frequency of use, being used only for commercial purposes.

In this sense, the external accessibility of the municipality is essentially done by a road network built to establish its connection with the districts of Palma, Macomia, Mueda, Muidumbe and the provincial capital, Pemba. Recent beneficiations have significantly improved the high state of degradation of the main roads, increasing the accessibility and mobility of the communities. In turn, the internal circulation of the municipality is distributed by a number of streets, main streets designed with two lanes and a central separator, which allows the accessibility to the village center. Within the *bairros*, the traffic drives through streets in poor conditions, unpaved, which tends to become impassable in the rainy season (due to erosion), with negative consequences in the vehicles access and mobility of communities.

Road connecting to the district of Palma
(Source: Field work, 2014)

Road connecting to the district of Macomia
(Source: Field work, 2014)

Roads which connect to the village center
(Source: Field work, 2014)

Internal circulation in *bairros*
(Source: Field work, 2014)

Photograph 7.17 – External and internal accesses

7.6 Land use patterns

Land use patterns in the study area were determined by photo-interpretation of aerial image. The subsequent validation occurred *in situ* during the recognition of the terrain (June 2014).

The adopted classification intended to be as far as possible, an analytic classification resulting of morphological, biophysical and socioeconomic characteristics, and intended to express the structure and forms of appropriation and exploitation of space in the study area. These spatial or territorial criteria ran a "mosaic" of homogeneous occupation of the territory under study, having been measured the land use patterns, subsequently described (**Figure 7.24**):

The **artificial areas** are the dominant occupation of this area corresponding to areas essentially related to human societies, where man lives in community. Within this pattern, it was found necessary to divide it into subclasses that, despite of coherent with its standard, are holders of particular features, including

- Human settlements, in which was included any form of land use, where man lives in the community. The *in situ* observation allowed to establish that this occupation is organized according to a settlement that tends to be concentrated;

- Zone of tourist facilities located in the Northern sector of the study area, in *bairro* Pamunda, where the larger hotel establishments are inserted;

- Aeronautical facility, corresponding to the bordering aerodrome, at South and West of the Unidade and *bairros* Milamba, respectively;

- Port facility, located in the *bairro* Cimento, next to the coastline;
- Road network, in which were included the main roads that allow external the accessibility of the municipality.

The **Humid areas** (hydrophilic communities) occur in the low lying areas, along the water lines (temporary or permanent), in seasonal ponds or in the periodic flood plains, and areas of swamps. It is also common to find in these areas, construction materials (straw), used to construct surrounded latrines and bathrooms.

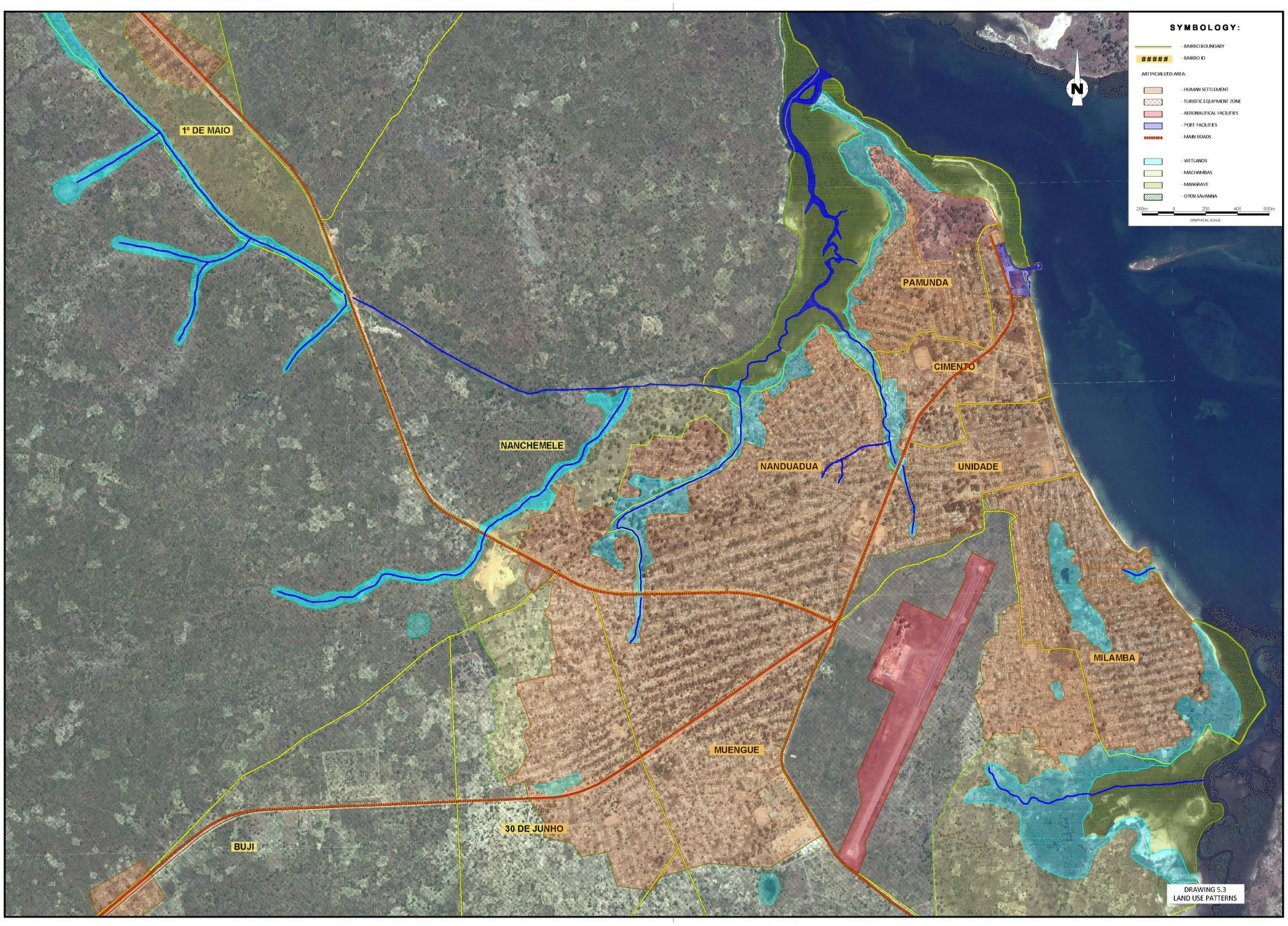
The **agricultural area (or "*machambas*")**, that arise in areas contiguous to existing human settlements sector in the South, where the cultivated land appear as *machambas*, fallow or secondary open forest.

The ***machambas*** (or cropland), that arise in areas contiguous to human settlements, where the cultivated land appear as *machambas* in the active, under fallow or as open secondary forest, dominating the exotic species such as mango (*Mangifera indica*) and coconut trees (*Cocos nucifera*). According to the bibliography, and concerning the land ownership, most of the farms belong, traditionally, to families, transmitted by inheritance to their children.

This type of vegetation responds to ecological peculiarities of the coast generally characterized by muddy soils under high salinity, strong changes in the water level and tidal areas. Constituting an ecosystem threatened by human settlement, its destruction can cause negative effects on fish and on the other hand, increasing coastal erosivity.

Mangroves, vegetation unit particularly well developed in the Northeast and Southeast sectors of the study area, near the mouth of streams that flow into the ocean. This type of vegetation responds to ecological peculiarities of the coast generally characterized by muddy soils under high salinity, strong changes in the water level and tidal areas. According to the bibliography, the mangroves of the study area are essentially represented by mangrove channels. Part of the population sees, in mangroves, a source of firewood and raw materials for the construction of dwellings (especially for walls). When excavated, allow access to brackish water, used by the local population for washing and bathing. Constituting an ecosystem threatened by human settlement, its destruction can cause negative effects on fish and the preservation of the existing coral in the vicinity of Quirimbas Islands, and on the other hand, increasing coastal erosivity.

The **open savannah,** community in which trees (especially cashews) occur dispersed within the extensive grasslands, which tends to focus on the Northern and Western sectors of the study area.



Source: Own elaboration, Field work, 2014

Figure 7.24 – Land use patterns

Depending on the occupation pattern of the dominant soil, where natural areas have been progressively invaded by human settlement, Mocímboa da Praia presents itself as a territory of clear urban characteristics, due to the impact that population growth (observed in recent decades) has been in the land occupation.

Similarly to the vast majority of Mozambican villages, that emerged during the colonial period, the urban structure of Mocímboa da Praia is characterized by two distinct types of areas:

- an urban area (commonly called the central zone of "Cidade Cimento"), which integrates the entire *bairro* Cimento, constituting an ordered space, especially with houses mainly of block walls and wide avenues, mostly asphalted, which are located much of the municipal and district public management;

- a peri-urban area (peripheral zone, which might be called by suburbs), where the human settlements have been developed in an unplanned manner, by setting different kinds of networks, mostly disorganized. According to size, expansion and the occupation growth, the peri-urban area can be divided into three distinct zones: a high density suburban area (comprising the *bairros* Nanduadua, Milamba and Unidade), a medium density suburban area, which includes the *bairros* Pamunda, Muengue and 30 de Junho, and finally a low-density suburban area, including the *bairros* 1º de Maio, Buji and Nanchemele. The informal settlements are the main threat to the environment in Mocímboa da Praia, so that, in some areas, the settlement tends to be located in hazardous areas.

There is, however, a tendency of decentralization of the central area, with the creation of attractions in non-core areas, such as educational facilities or health care centers, giving as an example the Secondary School, located in *bairro* Muengue, and the health care centers , in the *bairros* Milamba and Nanduadua.

In this context and considering the development options defined for the municipality, at the Municipal Council, there are currently two Plans of Detail (PD):

- PD of Ntende, whose intervention area covers a total of 1,020 parcels for housing and eight reserved areas for social spaces such as sports fields, markets, schools, among others, in an area located in South-west of Milamba;

- PD of Buji, covering about 2,000 parcels for housing, 160 parcels for turist accomodation (a total area of 40 hectares), one parcel for commercial purposes and a reserved area.

It is further known the intentions of the Municipal Council to draft three more PD: one for the *bairro* 1º de Maio, with designed areas for industry, tourism and housing, another for the 30 de Junho and a second PD for Buji. It also intension of the municipality to intervene in *bairros* Muengue and Nanduadua with the opening of streets.

7.7 Vulnerable groups

According to the characterization made earlier, it is possible to identify a distinct group of people who may be differentially or disproportionately affected in the absence of sanitation because of their disadvantaged or vulnerable status. Within that group, women, children, people with disabilities and low-income communities.

Globally, millions of children and women die each year from diseases associated with lack of sanitation, which could be prevented (UNICEF). According to the bibliography, **women** are especially vulnerable during pregnancy and childbirth, especially when hygiene conditions are not the most appropriate and when access to safe sanitation is non-existent. **Children** under five years old are the most vulnerable to poor hygiene and inadequate sanitation, two of the main causes of diarrhoea. According to the UNICEF, the disease kills at least 1.2 million children in this age group, more than HIV, malaria and measles combined.

It is known, as previously mentioned, that the whole sample analysed (2,565 inhabitants), 1,338 are women, standing, largely childbearing age [15 to 49]. It is known that 30.9% of the target population are children under 10 years. If, in addition to this fact, the sanitation conditions previously characterized, these groups already fragile tend to be more vulnerable, in so far as:

- More than half (66,8%) of the households surveyed do not have any sanitation infrastructure in their homes, and where it exists there is still a significant percentage with inadequate sanitation infrastructure (traditional latrines);
- Around 26% claim to practice open defecation;
- Approximately 40% still lay their solid waste in inappropriate places;
- Approximately 3% do not use soap when washing hands;
- The sanitation conditions in schools are not always the most appropriate, there are still establishments without any sanitation infrastructure;

- The analysed ratios suggest that there is a lack of basic services and health professionals to meet the needs of communities.

On the other hand, **people with disabilities** and households with disabled members suffer higher rates of deprivation, considering that have worse health perspectives, lower levels of education, less economic participation and higher rates of low income compared to people without disabilities. People with disabilities are more prone to food insecurity, poor housing, inadequate access to water and adequate sanitation services. Disabled people are also more prone to inadequate provision of health services in meeting their needs and have the necessary health services denied.

These considerations lead to integrate people with disabilities in vulnerable groups in a situation of deprivation in sanitation, so it was developed in the context of this study, a specific questionnaire for this group. Among the universe of people with disabilities detected during the execution of the questionnaires, only 19 responded to questionnaire, of which 15 are either paralyzed or have difficulty walking or are blind. These deficiencies cause considerable functional difficulties particularly with regard to access to sanitation. Of these 15 people, eight have no latrine or toilet, forcing them to defecate at the beach or in the bushes or in a pot. Of the remaining seven who claim to have latrine or toilet, six have difficulty using them, because of their disabilities, showing up, mostly dissatisfied with the type of existing sanitation system, especially for the quality it presents. Only one of the seven people claim not to use the latrine that your dwelling has, due to the difficulty his disability imposes.

Finally, the lack of sanitation is still associated with poverty, mainly affecting **low-income communities**, most vulnerable, as they are prone to shortages and lack of resources. Given the characterization made previously, are considered as low-income communities, that:

- Have less access to public services such as water and sanitation, since they are more exposed to waterborne diseases;
- depend more on agriculture for their livelihoods, since the fragility of this activity compared to climatic disasters can lead to starvation and consequent malnutrition;
- Show lower livelihood;
- Have a lower rate of economic development;

- Present greater exposure to environmental disasters, by focusing on geographical areas with the highest risk of extreme weather events such as floods.

Source: Field work, 2014

Photograph 7.18 – Vulnerable groups

Also noteworthy, that despite the sensitivity expressed by communities and stakeholders for these vulnerable groups, action for ensures that they cease to be tend to be, in general, still insufficient to the needs detected. On the other hand virtually non-existent when it comes, for example people with disabilities, where field observations could infer that improve access to services for these people is still a very incipient concern in public policy.

8 DIAGNOSIS

Based on the previously described of the baseline conditions it could be made a diagnosis, by a SWOT analysis (Strengths, Weakness, Opportunities and Threats). Constituting itself as a synthesis exercise able to list attributes (strengths) and limitations (weaknesses) of territory in terms of sanitation, as well as opportunities and threats that comes from abroad, this methodology establishes a benchmark of important basis for the development of subsequent phases of the SSP.

This diagnosis is organized around three strategic areas - **Natural Hazards and Climate Change**, **Public Health and welfare of communities**, and **ability to pay** - is presented in the following tables.

Table 8.1 – SWOT analysis – Natural hazards and climate change

Strengths	Weaknesses
---	• Regime of torrential rainfall; • Existence of flood prone areas; • Existence of human settlements in flood prone areas; • Dense occupation of the territory and not controlled; • Vulnerability to climate change, in that small changes in precipitation may induce significant changes in the water flow; • Lack of integration of climate change into decision making.
Opportunities	**Threats**
• Execution of an adequate drainage system; • Implementation of regulatory instruments of occupation of the territory, such as the Plano de Estrutura Urbana de Mocímboa da Praia (Structure Plan); • Involvement of communities: communication and awareness-raising;	• Uncertainties associated with the potential impacts of climate change; • Unplanned population growth; • Community ignorance for the vulnerability to the impacts of natural hazards and climate change.

Table 8.2 – SWOT analysis – Public health and welfare of communities

Strengths	Weaknesses
• Reduced mortality from diseases caused by poor sanitation; • Rural hospital considered a reference unit in the province.	• Low coverage of water supply network; • Low coverage of sanitation systems; • inefficient public system of sanitation; • Untreated excreta and possible groundwater contamination, if any water sources nearby; • Water accumulation ponds that remain for a long period of time, promoting the development of insects and diseases;

	• Deposition of waste in inappropriate places, prone to the development of insects and animals which transmit diseases; • Widespread practice of open defecation; • Existence of vulnerable groups.
Opportunities	**Threats**
• Access to safe water and sanitation; • Execution of an adequate drainage system; • Solid waste management; • Involvement of communities: communication and awareness-raising and promotion of safe hygienic practices.	• Behaviours not always the most appropriate, because of ignorance or an inability to follow alternative; • Ignorance of the communities of the existence of public latrines and adequate waste disposal sites; • Ignorance of communities to the impacts that the lack of sanitation on public health has; • Prevalence of diseases caused by poor sanitation; • Cultural aspects, there are many communities that make use of other traditional medicinal practices, rather than the Hospital; • Communities vulnerability to climate changes.

Table 8.3 – SWOT analysis – Ability to pay

Strengths	**Weaknesses**
• Willingness of communities to pay for improved sanitation service.	• Low income communities; • Low economic level of the communities; • Low rate of economic development, which results in a reduced ability to pay.
Opportunities	**Threats**
• Social and economic development in the municipality.	• Communities vulnerability to climate changes; • Low ratio of communities that will benefit from the development.

9 SYNTHESIS

In this document, it was presented the study that resulted from a broad community involvement, with which it is intended to build a baseline to guide the definition of scenarios and options to develop at a later stage of the Strategic Sanitation Plan of Mocímboa da Praia municipality.

Recognizing that access to safe sanitation is a right for everyone and it is the duty of all to contribute to this right. Recognizing that the current limitations of access to safe sanitation have negative impacts on the productive capacity and, especially, in the quality of life of the communities. Aware that the implementation of the Plan will be a key condition to ensure the environmental sustainability being patent the Millennium Goals. Integrate social and environmental component in decision making.

The mentioned references were the main challenges that guided the pursuit of the study, which resulted in a baseline characterization of the territory under study, focusing on a set of biophysical and socioeconomic dimensions which, in turn, formed the starting point for the identification of main problems and dysfunctions of the territorial system in sanitation. This characterization reflected the data obtained through research of varied literature, complemented with the results reported in the questionnaires carried out with the communities, with interviews with key stakeholders and *in situ* observation.

From the achieved explanation, the municipal communities further establish a standard type vulnerable to a lack of access to sanitation, so that:

- The right to adequate housing that provides basic living conditions does not constitute an acquired condition for all, since communities living in rudimentary dwellings, where the water supply is mainly from unimproved sources, many of which still persist without access to sanitation, and where it exists, is mostly characterized by systems outside the minimum acceptable standard. This reality, make communities more susceptible (or sensitive) to suffer damage due to the lack of sanitation;

- Their exposure to dangerous phenomena, including floods, is a constant, aggravated by human action;

- Their resilience is still constrained by low economic level and behaviors in terms of sanitation are not always the most appropriate, because do not have or do not

know another way to do it. Included in these features, the practice of open defecation and disposal of garbage in inappropriate places.

10 LEVELS OF DEMAND

By considering fundamental, in matter of sanitation, the interaction between the determinants of demand and supply, we tried, with the development of this chapter, to analyse the evolution of demand for the project's horizon of 15 years, i.e. 2030.

10.1 Population projections and urban expansion

It is expected that Mocímboa da Praia municipality will register in the coming years, a considerable economic growth, due to the expected enhancement of the tourism sector, combined with its location near of the hydrocarbon exploration points in Northern Province. Following this growth is expected to, at all *bairros* a positive population evolution but not homogenized, for which predict different growth rates, as shown in **Table 10.1**, whose values result from the annual growth rate of 3.6% applied to the population estimates made for the year "zero", i.e., for 2014:

- A rapid and strong growth in *bairros* that currently have a lower population density, namely 1º de Maio, Buji and Nanchemele. It is expected that Buji will have a distinct growth of the remaining districts, resulting from the growth perspective of about 4,000 people in the short term, present in the current *Plano de Pormenor* (Plan of Detail). This growth tends to decrease from 2020. It is expected an annual growth of 2.5%;

- A rapid growth in the *bairros* 30 de Junho and Milamba, until 2020, a period from which tends to stagnate, by considering that the urban area will not have more space to expand;

- A reduced growth in *bairros* where the urban space, already consolidated, already established neighborhoods where urban area doesn't have space to expand, resulting from the typification of buildings change (building height) and from the urban redevelopment that is expected to occur in the short / medium term. It is further understood that this growth may be conditioned towards the migration of the currently resident population to the peripheries, attracted by job opportunities that may arise.

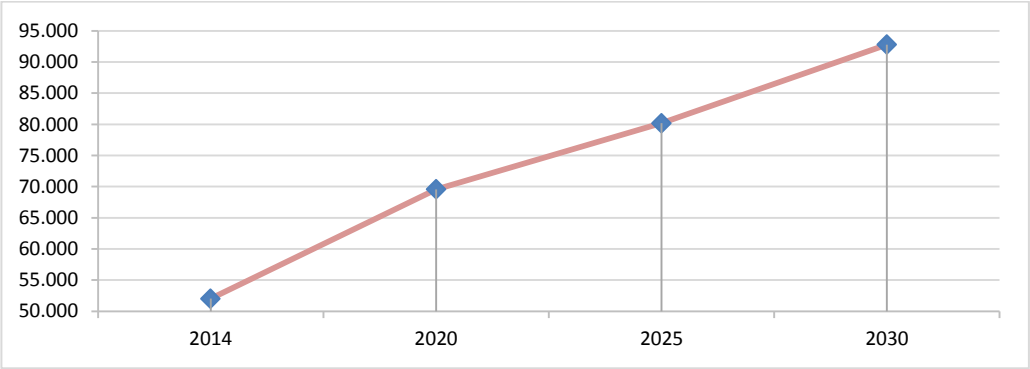
Table 10.1 – Previewed population growth

Bairro	**Annual growth rate**	
	2014-2020	***2020-2030***
Buji	40.0%	2.5%
1º de Maio e Nanchemele	6.0%	8.0%

Bairro	Annual growth rate	
	2014-2020	*2020-2030*
30 de Junho, Milamba	6.0%	2.5%
Nanduadua, Cimento, Pamunda, Unidade e Muengue	2.5%	2.5%

Source: Own elaboration, 2014

Applying this annual growth rate it was possible to predict the total population at the Mocímboa da Praia municipality for year 2030 (**Figure 10.1**) and its distribution per *bairro* (**Table 10.2** and **Figure 10.2**):



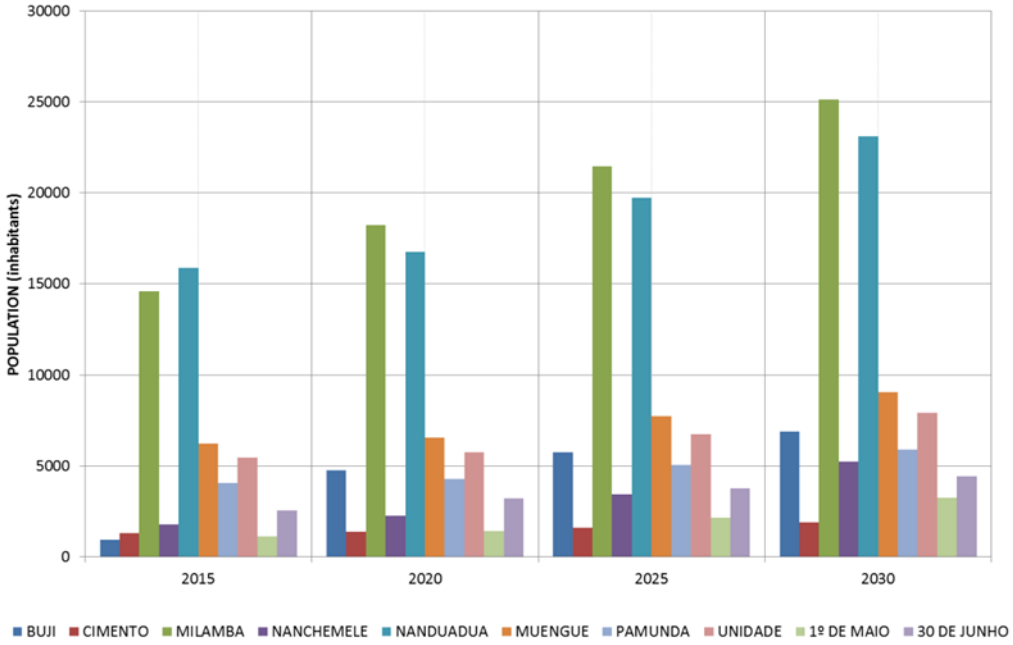
Source: Own elaboration, 2014

Figure 10.1 – Predicted population in Mocímboa da Praia municipality, 2014 - 2030

Table 10.2 – Estimated population per bairro, 2014 - 2030

Bairro	Year			
	2014	**2020**	**2025**	**2030**
1º de Maio	1,069	1,513	2,221	3,260
30 de Junho	2,443	3,461	3,913	4,424
Buji	682	5,126	5,941	6,885
Cimento	1,284	1,486	1,681	1,901
Milamba	13,834	19,620	22,196	25,109
Muengue	6,094	7,066	7,992	9,039
Nanchemele	1,713	2,426	3,562	5,230
Nanduadua	15,572	18,057	20,428	23,109
Pamunda	3,991	4,625	5,230	5,915
Unidade	5,340	6,189	6,999	7,916
Total municipality	**52,022**	**69,569**	**80,163**	**92,788**

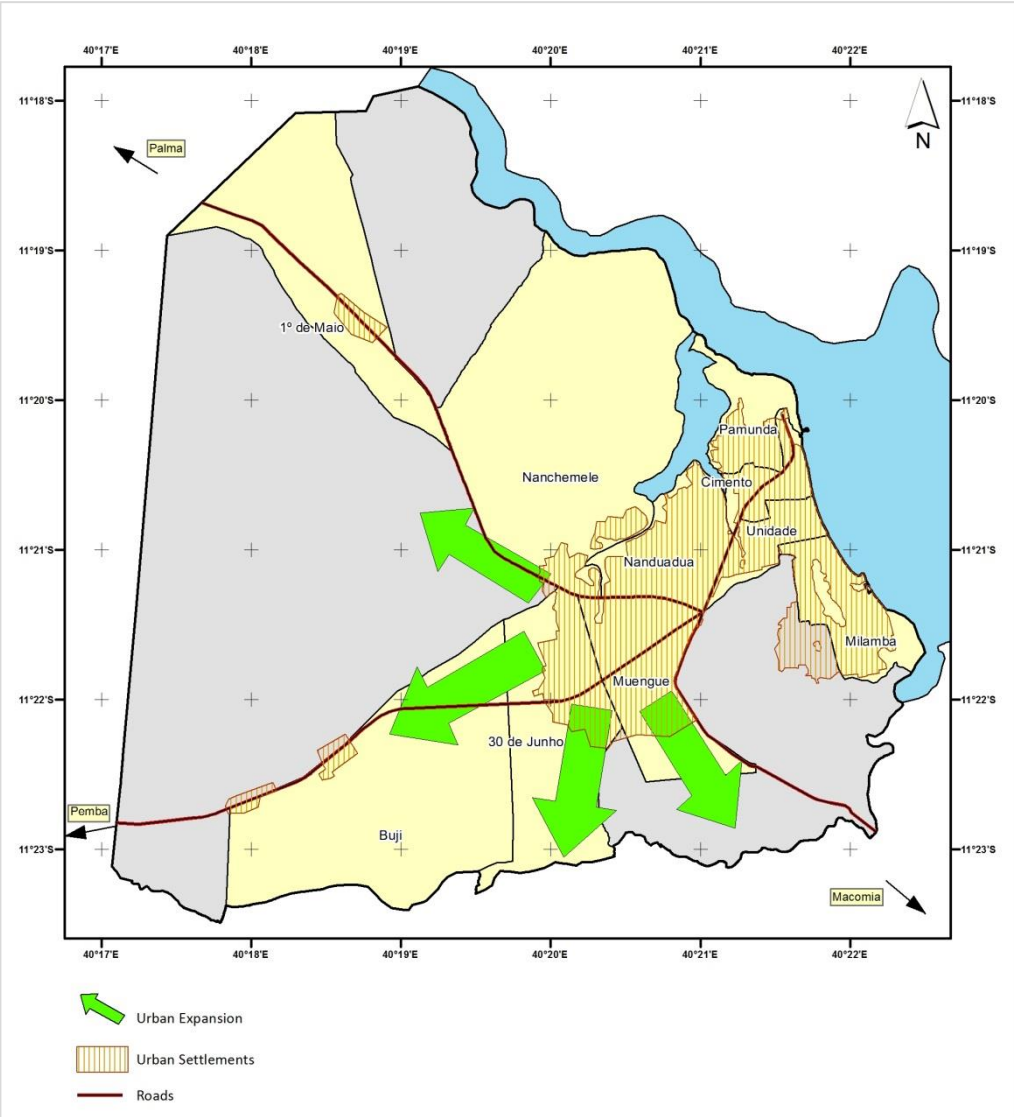
Source: Own elaboration, 2014



Source: Own elaboration, 2014

Figure 10.2 - Evolution of the predicted population by *bairro*

As a result of the estimated population growth and of the development options set for the municipality, it is expected that the current territorial model follow a trajectory of urban expansion for Northwest, Southwest, South and Southeast (**Figure 10.3**) being also expected the growth of informal settlements, despite of the several existing or planned instruments of territorial management. It is expected that this growth is mainly incident in *bairros* that currently have a lower population density, namely 1º de Maio, Buji and Nanchemele.



Source: Own elaboration, Field work, 2014; Plano de Estrutura Urbana de Mocímboa da Praia (Structure Plan)

Figure 10.3 –Urban expansion model

10.2 Demand evolution

According to the population projections made for the project's horizon year, it was possible to estimate the production of domestic wastewater and solid waste, considering the evolution of coverage and demand. The results obtained are summarized in the following points.

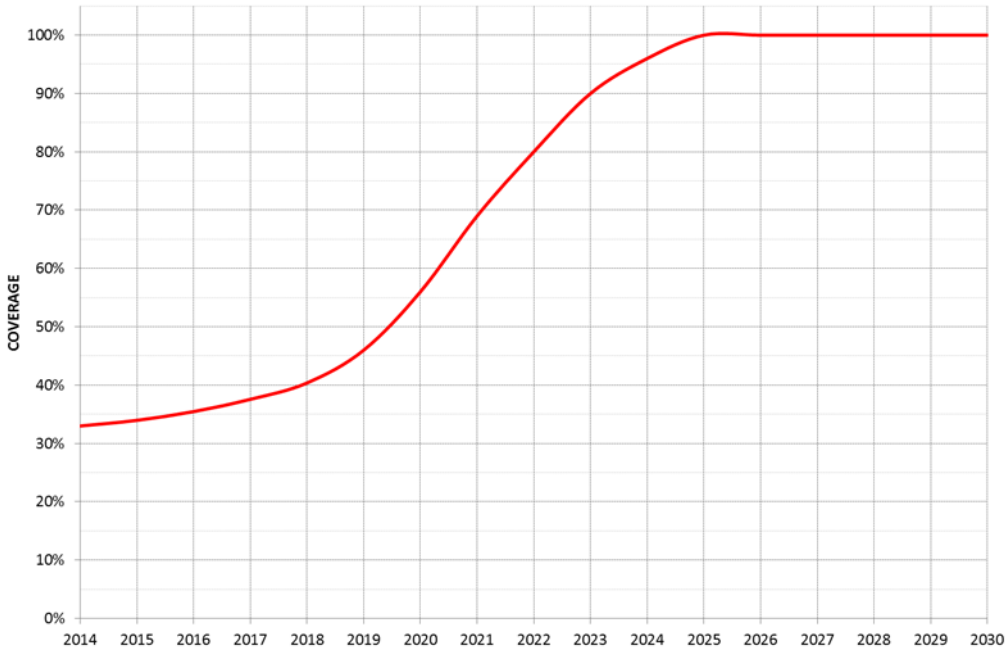
10.2.1 Wastewater production

10.2.1.1 Coverage evolution

It is defined as coverage of domestic wastewater, the existence of an infrastructure of safe sanitation (improved latrine or more advanced technology option) in a particular building. In this sequence, the Water Policy (2007) defines the following objectives:

- *"Increase the coverage in 2015 for 67% in urban areas (…) and about 60% in rural areas (…);*
- *Increase the coverage in long term (2025) to gradually approaching form universal coverage;*
- *Ensure that the medium term (2015) communities (...) have an adequate sanitation infrastructure to the level of every household (...)".*

Based on the baseline conditions presented in the previous chapters will be unrealistic to consider that, in 2015, the mentioned goals will be achieved, however it is expected that the coverage of sanitation infrastructure will have, in the coming years, major growth designed to ensure that universal coverage is reached in 2025, according to the evolution shown in **Figure 10.4**.



Source: Own elaboration, 2014

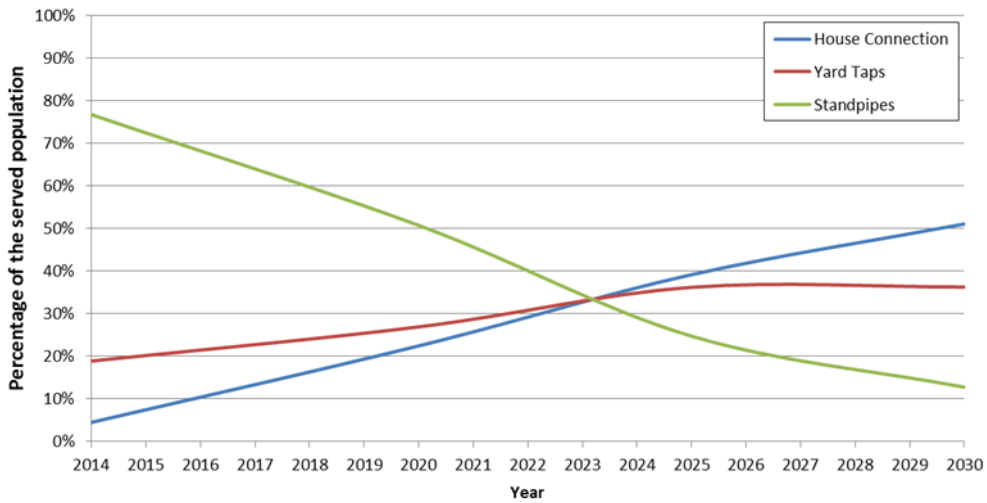
Figure 10.4 – Evolution of coverage of wastewater systems

10.2.1.2 Demand evolution

The demand of domestic wastewater, i.e., the amount of wastewater produced per capita, should also present a significant growth in the coming years. This growth will be due to the following factors:

- More and better coverage of water supply network, the easiest and nearest access to sources of safe water will cause an increase in water consumption, and consequently in rejected wastewater;
- The expected economic development in municipality will increase the average household's income, which will cause in an increase in water consumption;
- Increasing public awareness of the adoption of safe hygiene practices also cause an increase in average wastewater demand in the municipality.

Considering this framework, and assuming that the future planned water supply network is operational, it is expected that, in the long term, the number of dwellings served by house connection will increase and the number of families to obtain their supplies in standpipes will decrease (**Figure 10.5**).



Source: Own elaboration, 2014

Figure 10.5 – Evolution of water supply level of service in Mocímboa da Praia municipality

In the evolution of the level of service by b*airro*, there is, in most of them, a stronger growth of house connections, a less pronounced increase in the number of dwellings served by yard taps and a marked reduction of the population served by standpipes.

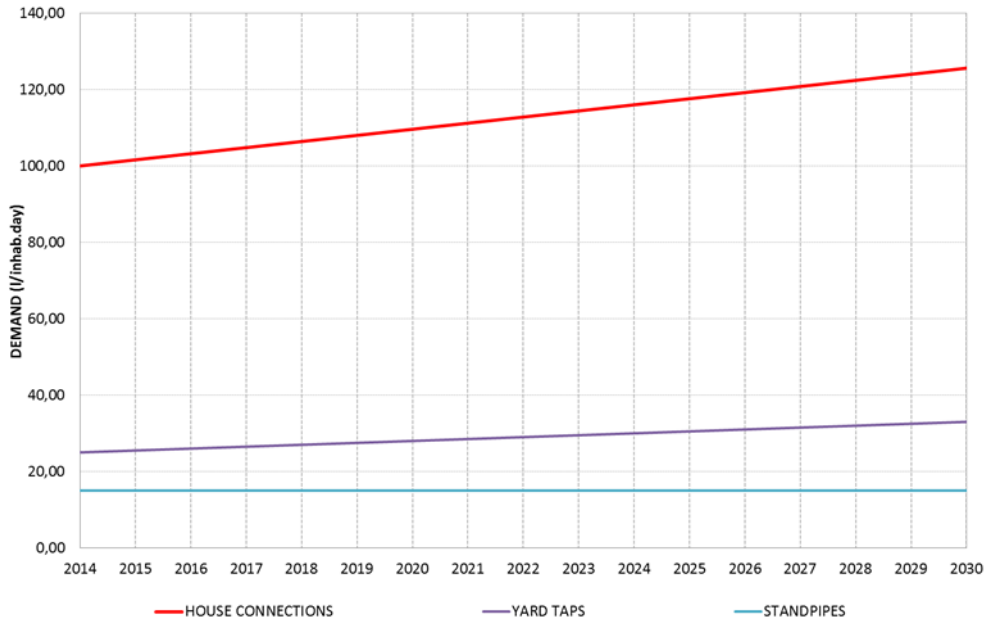
Assuming that the expansion areas subjected to the PD will be entirely supplied through home extension, is expectable that the growth of this type of service will be carried out, more significantly, in *bairro* Buji in which the number of people covered is higher (**Table 10.3**).

Table 10.3 - Evolution of water supply level of service per *bairro*

Bairro	**Level of service**	**Year**			
		2014	**2020**	**2025**	**2030**
1º de Maio	House connection	0%	30%	50%	65%
	Yard Tap	0%	30%	30%	30%
	Standpipe	100%	40%	20%	5%
30 de Junho	House connection	0%	10%	30%	45%
	Yard Tap	20%	30%	40%	40%
	Standpipe	80%	60%	30%	15%
Buji	House connection	0%	80%	85%	90%
	Yard Tap	20%	5%	10%	5%
	Standpipe	80%	15%	5%	5%
Cimento	House connection	90%	95%	100%	100%
	Yard Tap	5%	5%	0%	0%
	Standpipe	5%	0%	0%	0%
Milamba	House connection	5%	25%	40%	50%
	Yard Tap	30%	35%	40%	40%
	Standpipe	65%	40%	20%	10%
Muengue	House connection	0%	10%	25%	40%
	Yard Tap	5%	20%	35%	40%
	Standpipe	95%	70%	40%	20%
Nanchemele e Nanduadua	House connection	0%	10%	30%	45%
	Yard Tap	15%	25%	40%	40%
	Standpipe	85%	65%	30%	15%
Pamunda	House connection	5%	15%	35%	45%
	Yard Tap	25%	35%	40%	40%
	Standpipe	70%	50%	25%	15%
Unidade	House connection	5%	15%	35%	45%
	Yard Tap	20%	30%	40%	40%
	Standpipe	75%	55%	25%	15%

Source: Own elaboration, 2014

It is equally necessary to establish the evolution of the domestic wastewater demand for each type of water supply service, which will suffer, according to **Figure 10.6**, an increment, resulting from the predictable socio-economic development for the municipality.



Source: Own elaboration, 2014

Figure 10.6 - Evolution of demand per each of water supply level of service

Applying the values established in the previous paragraphs is obtained the demands per year of the municipality, which are presented in **Table 10.4**.

Table 10.4 - Evolution of average wastewater demand (l/inhab/day) in Mocímboa da Praia municipality

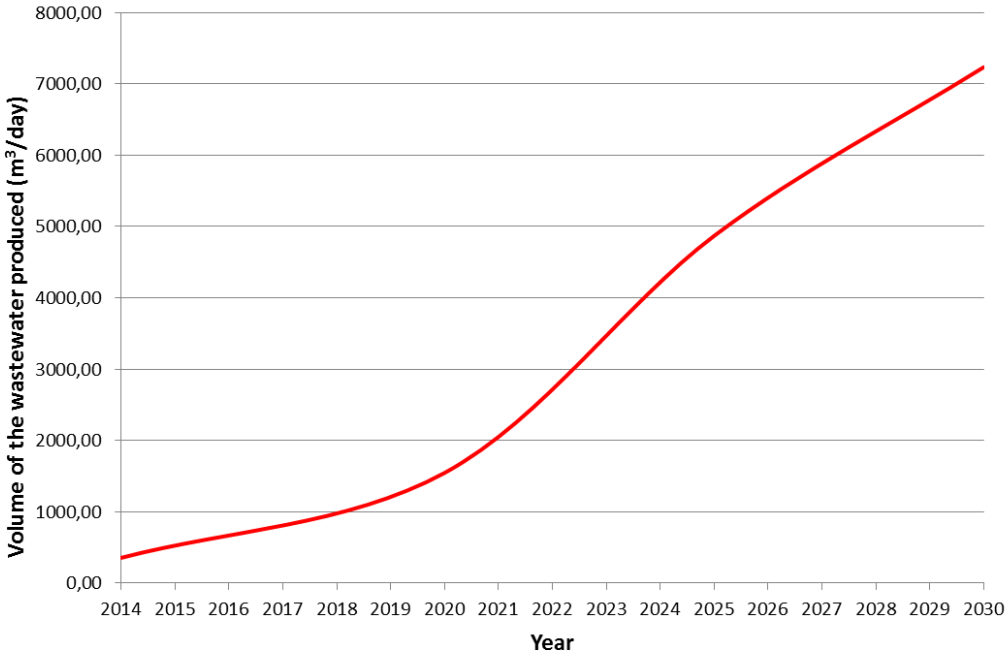
2014	2020	2025	2030
21	40	61	78

Source: Own elaboration, 2014

It was considered that the hotel establishments, the rural hospital and the industries will always have its own collection and treatment system of the generated wastewater.

10.2.1.3 Evolution of wastewater production

Considering the evolution of demands, of the coverage and of population it is concluded that the daily volume of wastewater produced will increase from the current 350 m^3/day to a value at about 20 times higher (above 7,000 m^3/day) as shown in **Figure 10.7**.



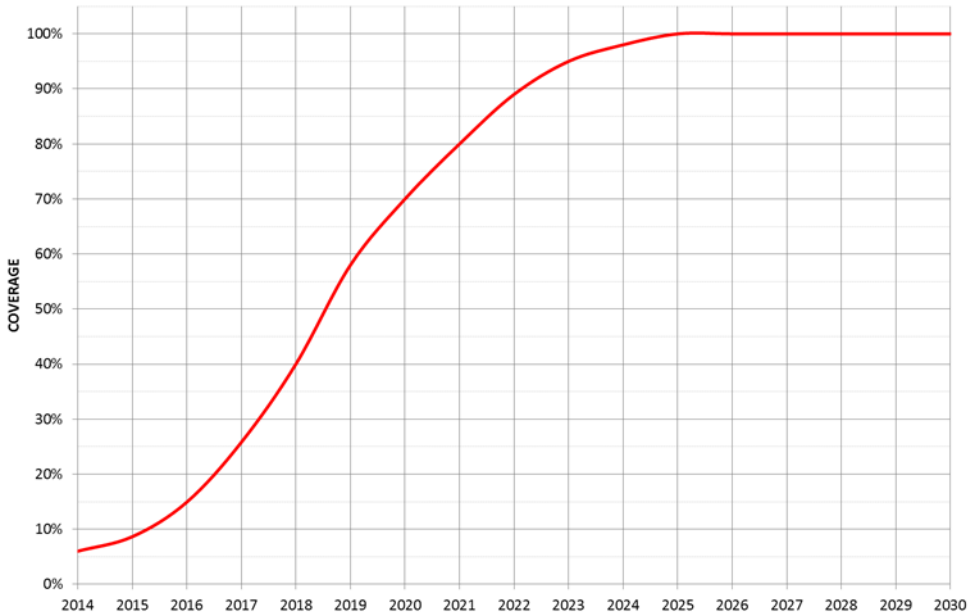
Source: Own elaboration, 2014

Figure 10.7 - Evolution of wastewater production in Mocímboa da Praia municipality

10.2.2 Solid waste production

10.2.2.1 Coverage evolution

Assuming the results from questionnaires as representative, only a small part of the population (below 10%) deposits their waste in the municipal collection points. Therefore, the disposal of solid waste at the deposition sites defined by the municipality, for the entire population, and their transport to a point of final disposal with appropriate conditions should be up objectives to be achieved by 2025. In this sequence, will be expectable that the coverage of the solid waste collection system tracks the trajectory shown in **Figure 10.8**.

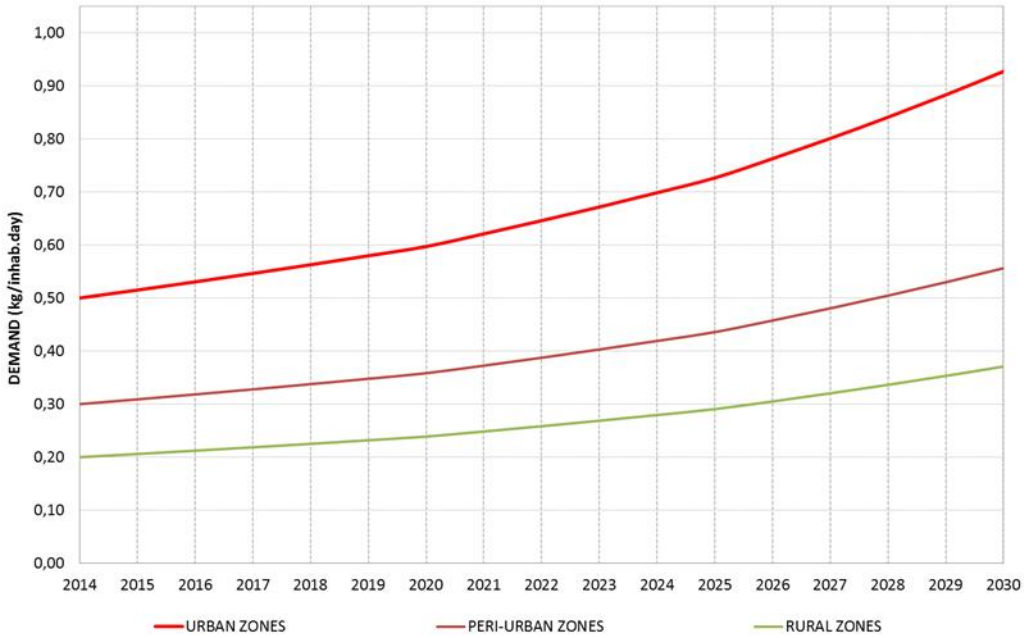


Source: Own elaboration, 2014

Figure 10.8 – Evolution of municipal solid waste system coverage

10.2.2.2 Demand evolution

Similarly to the above mentioned, particularly as relates to the production of waste water, also the amount of solid waste produced by person will increase over the coming years. As major causes are identified the economic development and the growing awareness of the population for adopt good hygiene practices. According to **Figure 10.9**, it is expected that, in urban areas, the growth is more accelerated than in suburban and rural areas.



Source: Own elaboration, 2014

Figure 10.9 - Evolution of solid waste demands

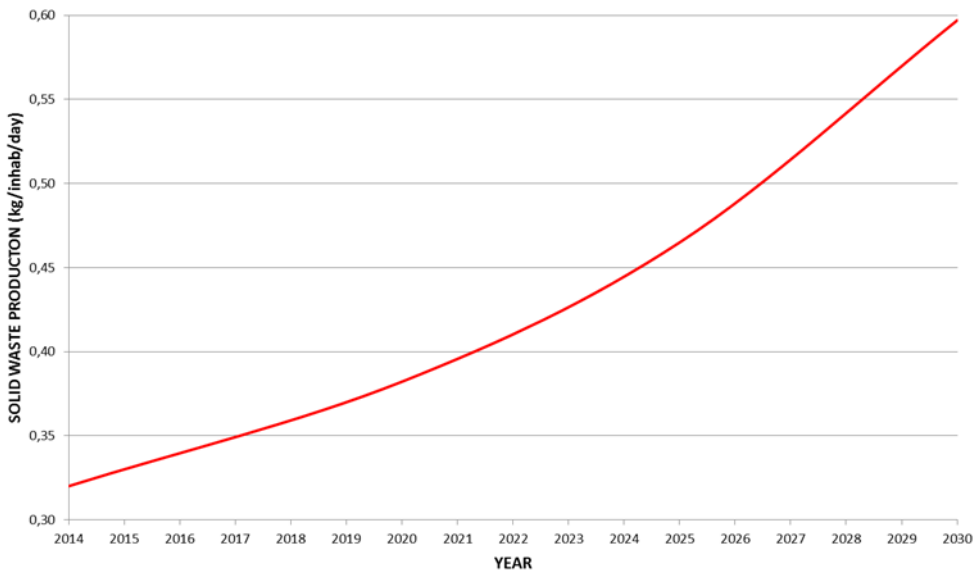
To establish the distribution of population by type of land occupation (urban, peri-urban and rural) it was used the same distribution seen in *"Consultancy services for the preparation of long term water supply and sanitation services investment plan for the AIAS – Fase 4 – Plano de Investimentos de Água e Saneamento"* drawn up in July 2013, by Engidro. The referred distribution is presented in **Table 10.5**, and in this study it is considered that the distribution of population in 2014 is equal to 2015.

Table 10.5 – Population of distribution per type of land occupation

	2015	2020	2025	2030	2040
Urban	10%	10%	10%	11%	13%
Dense peri-urban	40%	43%	45%	49%	58%
Dispersed peri-urban	50%	48%	45%	40%	30%
Rural	0%	0%	0%	0%	0%

Source: Own elaboration, 2014

From these values it is obtained the average per capita of the domestic solid waste production in Mocímboa da Praia municipality, which is presented in **Figure 10.10**.



Source: Own elaboration, 2014

Figure 10.10 - Evolution of solid waste average demand in Mocímboa da Praia municipality

According to the produced waste by hotels, industries, markets and institutions and resulting from sweeping of the streets it is assumed the following assumptions for its evolution:

- Waste of markets and sweeping increasing proportionally to the increase of the population;
- The number of beds for tourists in the municipality will increase considerably at the rate of 20% per year until 2030, considering a strong commitment to the development of this sector in the years ahead;
- The amount of waste generated by industries and commercial establishments of domestic typology will remain as 5% of the total produced by the inhabitants of the municipality. This value considers an increase in the number of industries and commercial establishments more than the increase in population.

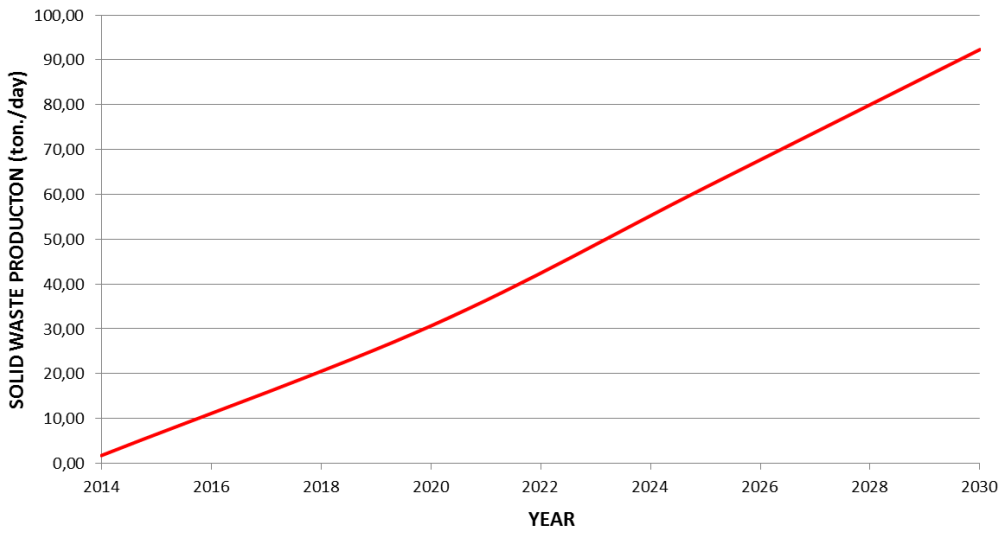
10.2.2.3 Evolution of solid waste production

Considering the evolution of the coverage, of the demand and the municipality's population, it is presented the evolution of the amount of municipal solid waste produced in Mocímboa da Praia municipality. The obtained values are shown on **Table 10.6** and **Figure 10.11**.

Table 10.6 – Evolution of solid waste production in Mocímboa da Praia municipality (tons/day)

Type of solid waste	2014	2020	2025	2030
Domestic	1,00	18,61	37,27	55,40
Industrial	0,05	0,93	1,86	2,77
Tourism	0,11	0,33	0,82	2,03
Markets and fairs	0,42	7,82	15,65	23,27
Sweeper	0,16	2,98	5,96	8,86
Total	1,74	30,66	61,56	92,33

Source: Own elaboration, 2014



Source: Own elaboration, 2014

Figure 10.11 - Evolution of solid waste production in Mocímboa da Praia municipality

Beyond the amount of solid waste produced, it is also anticipated that its typology will change in the coming years, for the reasons listed below:

- It is expected the establishment of some companies in the municipality, as well as the development of tourism which result in an increase of jobs in the tertiary sector at the expense of reduction of the primary sector. The less people working in agriculture or fishing should lead to decreased production of waste of organic origin;

- It is also expected that the economic level of the community will increase, which will lead to a higher consumption of not so essential goods, expecting rejection of a greater number of plastic and glass.

Because of these factors the percentage of residues of organic origin should decrease, while the amount of inorganic waste (plastic, glass ...) should increase.

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ANNEXES

Annex 1 – Questionnaire addressed to the household

Questionnaire addressed to the responsible of the house

1. GENERAL INFORMATION

VILLAGE: _____ QUESTIONNAIRE Nº _____

BAIRRO : _____

INQUIRER: _____

DATE: _____

RESPONDENT

GENDER Male ☐ Female ☐

2. HOUSEHOLD (H)

GENERAL

2.1 COMPOSITION OF THE H?
(including the respondent)

How many men ☐

How many women ☐

	0 - 9 years	10 - 14 years	15 - 18 years	19 - 64 years	65 years or more
Men (n.º)					
Women (n.º)					

2.2 IS THERE ANY PERSON WITH DISABILITIES IN THE H ? YES ☐ NO ☐

IF YES, WHAT TYPE OF DISABILITY? Physical ☐ Mental ☐ Visual ☐ Other ☐

IF ANSWERED OTHER, SPECIFY _____

3. WATER SUPPLY

WATER SUPPLY

3.1 WHERE IS USUALLY MADE THE WATER SUPPLY?
(Place X in one of the options)

- Pipped water inside the house ☐
- Tap in the yard ☐
- Tap in a neighboring yard ☐
- Well (masonry structure) in the yard ☐
- Well (masonry structure) in a neighboring yard ☐
- Public well (masonry structure) ☐
- Traditional well in the yard ☐
- Traditional well in a neighboring yard ☐
- Public traditional well ☐
- Public standpipe /manual pump ☐
- River/pond ☐
- Other ☐

IF ANSWERED OTHER, SPECIFY _____

EFFLUENT DESTINATION

3.2 WHAT IS THE DESTINATION OF THE REJECTED WATERS?
(Place X in one of the options)

- Infiltration well ☐
- Septic tank ☐
- Direct discharge into sea/river ☐
- street/yard ☐
- Other ☐
- Doesn't know ☐

IF ANSWERED OTHER, SPECIFY _____

4. SANITATION

AVAILABILITY

4.1 HAVE YOUR HOUSE A SANITATION SYSTEM? (Place X in one of the options)

- YES, toilet with cistern and runnig water [ ]
- YES, toilet without cistern [ ]
- YES, improved latrine [ ]
- YES, traditional latrine [ ]
- Doesn't have [ ]

4.2 IF YOU HAVE LATRINE / SEPTIC TANK AT HOME, HAS IT ALREADY BEEN EMPTIED?

YES	NO

IF ANSWERED YES TO THE PREVIOUS QUESTION, WHO DOES THE EMPTYING OF THE LATRINE/SEPTIC TANK? (Place X in one of the options)

- Household members manually [ ]
- Formal operator manually or with small pumps [ ]
- Informal operator manually [ ]
- Formal operator through a vacuum tank [ ]
- Informal operator through a vacuum tank [ ]

4.3 IS THERE A COMMUNITY LATRINE IN YOUR *BAIRRO* ?

YES	NO

4.4 IF YOU HAVE NO SANITATION SYSTEM AT HOME, HOW LONG DOES IT TAKE TO THE MAIN COMMUNITY BATHROOM / LATRINE? (minutes) [ ]

4.5 WHERE DO YOU DO DEFECATE? (Place X in one of the options)

- Toilet with cistern and running water (individual) [ ]
- Toilet with cistern and running water (public) [ ]
- Toilet without cistern (individual) [ ]
- Toilet without cistern (public) [ ]
- Improved latrine (individual) [ ]
- Improved latrine (public) [ ]
- Tradicional latrine (individual) [ ]
- Tradicional latrine (public) [ ]
- Beach [ ]
- River [ ]
- Bush [ ]
- Other [ ]

IF ANSWERED OTHER, SPECIFY [ ]

SATISFACTION

4.6 WHAT IS YOUR CURRENT LEVEL OF SATISFACTION WITH THE BATHROOM/LATRINE? (Place X in one of the options)

- Very unsatisfied (a) [ ]
- Unsatisfied (b) [ ]
- Satisfied ((c) [ ]
- Very satisfied (d) [ ]

4.7 WHAT IS THE REASON FOR YOUR LEVEL OF SATISFACTION? (Place X in all the right options)

	If answered to 4.5 a) or b):	If answered to 4.5 c) or d):
Cost	[ ]	[ ]
Quality	[ ]	[ ]
Availability	[ ]	[ ]
Privacy	[ ]	[ ]
Cleansing	[ ]	[ ]
Proximity	[ ]	[ ]
Other	[ ]	[ ]

IF ANSWERED OTHER, SPECIFY [ ]

EFFLUENT DESTINATION

4.8 WHAT IS THE DESTINATION OF THE TOILETS/LATRINES WASTEWATER? (Place X in one of the options)

- Septic tank (masonry structure), infiltration well [ ]
- Septic tank (masonry structure), infiltration trenches [ ]
- Septic tank (masonry structure), sea/river discharge [ ]
- Direct discharge into the sea/river [ ]
- Hole in the ground [ ]
- Other [ ]
- Doesn't know [ ]
- Not aplicable [ ]

IF ANSWERED OTHER, SPECIFY [ ]

EFFLUENT DESTINATION	4.9	WHERE WERE DEPOSITED THE EXCRETA IN THE LAST EMPTYING? (Place X in one of the options)	Buried locally ☐ Drainage system ☐ Deposition at an authorized local ☐ Other ☐ Doesn't know ☐ IF ANSWERED OTHER, SPECIFY ☐
COST	4.10	WHAT WAS THE COST OF THE LATRINE/SEPTIC TANK EMPTYING?	(MZM) ☐
OPEN DEFECATION	4.11	ARE YOU PRACTICING OPEN DEFECATION?	YES ☐ NO ☐
		IF ANSWERED YES TO THE PREVIOUS QUESTION, WHY DO YOU DO THE NEEDS IN THE BEACH/RIVER/BUSH? (Place X in all the right options)	Lack of space in the yard to build a latrine ☐ Unsuitable land in the yard to build a latrine ☐ Don´t have the means to build a latrine ☐ Is cleaner ☐ Doesn't know another way of doing it ☐ Other ☐ IF ANSWERED OTHER, SPECIFY ☐
	4.12	IF ANSWERED YES TO THE PREVIOUS QUESTION, ARE YOU SATISFIED WHIT THIS WAY OF DOING THE NEEDS?	YES ☐ NO ☐

5. SOLID WASTE

GENERAL

5.1 WHAT TYPE OF WASTE DO YOU PRODUCE?
(Place X in all the right options)

- Peels, fruits and vegetables leftovers ☐
- Plastic or metallic containers ☐
- Paper ☐
- Leaves and branches of trees ☐
- Glass ☐
- Animal waste (shell/gut fish, chicken feathers)) ☐
- Other ☐
- Doesn't know ☐

IF ANSWERED OTHER, SPECIFY ☐

5.2 WHERE DO YOU USUALLY DEPOSIT YOUR WASTE?
(Place X in one of the options)

- Hole in the yard ☐
- In a deposition point defined by the municipality ☐
- In a ditch/street ☐
- In the sea/river ☐
- In the bush ☐
- Municipal car (whistle system) ☐
- Other ☐
- Doesn't know ☐

IF ANSWERED OTHER, SPECIFY ☐

5.3 WHY DO YOU DEPOSIT THE WASTE IN THIS PLACE?
(Place X in one of the options)

- Doesn´t know another way of doing it ☐
- Unsuitable soil for doing a hole in the yard ☐
- Lack of space to do a hole in the yard ☐
- Other ☐
- Doesn't know ☐

IF ANSWERED OTHER, SPECIFY ☐

5.4 THE "*CHEFE DO BAIRRO* " EXPLAINED WHERE SHOULD BE DISPOSED THE WASTE?

YES	NO
☐	☐

5.5 HOW OFTEN IS COLLECTED THE WASTE BY THE MUNICIPALITY?
(Place X in one of the options)

- 7 days per week ☐
- 5 days per week ☐
- 2-3 days per week ☐
- 1 day per week ☐
- No collection ☐
- Other ☐
- Doesn't know ☐

IF ANSWERED OTHER, SPECIFY ☐

5.6 ARE YOU SATISFIED WITH THE WAY THAT THE WASTE IS HANDELED IN THE VILLAGE?

YES	NO
☐	☐

5.7 WOULD YOU BE ABLE TO PAY FOR THE IMPROVEMENT OF THE WASTE COLLECTION AND TREATMENT?

YES	NO
☐	☐

6. HYGIENE

GENERAL HYGIENE	6.1	DO YOU WASH YOUR HANDS BEFORE MEALS?	YES	NO
	6.2	DO YOU WASH YOUR HANDS AFTER DOING THE PHYSIOLOGICAL NEEDS?	YES	NO
	6.3	DO YOU USE SOAP IN THE HANDWASHING PROCESS?	YES	NO
	6.4	WHERE DO YOU HAVE A BATH? (Place X in one of the options)	Conventional bathroom with running water Conventional bathroom without running water Fenced area in the yard Springs on the beach River Other	
		IF ANSWERED OTHER, SPECIFY		
MENSTRUAL HYGIENE	6.5	WHAT IS THE TYPE OF PAD USED? (Place X in one of the options)	Reusable pads (a) Disposable pads (b) Other	
		IF ANSWERED OTHER, SPECIFY		
		IF ANSWERED a IN THE PREVIOUS QUESTION, WHERE IS DUMPED THE WASHING WATER? (Place X in one of the options)	Latrine Soil Other	
		IF ANSWERED OTHER, SPECIFY		
		IF ANSWERED b IN THE PREVIOUS QUESTION, WHERE IS DUMPED? (Place X in one of the options)	Normal waste Latrine Other	
		IF ANSWERED OTHER, SPECIFY		
	6.6	WHERE IS PERFORMED THE MENSTRUAL HYGIENE? (Place X in one of the options)	Private bathroom Public bathroom Room Other	
		IF ANSWERED OTHER, SPECIFY		

7. STANDARD OF LIVING

HOUSING CONDITION	7.1	IS YOUR HOUSE CONNECTED TO THE WATER SUPPLY SYSTEM?	YES ☐ NO ☐
	7.2	IS YOUR HOUSE CONNECTED TO ELECTRICITY?	YES ☐ NO ☐
	7.3	TYPE OF HOUSING OBSERVATION (Evaluation of the inquirer)	Block walls and corrugated iron coverage ☐ *Matope* walls and corrugated iron coverage ☐ Block walls and *Macuti* / straw coverage ☐ *Matope* walls and *Macuti* / straw coverage ☐
ECONOMIC CONDITION	7.4	WHAT IS THE INCOME SOURCE OF THE HOUSEHOLD ? (Place X in all the right options)	Monthly salary ☐ Store ☐ Guest house/hotel ☐ Restaurant ☐ Bar ☐ Small business ☐ Agriculture ☐ Raising cattle ☐ Odd jobs ☐ Fishery ☐ Passanger transportation ☐ Transport of goods ☐ Home rental ☐ Other ☐ IF ANSWERED OTHER, SPECIFY ☐
	7.5	SOMEONE OF THE HOUSEHOLD HAS? (Place X in all the right options)	Truck ☐ Car ☐ Motorcycle ☐ Bicycle ☐ TV ☐ Music Device ☐ Computer ☐
	7.6	DO YOU BUY SOME OF THE FOLLOWING PRODUCTS EVERY WEEK? (Place X in all the right options)	Meat ☐ Chicken ☐ Milk ☐

8. STORMWATER DRAINAGE

GENERAL	8.1	ARE THE SURROUNDINGS OF YOUR HOUSE FLOODED IN THE RAINY PERIOD?	YES ☐ NO ☐
		IF ANSWERED YES, WHAT IS THE MAXIMUM HEIGHT ACHIEVED? (Place X in one of the options)	- 0,5 meters ☐ 0,5 a 1,0 meters ☐ 1,0 a 2,0 meters ☐ + 2 meters ☐ Doesn't know ☐
	8.2	WOULD YOU BE ABLE TO PAY BY THE STORMWATER DRAINAGE SYSTEM IMPROVEMENT?	YES ☐ NO ☐

Annex 2 – Questionnaire addressed to people with disabilities

Questionnaire addressed to people with disabilities

1. GENERAL INFORMATION

VILLAGE: _____ QUESTIONNAIRE Nº _____

BAIRRO : _____

INQUIRER: _____

DATE: _____

RESPONDENT

GENDER Male ☐ Female ☐

2. TYPE OF DISABILITY

GENERAL

2.1 WHAT TYPE OF DISABILITY DO YOU HAVE?
(Place X in one of the options)

- Difficulty in walking ☐
- Deaf ☐
- Blind ☐
- Dumb ☐
- Paralytic ☐
- Mental ☐
- Other ☐

IF ANSWERED OTHER, SPECIFY _____

3. SANITATION

AVAILABILITY/ SATISFACTION

3.1 HAVE YOUR HOUSE A SANITATION SYSTEM? (Place X in one of the options)

- YES, toilet with cistern and runnig water ☐
- YES, toilet without cistern ☐
- YES, improved latrine ☐
- YES, traditional latrine ☐
- Doesn't have ☐

3.2 IF YOUR HOUSE HAS A SANITARY FACILITY, DO YOU USE THE TOILET/LATRINE?

YES	NO
☐	☐

3.3 IF YOU ANSWERED YES TO QUESTION 3.2, HAVE YOU HAD DIFFICULTY IN THE USAGE OF THE TOILET/LATRINE?

YES	NO
☐	☐

WHAT IS YOUR CURRENT LEVEL OF SATISFACTION WITH THE BATHROOM/LATRINE?
(Place X in one of the options)

- Very unsatisfied (a) ☐
- Unsatisfied (b) ☐
- Satisfied ((c) ☐
- Very satisfied (d) ☐

WHAT IS THE REASON FOR YOUR LEVEL OF SATISFACTION?
(Place X in all the right options)

	If you answered to 3.3 a) or b):	If you answered to 3.3 c) or d):
Cost	☐	☐
Quality	☐	☐
Availability	☐	☐
Privacy	☐	☐
Cleansing	☐	☐
Proximity	☐	☐
Other	☐	☐

AVAILABILITY/ SATISFACTION	3.4	IF YOU ANSWERED NO TO QUESTION 3.2, WHAT IS THE REASON FOR NOT USING THE TOILET/LATRINE? (Coloque x numa das opções)	It's difficult, due to the disability ☐ Other reason ☐
		IF ANSWERED OTHER REASON, SPECIFY	
		IF YOU DON'T USE THE TOILLET/LATRINE, WHERE DO YOU DO THE MAJORITY OF THE NEEDS? (Coloque x numa das opções)	Beach/river/bush ☐ in a vessel ☐ Other ☐
		IF ANSWERED OTHER, SPECIFY	
		ARE YOU SATISFIED WHIT THIS WAY OF DOING THE NEEDS?	YES ☐ NO ☐
GENERAL HYGIENE	3.5	DO YOU WASH YOUR HANDS BEFORE MEALS?	YES ☐ NO ☐
	3.6	DO YOU WASH YOUR HANDS AFTER DOING THE PHYSIOLOGICAL NEEDS?	YES ☐ NO ☐
	3.7	DO YOU USE SOAP IN THE HANDWASHING PROCESS?	YES ☐ NO ☐
	3.8	WHERE DO YOU HAVE A BATH? (Place X in one of the options)	Conventional bathroom with running water ☐ Conventional bathroom without running water ☐ Fenced area in the yard ☐ Springs on the beach ☐ River ☐ Other ☐
		IF ANSWERED OTHER, SPECIFY	

4. STORMWATER DRAINAGE

GENERAL	4.1	ARE THE SURROUNDINGS OF YOUR HOUSE FLOODED IN THE RAINY PERIOD?	YES ☐ NO ☐
		IF ANSWERED YES, DOES THESE FLOODS CARRY OUT SOME DIFFICULTIES, DUE TO YOUR DISABILITY? (Place X in one of the options)	YES ☐ NO ☐

Annex 3 – Field worksheets

HEALTH EQUIPMENTS. CURRENT SITUATION

1. GENERAL INFORMATION

Municipality:	
Date:	
Heath care unit:	
Bairro :	

2. SPECIALTIES / CURRENT SERVICES

3. RESOURCES

Human resources:

Personnel		*Number*
Administratives		
Level of education	Higher level	
	Medium level	
	Basic level	
Personnel employed	Doctors	
	Nurses	
	Assistents	

Physical resources:

Description	*Number*
Beds	
Vehicles	

4. EFFICIENCY

Description	Number
Attended patients/day	
vaccinated children/year	

Source of information:

5. EPIDEMIOLOGICAL FRAMEWORK

Main diseases

Description	Number
Deaths	
Deaths (children)	

Main diseases related to poor sanitation

Description	Number
Deaths associated with diseases related to poor sanitation	
Deaths (children) associated with diseases related to poor sanitation	

6. SANITATION

Toilet with cistern and running water	
Toilet without cistern	
Improved latrine	
Traditional latrine	
Septic tank	

7. SOLID WASTE

	Yes	No
Source separation?		

Where are deposited? _____

Who collects? _____

8. PRINCIPAL NEEDS

EDUCATION EQUIPMENTS. CURRENT SITUATION

1. GENERAL INFORMATION

Municipality:	
Date:	
School:	
Bairro :	
Respondent:	

2. ENSINO LECIONADO

EP1 (1th to 5th year)	
EP2 (6th to 7th year)	
ESG 1 (8th to 10th year)	
ESG 2 (10th to 12th year)	
Higher education	

2. STUDENTS AND TEACHERS

Description	***Number***
Students	
Teachers	

3. PHYSICAL CONDITIONS

Type of construction

Sanitation

Toilet with cistern and running water	
Toilet without cistern	
Improved latrine	
Traditional latrine	
Doesn't have	
Septic tank	

4. SOLID WASTE

Where are deposited? _____

Who collects? _____

5. PRINCIPAL NEEDS

Annex 4 – Photographic report

Bairro 1.º de Maio

Interview with the representative of the community

Road to Palma

Bairro 30 de Junho

Interview with the substitute representative of the community

Bairro Buji

Interview with the representatives of the community

Bairro Cimento

Interview with the representative of the community

Bairro Milamba

Interview to the representatives of the community

Bairro Muengue

Interview to the representatives of the community

Bairro Nanduadua

Interview to the representative of the community

Bairro Nanchemele

Interview to the representatives of the community

Bairro Pamunda

Interview with the representatives of the community

Bairro Unidade

Interview with the representatives of the community