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Environmental Analysis of the Queixada Stream Watershed In Jataí–Goiás (Brazil)

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ABSTRACT: *The present work consists of a scientific investigation that addresses the study of the Queixada Stream watershed, located in the municipality of Jataí, southwest of the state of Goiás, Brazil. The main objective is to analyze the water quality and environmental vulnerability of this watershed. Land use and occupation are essential elements for evaluating and understanding the physical characteristics of the environment. Urban expansion in Jataí has negatively impacted areas of natural vegetation and water sources, and the study area of the Queixada Stream watershed is no exception. This expansion is associated with population growth, resulting in increased demand and expectations for socioeconomic development, which in turn implies greater consumption of natural resources. The overall objective of this study is to conduct a comprehensive environmental analysis of the Queixada Stream watershed in the municipality of Jataí, Goiás. In addition, the water and soil quality will be evaluated, using resolutions 357/2005 and 420/2009 from the National Council for the Environment (CONAMA) as parameters. These resolutions establish guidelines and criteria for monitoring and controlling environmental quality. To achieve the proposed objectives, two methods were used in this study: field research with sample collection and laboratory analysis of water and soil. These elements are naturally found in the waters and are responsible for the proper functioning of aquatic ecosystems.*

Keywords: *Queixada Stream, Environmental analysis, Jataí, Brazil, Nature.*

I. INTRODUCTION

The Queixada Stream watershed is an important drainage area located in Jataí, Goiás, Brazil. The Queixada Stream is part of the Claro River watershed, which in turn integrates the Paranaíba River basin. The Queixada Stream watershed plays a fundamental role in supplying water to the region and also in local environmental balance. It encompasses a significant area and has a variety of natural resources, including springs, watercourses, riparian forests, and a diversity of flora and fauna.

This research focuses on the study of the Queixada Stream watershed, located in the municipality of Jataí, in the southwest of the state of Goiás. The main objective is to analyze and describe the water quality in this stream. It is observed that urban growth in Jataí has expanded in recent years towards areas where water supply sources are located, such as the Queixada Stream. This expansion has resulted in population growth, generating increased demand for resources to meet the needs and expectations of this socioeconomic growth.

A physiographic description is an indispensable tool for environmental planning. Without prior knowledge of the natural resources of a particular region, it is difficult to diagnose environmental problems and indicate the most appropriate solutions. In this sense, cities undergo some of the most significant alterations to the landscape produced by humans, through the dynamics of nature itself and the interplay of natural, socioeconomic, and cultural forces (VON SPERLING, 2005). Land use and occupation significantly alter the physical, chemical, and biological processes of natural systems. Thus, surface water sources integrate the phenomena occurring in the watershed area (MENEZES et al., 2016).

In addition to urban expansion and population growth, the intensification of agricultural activities and industrial development exacerbates environmental damage. Several water quality problems are caused by improper land use, as well as urbanization, industrial, and agricultural activities (KANG et al., 2010; DUPASA et al., 2015, MENEZES et al., 2016).

To mitigate environmental impacts, it is necessary to plan and regulate the space so that human uses and occupations occur in a sustainable manner to minimize potential environmental damage. The contamination of aquatic ecosystems resulting from anthropogenic activities is one of the major ecological concerns in recent years (SCHIRMER; LESCHIK; MUSOLFF 2013).

Watersheds are references in geographical studies and are commonly used in territorial planning strategies by states, which take into account their boundaries, physical aspects, and land use and occupation. Urban watersheds have some specificities, including the socio-environmental complexity of occupation and demand for space inherent to cities. In particular, poor land use management, combined with population growth and industrial expansion observed in recent decades, has led to a decrease in water quality in rivers, lakes, and reservoirs (ALLAN, 2004; DUPASA et al., 2015; FIA et al., 2015).

In light of the aforementioned facts, the general objective of this study is to conduct an environmental analysis of the Queixada Stream watershed in the municipality of Jataí, Goiás. The water and soil quality will also be evaluated using resolutions 357/2005 and 420/2009 from the National Council for the Environment (CONAMA) as parameters. To achieve the proposed objectives, two methods were used in this study: field research with sample collection and laboratory analysis of water and soil.

II. STUDY AREA

The Queixada Stream watershed is located west of the urban area of Jataí, in the Southwest region of Goiás. It is a tributary of the Claro River, which is a tributary of the Paranaíba River and one of the main contributors to the Paraná River. According to Martins and Oliveira (2012), the Queixada Stream watershed has an approximate length of 6 km.

In studies conducted by Martins and Oliveira (2012), it was found that the Queixada Stream watershed has an area of 1,943.56 hectares and is geologically overlain by the Serra Geral Formation. Lithologically, it is composed of basalt and sandstones, while pedologically, it is covered by red latosols. The terrain is classified as flat to gently undulating, with slopes of less than 8%.

In this regard, three points were selected for data collection. The first point (P1) is located near the stream's source, the second point (P2) is positioned under a bridge in the urban area of the city of Jataí, and the third point (P3) is located near the stream's mouth.

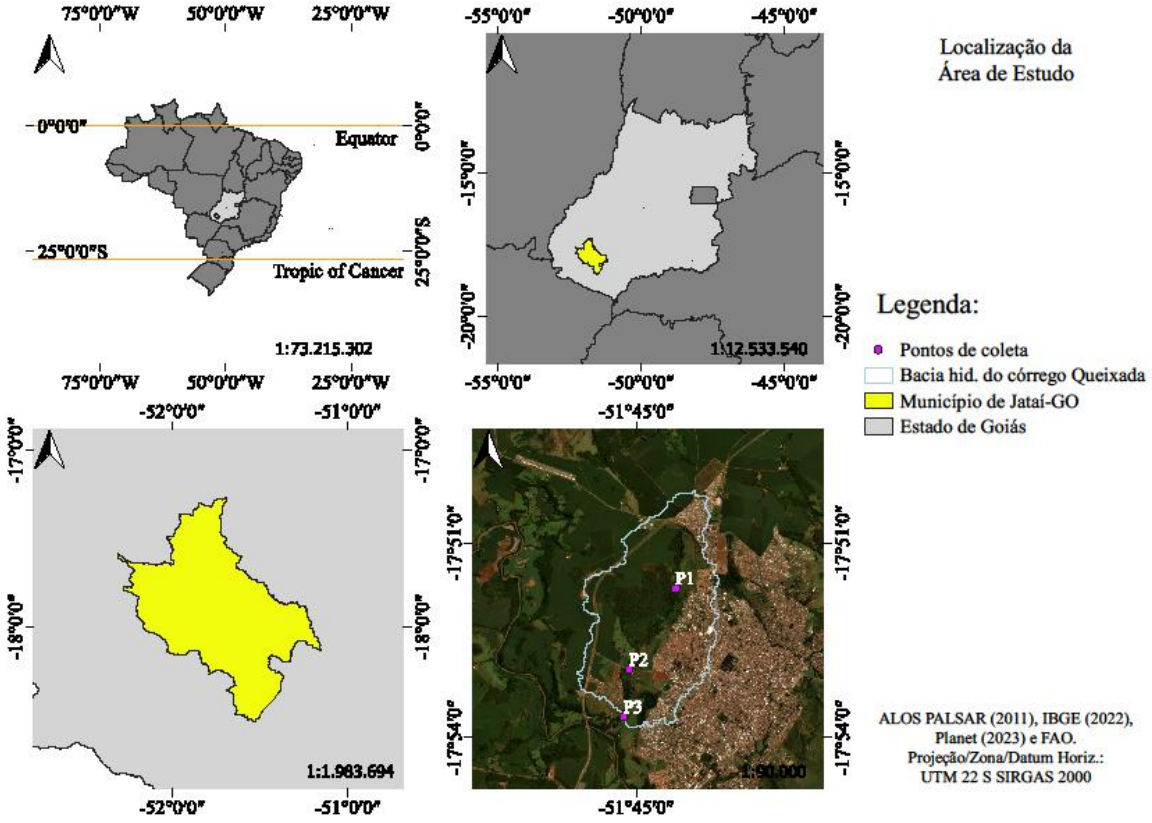

Figure: 1 - Location of the collection points

III- METHODOLOGICAL PROCEDURES

This research aims to conduct an environmental analysis of the stream of the Queixada River in the Municipality of Jataí, state of Goiás, Brazil, with a focus on water quality, seeking to analyze the components present in the water, as well as in the sediments and soils in its surroundings.

The study adopts a qualitative approach, as it seeks to comprehend the phenomena through explanations and contributing facts. It has an applied nature, aiming to generate new knowledge and investigate and identify potential problems in a more specific manner. The research incorporates both exploratory aspects, which involve becoming more familiar with the search to understand these phenomena requiring constant data monitoring, and descriptive aspects, which involve detailing data collection, record richness, and description of the characteristics of the phenomena under consideration. Thus, this research is based on the following procedures:

Bibliographic research: Initially, a literature review was conducted to gather relevant information on the topic.Field visit with material collection: A field trip was carried out to collect samples and data. Qualitative analysis of collected materials: The obtained materials were qualitatively analyzed. Experimental tests: Experimental tests were performed at the laboratory of the Federal University of Jataí (UFJ).

Three points were selected for analyzing the parameters, chosen at equidistant distances along the stream. The first point was located near the spring, the second approximately halfway through the channel, and the third near its mouth.

Data collection was performed on April 4, 2023, during the autumn equinox. To map the study points, shapefiles from the Brazilian Institute of Geography and Statistics (IBGE) and satellite images from Planet (land use and land cover) and ALOS PASAR (basin delimitation) were used.

Supervised classification (using the Dzetsaka classifier algorithm) and nearest neighbor interpolation were carried out using QGIS Desktop 3.16.7 with GRAS 7.8.5. This involved processing, area calculations, and map creation.

For the evaluation of the physicochemical parameters of the water in the Queixada Stream, a Multiparameter Probe (Water Quality Meter) was used. The probe was immersed directly into the water flow, and after parameter stabilization, readings were taken and recorded for later graph generation.

The following parameters were assessed for the water quality of the Queixada Stream: Temperature, pH, MV, Electrical Conductivity, Salinity (NACL), Total Dissolved Solids, and Dissolved Oxygen (DO).

IV- RESULTS AND DISCUSSION

The analyzed areas are primarily affected and influenced by anthropogenic activities, where the presence of properties with pastures and livestock was observed, along with urban influence. Due to the proximity to the stream, urban activities generate waste that is transported to the watercourse. According to LACORTE; ALMEIDA (2015), the occupation of vegetated urban areas with pastures becomes a possible cause of impacts within these areas, which should be reserved for environmental preservation functions.

The land cover in the vicinity of the three analyzed points reveals a predominance of pastures, agriculture, exposed soil, and paved areas. These characteristics create a diverse landscape in the studied region. The extensive pasture areas stand out prominently, alongside identified agricultural areas.

However, it is also possible to observe stretches of exposed soil, where natural vegetation has been removed, leaving the soil unprotected and vulnerable to compaction. This removal of vegetation may result from intensive agricultural activity or other activities involving the exploitation of natural resources.

Changes in land cover and land use induced by human actions have become one of the factors contributing most to more profound and severe environmental alterations, with consequences that can be felt from local to global scales (CAPITANI et al., 2016). It is important to emphasize that the presence of exposed soil can lead to soil erosion, environmental degradation, and negative impacts on soil and water quality.

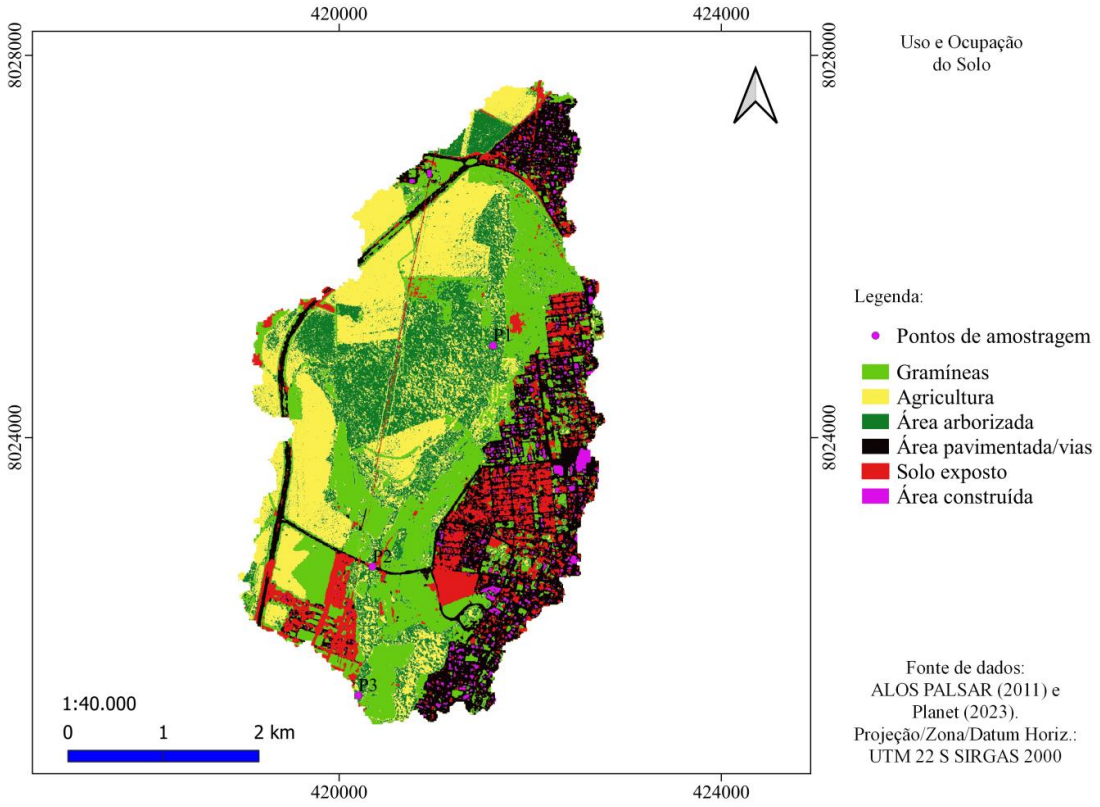

Figure 2 *- Land use and land cover.*

At the first point, located near the source of the Queixada Stream, a remarkable predominance of pastures and livestock activities was evident. The analyzed area showed clear signs of cattle farming, with traces and marks left by the animals.

Figure 3 *- Animal tracks at point 1*

Figure 4 *- Exposed soil at point 1*

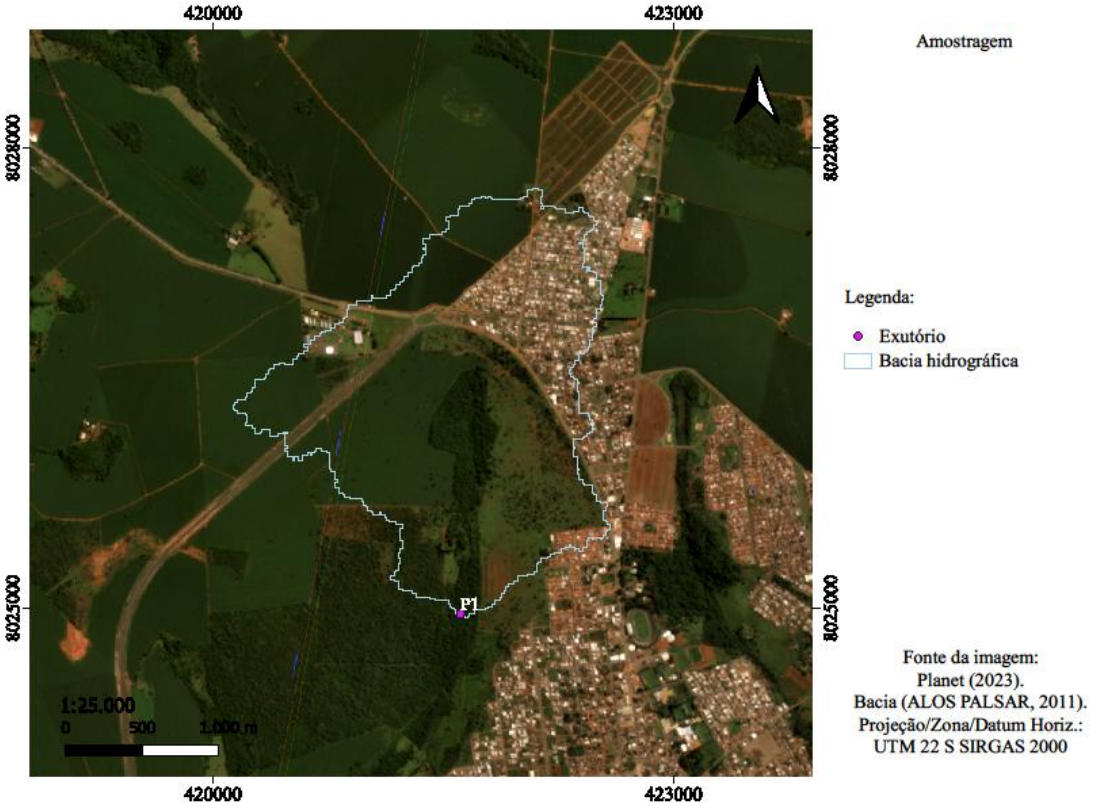

Figure 5 - Location map of Point 1.

At the second point, located under a bridge in the urban perimeter of the city of Jataí, the presence of plastic debris was observed. These debris were found both on the stream's banks and in its bed. These plastic residues are the result of human activity, probably improperly discarded. Additionally, it is possible that some of these debris have been carried by rainwater runoff, accumulating at the site. The presence of these plastic debris highlights the need for environmental awareness and the adoption of measures to minimize stream pollution.

Figure 6 *- Trash on the stream banks under the bridge.*

At the third point, located near the mouth of the stream, different characteristics were observed. Firstly, the presence of erosions was noted, indicating processes of soil wear and removal in the area.

Additionally, sandbanks were identified, possibly resulting from siltation caused by the transportation of sediments along the stream. Furthermore, construction debris was found, suggesting human activities in the region that may have contributed to environmental degradation. Finally, a large amount of debris brought by the rain was noticed, which may include solid waste and various materials.

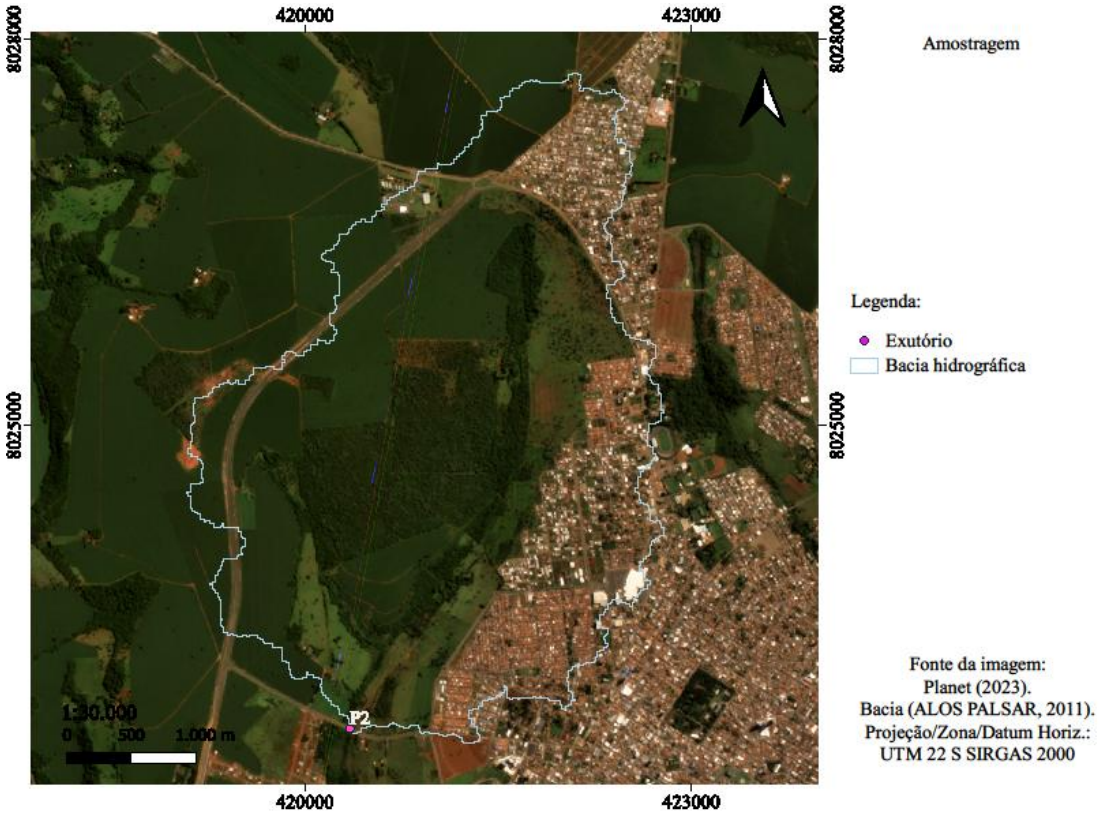

Figure 7 *- Location map of point 2.*

Organic matter, nitrogen, and phosphorus originate from the discharge of sewage and solid waste directly into drainage systems (WOLFF et al., 2016), which are then carried to rivers and streams.

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Figure 8 *- Debris anchored to tree roots* ***Figure 9*** *- Streambed at point 3.*

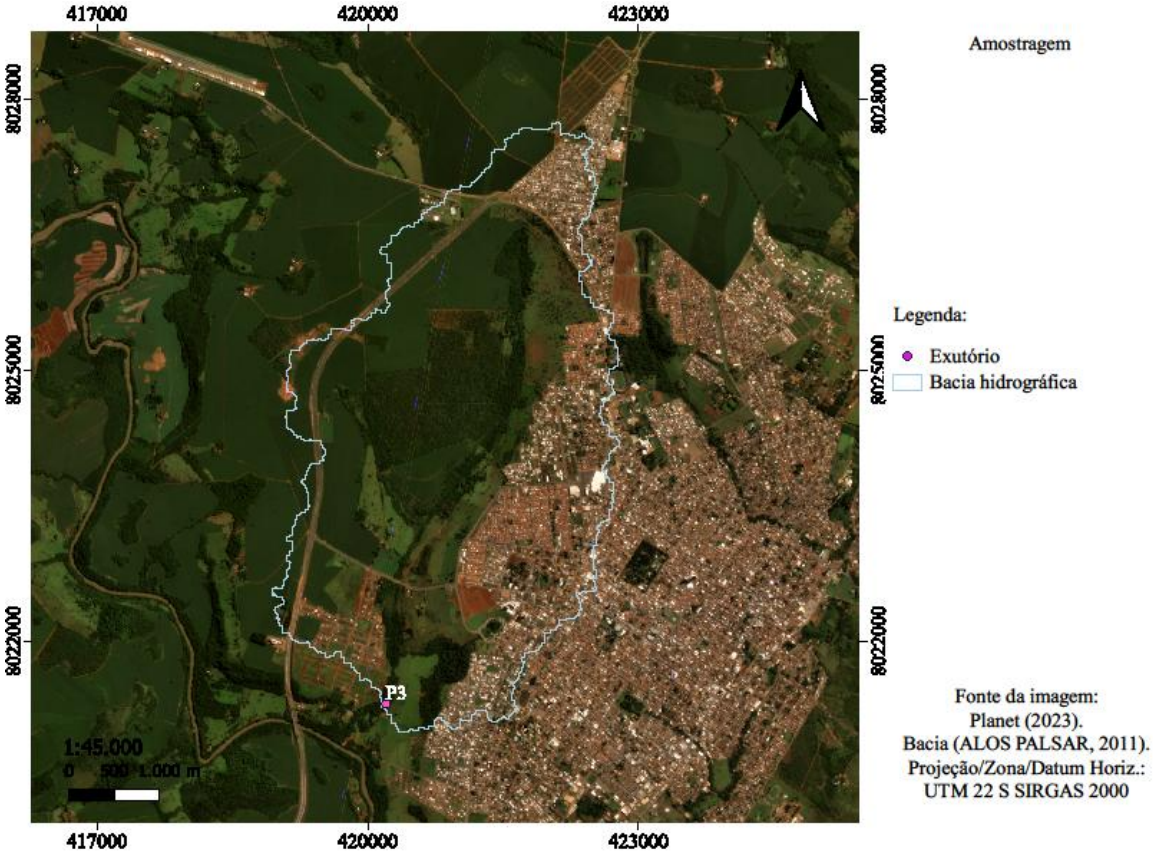
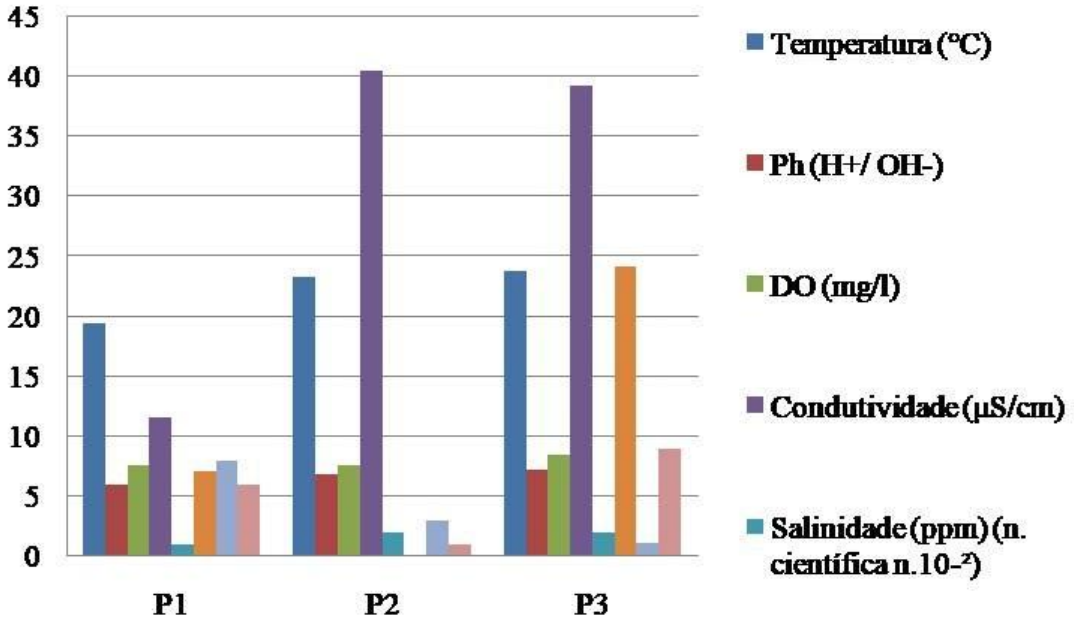


Figure 10 **–** Locationmapof point 3.

During the data collection in the field, a Multiparameter Probe (Water Quality Meter) was used to assess various water parameters. This probe was employed for the precise and simultaneous determination of parameters such as temperature, pH, dissolved oxygen, electrical conductivity, and salinity.

The Multiparameter Probe plays a crucial role in water quality assessment, environmental monitoring, and water resource management, providing accurate and up-to-date data that are essential for the preservation and protection of aquatic ecosystems.



Graph 1 - Resultsobtainedwith a probetomeasurewatertemperature, pH, DO (DissolvedOxygen), electricalconductivity, andsalinity.

According to graph 1, the temperature varied between 22°C to 24.3°C, with a range of 2.3 degrees Celsius, which is due to the collection time, as point 3 showed the highest temperature. Water temperature is a parameter of great importance for the aquatic community since it influences most of the physical, chemical, and biological processes (ROCHA, CABRAL; NOGUEIRA; BARCELOS, 2015).

In a study conducted by Rocha, Cabral, and Braga (2014) in the UHE Barra dos Coqueiros Basin, water temperatures in the tributaries ranged from 22.6°C to 24.6°C, while in the UHE Caçu tributaries, they ranged from 21.3°C to 23.1°C (BARCELOS et al., 2012). Water temperature varies according to seasonal fluctuations, influenced by latitude, altitude, seasons, time of day, and bed depth. These variations occur gradually since water can absorb or lose heat without significant changes (EMBRAPA, 2004).

The pH scale ranges from 0 to 14, from extremely acidic (0), through neutral (7), to maximum alkalinity (14) (EMBRAPA, 2004). Concerning pH, the CONAMA Resolution No. 357/2005 (National Environment Council) states that water intended for human consumption should have a pH ranging from 6 to 9.

The observed pH values (graph 1) varied from 6.52 to 7.11, with the most acidic pH 6.52 found at point 1 and the most neutral pH 7.11 at point 3. Lower pH values can increase water corrosivity, leading to the presence of substances such as iron and manganese, which give it an unpleasant taste. Higher pH values can also attack metals (LIRA, 2014).

It is essential to reflect on other aspects of the pH results, in addition to the standards set by CONAMA Resolution 357/05, which specifies pH should be between 6 and 9 for freshwater rivers, Class II, to avoid corroborating the idea of a stream in good environmental conditions.

According to the analyses, DO presented values ranging from 7.41 mg/L to 8.9 mg/L. According to CONAMA Resolution No. 357/05, the samples should not contain values below 6 mg/L for Class 1; 5 mg/L for Class 2; 4 mg/L for Class 3; 2 mg/L for Class 4.

The Electrical Conductivity (EC) parameter is defined by its capacity to conduct electric current, associated with the concentration of dissolved ions (salinity content), which are 87 electrically charged particles (ESTEVES, 1998; PAULA, 2010). According to graph 1, EC ranged from 12.4 µS/cm to 42.4 µS/cm.

High EC concentrations suggest a high concentration of dissolved ions in the water. Depending on the type and concentration of ions present, the water may be unsuitable for human consumption, as it could contain harmful substances such as heavy metal ions.

Salinity is the sum of dissolved salts in the water (TUNDISI, 2008). Thus, CONAMA Resolution of 2005 determines that freshwater values should be below 0.5‰; the values obtained in this research are in mg/L.

Analyzing graph 1, NACL (salinity) showed the lowest values at point 1. It was observed that NACL values ranged from 0.01 to the minimum and 0.03 mg/L to the maximum.

In the laboratory, to analyze the pH of the soil and sediment samples collected at the points, they were left to dry. Then, the samples were crushed and placed in tubes with the corresponding reagents, left to rest for 15 minutes before measuring the pH.

The transformations caused by human activities also contribute to altering the chemical composition of natural waters, such as removing vegetation cover, various soil treatments, industrial and agricultural discharges. Therefore, it can be stated that the chemical composition of the natural waters draining all the continents' river basins is the result of a set of chemical processes and interactions occurring between terrestrial, aquatic, and atmospheric systems (TUNDISI, 2008).

V- CONCLUSIONS

Through this research, the importance of preserving and monitoring the water supply environments in the city is evident, as well as the significant influence of the lack of extended stormwater drainage systems and the presence of contaminants and animals in the surrounding areas on water quality. Neglecting these factors can lead to false or misleading results.

This study, delimited by these three collection points, presented divergent results for the same stream, indicating the presence of various contaminant sources along its course. As shown, various elements were detected in the samples, some with low concentrations and others with higher concentrations, which categorized the stream as Class 2, indicating the presence of contaminants with low levels of risk to the local population's health. Nevertheless, continuous monitoring is necessary.

Similar to many other areas in hydrographic basins, the Queixada stream basin faces challenges concerning preservation and conservation. Urbanization, deforestation, pollution, and improper land use negatively impact water quality and compromise the local ecosystem.

The results highlighted that, regarding the evaluated physical-chemical parameters, dissolved oxygen and electrical conductivity values did not comply with those recommended by CONAMA. However, most of the physical and chemical parameters analyzed are in accordance with the standards set for human consumption. Nevertheless, anomalous values were detected at some points.

To ensure the protection and sustainability of the Queixada stream basin, it is essential to promote environmental awareness and implement appropriate management practices, such as sewage treatment and the restoration of degraded areas. Strengthening environmental legislation and enforcement is also crucial in safeguarding the water resources.

VI- Acknowledgements

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