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EVALUATION OF THE VULNERABILITY AND QUALITY OF GROUNDWATER IN AREAS OF INFLUENCE OF THE GANGAN RIVER, IN SÃO LUÍS – MA

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Bruna Roberta Floriana Oliveira Belfort[1] and Jonas Jansen Mendes[2].

ABSTRACT

Groundwater plays a key role in human supply, especially in regions with a scarcity of surface water resources. This study aimed to analyze the quality of water from wells for human consumption in the area of influence of the Gangan River, in the Turu neighborhood, in São Luís – MA, analyzing its compliance with Brazilian legislation, such as CONAMA Resolution No. 396/2008 and Ordinance GM/MS No. 888/2021. Physicochemical and microbiological analyses were carried out in three wells with different depths (60 m, 30 m and 48 m). The parameters analyzed included hydrogen potential (pH), chlorides, total solids, hardness, iron, total coliforms and Escherichia coli. From these data, the Natural Groundwater Quality Index (IQNAS) was calculated, which ranges from 0 to 100, where higher values indicate better water quality. For the analysis of the vulnerability of the aquifer, the GOD method was applied, which considers the type of aquifer, the lithology of the aquifer and the depth of the water table. The results indicated that the Natural Groundwater Quality Index (IQNAS) was classified as "unacceptable" at all collection points, and the vulnerability of the aquifer was classified as low, according to the GOD evaluation method. Although the physicochemical parameters were in accordance with the potability standards, the presence of total coliforms was detected, which compromised the potability of the water for human consumption. This study highlights the importance of continuous monitoring of groundwater quality, aiming to ensure public health and the sustainability of water sources.

Keywords: Gangan River. IQNAS. GOD.

[1] Undergraduate student of the Science and Technology Course / UFMA
E-mail: brunaroberta.belfort@gmail.com
[2] Adjunct Professor / UFMA
Email: jonas.jansen@ufma.br

Revista ARACÊ
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INTRODUCTION

Water is a vital resource for the maintenance of life on planet Earth, playing an essential role in sustaining ecosystems and the socioeconomic development of societies, being used from human supply to the production of goods and services. However, in recent decades, the availability of freshwater has been pressured by a combination of factors, including population growth and pollution of water bodies. In this way, the exploration of groundwater becomes important, because according to Fernandes (2022), this resource represents about 29.9% of the fresh water available on Earth. Its use enables public and private supply, presenting low cost, satisfactory quality and easy obtainment.

The quality and availability of water are issues of great relevance in Brazil, a country that has continental dimensions with different climates and geographical characteristics. The distribution of this resource is unequal, reflected in regions where access to quality water is a challenge for local communities. Problems such as scarcity of water resources, pollution and poor management of water sources become frequent concerns.

The state of Maranhão has 217 municipalities and an urban population of around 4.8 million inhabitants (ANA, 2021). According to the report by the National Water and Basic Sanitation Agency (ANA, 2021), 44% of the population of the state of Maranhão is supplied by underground springs. This demonstrates the importance of adequate infrastructure and effective control of groundwater quality, so that the population, especially in rural areas, is not exposed to potential health risks, and therefore a continuous effort by public authorities and management agencies is necessary to ensure that water sources are safe.

According to Fernandes (2022), despite having reserves with large volumes and superior quality because it is more protected, compared to surface water, however, it is not free from contamination by anthropogenic actions, such as the application of agricultural fertilizers, septic tanks, cemeteries, industrial effluents, inadequate deposition of solid waste, among others. Thus, it is important that monitoring is carried out, based on analyses of microbiological, physical and chemical parameters of the water.

From this, the relevance of investigating the quality of water from wells for human supply is notorious, after all, ensuring access to drinking water is extremely important. For the Consolidation Ordinance No. 5, of September 28, 2017 of the Ministry of Health, water for human consumption is defined as "drinking water intended for the ingestion, preparation and production of food and personal hygiene, regardless of its origin". Therefore, compliance with the limits established by the respective water quality standards is essential to ensure public health and prevent diseases related to the consumption of contaminated water, ensuring the promotion of the well-being of the population and the protection of the environment.

In this context, the research is justified by the need to investigate the quality of the water from the wells, considering the guidelines provided by environmental and public health legislation. Agencies such as the National Council for the Environment (CONAMA) regulate water quality standards through resolutions such as CONAMA No. 357/2005, which provides for the classification of water bodies, and CONAMA No. 396/2008, which establishes classification and guidelines for groundwater in Brazil. In addition, Ordinance GM/MS No. 888/2021 establishes the standards for the potability of water for human consumption, being a reference for the evaluation of the safety of water collected from wells. Therefore, understanding how the water quality is in a given location is essential for the development of control measures, the protection of water sources, and public health.

Thus, the objective of the research is to evaluate the quality and vulnerability of groundwater for human consumption in the area of influence of the Gangan River in the Turu neighborhood, located in the municipality of São Luís - MA, verifying its compliance with the legislation, applying the Groundwater Natural Quality Index (IQNAS) and identifying the degree of vulnerability of the aquifer.

THEORETICAL FRAMEWORK

GROUNDWATER

Groundwater is stored in aquifers, resulting from the process of percolation of surface water into the soil by infiltration. According to the Brazilian Association of Groundwater (ABAS, 2025), groundwater can be defined as all water that occurs below the earth's surface, filling the pores or intergranular voids of sedimentary rocks, or the fractures, faults and fissures of compact rocks. In addition, it plays an important role in soil moisture and flow of rivers, lakes, and wetlands.

Groundwater is present in geological formations known as aquifers and plays a crucial role in the water cycle. Inside an aquifer, water moves slowly, starting in the recharge area, where rainfall and other forms of precipitation infiltrate. It then advances towards the discharge zone, where these fluids emerge and integrate into surface waterways, such as rivers, lakes, and seas (HIRATA et al., 2019).

Revista ARACÊ
ISSN: 2358-2472

An aquifer is defined by the Brazilian Groundwater Association as a geological formation of the subsoil, composed of permeable rocks that store water in their pores or fractures. In addition, it can be understood as the geological material capable of serving as a repository and transmitter of stored water. According to ABAS (2025), the quality of the aquifer as a reservoir and the speed of the water in its environment depend on its geological constitution. As for porosity, aquifers can be classified as porous/sedimentary, fractured/fissural, or karst. Regarding water pressure, they can be classified as phreatic/free aquifers or confined/artesian aquifers.

Groundwater, unlike surface water, does not manifest itself easily. In Brazil, they can be extracted through tubular wells (artesian or semi-artesian), excavated wells and springs. However, despite the legal requirement for registration and/or authorization for the granting of water, the exact number of wells in the country remains unknown, with regular withdrawals from tubular wells accounting for just over 1% (HIRATA et al., 2019). As it is a fundamental part of the hydrological cycle, groundwater should be constantly considered in territorial management and infrastructure investments. However, this issue is often not addressed, and is often left out of the political agenda related to the use of water resources and urban planning (CONICELLI et al., n.d.).

According to Hirata et al (2019), groundwater generally has excellent natural quality and, in most cases, treatment is dispensed with in most catchments, in addition to the aquifer has a large water storage capacity, promoting stable flows from wells even after long periods of drought. The wells also have low operation and maintenance costs, working autonomously and are made in simple and fast works.

The use of underground springs is significant in Maranhão, with more than 70% of urban centers receiving this supply. According to data from ANA (2021), the states with the highest percentages include Mato Grosso do Sul (80%), Piauí (78%), Maranhão (74%), Pará (74%) and Amazonas (71%), totaling a service to an urban population of 7 million inhabitants. These data underscore the need for continuous monitoring of groundwater quality, which is essential for the preservation of water sources and the protection of public health.

NATURAL GROUNDWATER QUALITY INDEX (IQNAS)

The Natural Groundwater Quality Index (IQNAS) is a method used to assess groundwater quality based on physicochemical and microbiological parameters. According to Oliveira et al. (2006), the IQNAS was developed based on the methodology used to create the Water Quality Index (WQI), prepared by CETESB (Environmental Company of the State of São Paulo).

IQNAS is an important tool for the community, its great differential is the ability to synthesize information clearly, allowing the evaluation of water quality at different points of the same water resource, which facilitates access and understanding of data related to water quality (Oliveira *et al*. 2006).

The proposed index follows the principles generally adopted in the construction of quality indexes, which include: (1) limiting the number of variables, ensuring objectivity and practicality; (2) the selection of relevant chemical parameters, such as pH, chloride, total solids, hardness, iron and manganese, essential for the assessment of groundwater quality in various types of hydrogeological domains; and (3) the choice of variables whose data are frequently available in the chemical analyses of groundwater (OLIVEIRA et al., 2006).

In this way, evaluating water quality through the Natural Groundwater Quality Index makes it possible, from its scale of 0 to 100, to classify water objectively, assisting in the management of water resources, monitoring the use of water for human consumption, in addition to contributing to decisions on the protection and recovery of aquifers.

AQUIFER VULNERABILITY

Groundwater is an important alternative source to address the problem of water availability. In this context, its use has become increasingly indispensable. However, human development and urban sprawl in recent decades have contributed significantly to aquifer pollution. Thus, as the remediation of aquifers is often costly and difficult to execute, it is essential to deepen studies on the vulnerability and preservation of these systems (COSTA et al., 2022).

According to Silva (2012), the vulnerability study is the initial step in assessing the risk of groundwater contamination. In addition, it serves as an important tool for the planning of actions and policies aimed at the protection of underground water sources, allowing the identification and cartographic representation of critical areas.

Aquifer contamination can be caused by natural phenomena or anthropogenic activities. Among the natural sources, the incorporation of chemical elements into the water stands out, resulting from the dissolution of minerals present in the rocks, such as iron and manganese. In addition, poorly constructed or abandoned wells, with the absence of adequate closure, corroded or damaged casings, or even built without observing technical criteria, also contribute to contamination (FERNANDES, 2022).

On the other hand, according to Fernandes (2022), anthropogenic forms can include the improper disposal of solid waste in industrial, controlled, domestic, and hospital landfills, the indiscriminate use of pesticides, and contamination by the infiltration of untreated industrial and domestic effluents. Like surface springs, underground sources also face difficulties due to contamination by uncollected and inadequately treated sewage, which compromises water quality, becoming the main contaminant (ANA, 2021).

METHODOLOGY

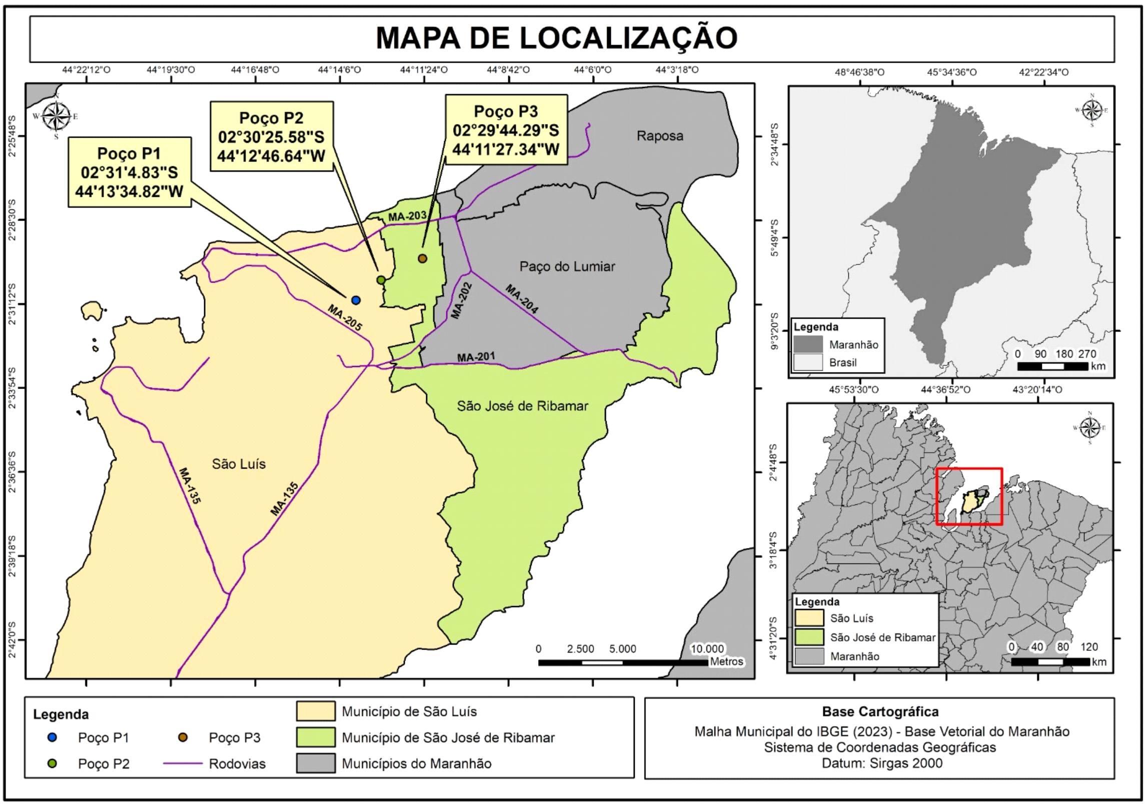
CHARACTERIZATION OF THE STUDY AREA

The Paciência Basin covers the municipalities of São Luís, São José de Ribamar, Paço do Lumiar and Raposa, located in the Northeast region of Brazil. It is an intermunicipal basin located between the geographic coordinates 02º 25' 30" to 02º 37' 30" South Latitude and 44º 07' 30" to 44º 16' 30" West Longitude. It is noteworthy that the Paciência River is in constant environmental degradation, mainly due to the inadequate discharge of sewage, largely from domestic sources. As a result, water quality is significantly compromised, which increases the risks of contamination and aggravates problems related to basic sanitation, especially with regard to public water supply (ROCHA et al, 2012).

The Gangan River channel is 1,700 meters long, starting at Aririzal Street and ending at Pai Inácio Street, near the Turu neighborhood. Accelerated urbanization has drastically modified the natural environment of the river, resulting in deforestation of the banks, irregular occupations, siltation and sewage pollution.

To evaluate the quality of groundwater in areas of influence of the Gangan River, samples were collected from three different wells (Figure 1) located near the course of the river. The samples were collected in sterilized vials, ensuring the absence of contamination and avoiding the formation of air bubbles. Subsequently, they were kept in conditions similar to the environment of the collection sites until they were analyzed in the laboratory, in duplicate. This methodology ensures the accuracy of the results, allowing a detailed analysis of the physicochemical and microbiological parameters of groundwater, which is essential to understand the impacts of human activities on water resources.

Figure 01 - Location of the collection points.



Source: Authors (2025).

TECHNIQUE OF PARAMETER ANALYSIS

The microbiological variables analyzed were Total Coliforms and *Escherichia coli* and the physicochemical variables were hydrogen potential, hardness, chlorides, iron, manganese and total solids. The analysis of physical, chemical and microbiological variables was performed according to the standards established in *the Standard Methods for the Examination of Water and Wastewater* (APHA, 2012), as detailed in Table 01.

Table 01 - Parameters, unit, detection limit of the method and analytical method.

Parameter	Unit	LDM	Analytical Method
Hydrogen Potential	-	0-14	SMEWW4500-H+B
Chlorides	Mg. L−1Cl	0,5	SMEWW4500-Cl-
Total Solids	Mg. L−1	0,5	SMEWW2540C
Hardness	CaCO3.L−1	0,5	SMEWW2340C
Iron	Mg. L−1	0,1	SMEWW3500 Faith
Totais coliforms	NPM	1	SMEWW9223B
Escherichia coli	NPM	1	SMEWW9223B

Source: Modified from Santos et al. (2020).

Comparisons with the results obtained were carried out based on Ordinance 888/21 of the Ministry of the Environment, which deals with water potability standards and

Revista ARACÊ
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CONAMA Resolution 396/08, which provides for classification and environmental guidelines for the classification of groundwater.

CALCULATION OF THE NATURAL GROUNDWATER QUALITY INDEX (NQI)

The IQNAS was determined using a scale of 0 to 100, where higher values indicate better water quality. This scale was subdivided into four (04) classes, where from 0 to 25 determines the waters as an unacceptable standard, from 26 to 50 acceptable, from 51 to 75 as good quality and from 76 to 100 as an excellent characteristic.

For the calculation , the mathematical formulation of IQNAS (Equation 1) was used, which was adapted taking into account the Groundwater Quality Index, proposed by Oliveira et al. (2006).

Equation 01:

$$\text{IQNAS} = Produto\left(Q_i{}^{wi}\right) = Q_1{}^{w1}\,x\,Q_2{}^{w2}\,x\,Q_3{}^{w3}\,x\,\ldots.Q_n{}^{wn},$$

Where:

- **IQNAS:** Natural Groundwater Quality Index
- **Wi:** Weight assigned to the ith parameter
- **Qi:** Quality value of the ith parameter (between 0 and 1)
- **n:** Total number of parameters

The Qi value is obtained through a specific quality curve for each parameter. This curve relates the concentration of the parameter to a value between 0 and 1, where 1 indicates the best quality. The suggested weights for each parameter, as shown in Table 2, consider their influences. In this context, *Escherichia coli* receives the highest weight (0.25), due to its relevance as an indicator of fecal contamination and its potential risk to human health. The weights of the other parameters were adjusted to balance their importance in the calculation of the IQNAS.

Table 02 - Suggested Parameters and Weights.

Parameter	Suggested Weight	Supporting
ph	0,15	Important for aquatic life and chemical processes
Chloride	0,15	Influences taste and electrical conductivity
Total solids	0,15	Indicates the amount of dissolved solid material
Hardness	0,15	Influences scale formation and flavor

Revista ARACÊ
ISSN: 2358-2472

Iron	0,15	It causes stains, alters the flavor and can be harmful to health
Escherichia coli	0,25	Indicator of fecal contamination and health risk

Source: Authors (2024).

To calculate the IQNAS, the mathematical equations of quality versus concentration of the parameter, adapted from Santos et al. (2020), were also used as a basis. To calculate the *Escherichia coli parameter*, a value of 1 was assigned when the absence was identified in the sample and a value of 2 when the presence was verified.

Table 03 - Mathematical equations of Quality versus Parameter Concentration.

Parameters and Units	Mathematical Equations	Validity Intervals	Pesos (wi)
pH, (-)	QpH= 1,7354 x $(pH)^{2QpH=16405x[(pH)-2,5}$]-17	[2≤pH7,34] [pH ≥ 7,35]	0,15
Cloreto, (Cl,mgL^{-1})	QCl=100 QCl=138,9x$(Cl)^{-0,19561}$–$(Cl)^{0,42QCl= 0,0}$	[Cl<4,86] [4,86≤Cl≤3000] [Cl>3000]	0,15
Total Solids, (ST, mgL-1)	QST=79–0,167284xST+EXP[$(RT)^{0,228}$] QST= 27,7	[0≤ST≤ 1630] [ST> 1630]	0,15
Dureza, (Durr, MGL-1)	QDUR=100 QDUR=101,1xEXP(-0,00212x DUR)	[DUR<5,4] [DUR≥5,4]	0,15
Ferro, (F,mgL^{-1})	QFe=Fe x wi	-	0,15
Escherichia coli, (UFC)	Qe = Ec x Wi	Qe (ausente) = 1 Qe (present) = 2	0,25
Total soma two pesos			1,00

Source: Modified from Santos et al. (2020).

AQUIFER VULNERABILITY INDEX (GOD METHOD)

The vulnerability of the aquifer was assessed using the GOD methodology, as described by Santos et al (2021) and based on the model proposed by Foster and Hirata (1988). This method considers three physical parameters to generate a natural vulnerability index, namely: G (type of aquifer as free, confined or semi-confined), O (general lithology of the aquifers, such as permeability and porosity of the aquifer material) and D (depth of the water table, that is, the distance between the soil surface and the aquifer level).

Table 01 - Aquifer Vulnerability Classes.

Vulnerability Classes	Definition
Extreme	Aquifers directly exposed to potential contaminants that require immediate protection measures.
Discharge	Aquifers with low natural protection and highly susceptible to potential contaminants.
Moderate	Aquifers with moderate protection and vulnerable to some pollutants and only when released frequently.

Revista ARACÊ
ISSN: 2358-2472

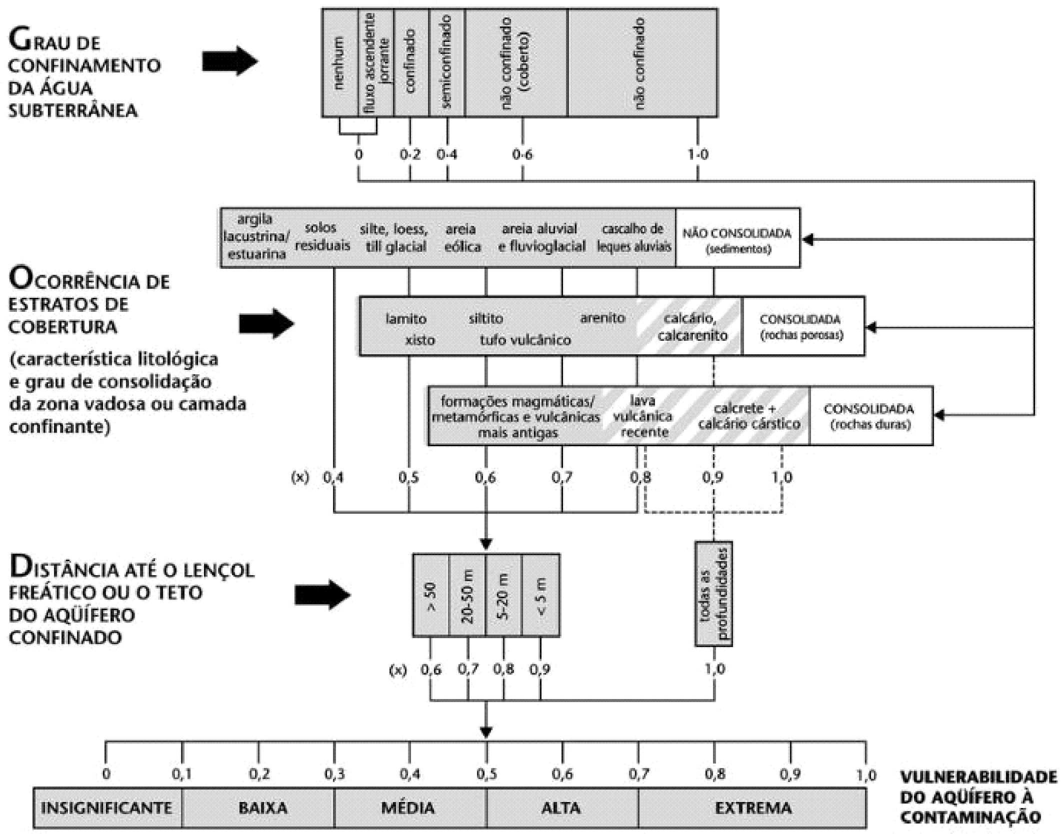
Low	Aquifers with some natural protection, where contamination is possible, but at a slow pace and when released continuously.
Despicable	Aquifers with excellent natural protections, where contamination is extremely low.

Source: Modified from Santos et al. (2020).

With the use of the GOD method, it was possible to classify the natural vulnerability of the aquifer into one of the five categories described in Chart 01: negligible, low, moderate, high or extreme, allowing the determination of the susceptibility of the aquifer to contamination and the prioritization of actions in more vulnerable areas.

To establish the reference value of the distance to the water table (D), the defined criteria were assigned: 0.6 for depths above 50 m and 0.7 for depths between 20 m and 50 m. Considering that the evaluated wells cover both categories, the average of the assigned factors was calculated to adequately represent the overall condition. This mean value was adopted as representative for D.

Figure 02 – GOD vulnerability method.



Source: Santos et al. (2020).

Revista ARACÊ
ISSN: 2358-2472

RESULTS AND DISCUSSION

From the results of the analyses, it was possible to compare the values obtained from the physical-chemical and microbiological analyses with the potability standards established by CONAMA Resolution No. 396/2008 and Ordinance GM/MS No. 888/2021, in addition to making it possible to evaluate the Natural Quality Index of Groundwater (IQNAS) and verify the Vulnerability Index of the aquifer.

The results obtained from the samples collected are shown in Chart 02.

Table 02 - Comparison of the results of the analyses with CONAMA Resolution 396/08 and Ministry of Health Ordinance 888/21 *VMP Maximum value allowed.

Parameter	Point 1	Point 2	Bullet 3	Unit	VMP CONAMA 396/08	VMP Ordinance 888/21
ph	4,65	4,20	4,13	-	Not listed	6.0 to 9.5
Hardness	18,99	18,99	18,99	mg/L $CaCO_3$	Not listed	300
Chlorides	24,99	34,92	42,45	mg/L	250.000	250
Iron	0,099	0,099	0,099	mg/L	300	0,3
Coliforms totais	Presence	Presence	Presence	NPM/100mL	Missing in 100ml	Missing in 100ml
Escherichia coli	Absence	Absence	Absence	NPM/100mL	Missing in 100ml	Missing in 100ml
Total Solids	41	100	111,5	mg/L	1.000.000	1000

Source: Modified from Santos et al. (2020).

Thus, it is possible to verify that the results of the analyzed parameters are in accordance with the maximum values allowed by CONAMA Resolution 396/08 and with Ordinance No. 888/21 of the Ministry of Health, with the exception of the Total Coliforms parameter, which was detected in the samples.

The presence of total coliforms at the wells' analysis points is considered an indication of the possible existence of pathogenic microorganisms in the water, such as coliform bacteria capable of causing disease (SANTOS et al., 2020). Therefore, the detection of total coliforms in 100 ml of water sample demonstrates that it does not meet the standards established by CONAMA Resolution 396/08 and Ordinance 888/21.

From the data obtained by the analysis of water samples and adaptations in the formulations and parameters used for analysis, it was possible to obtain the Groundwater Quality Index (IQNAS). For this, the groundwater quality values for each chosen chemical parameter (Qi) was raised to the weight assigned to each variable (wi) at each point analyzed.

Revista ARACÊ
ISSN: 2358-2472

Chart 03 provides the results obtained for the IQNAS and the classification in each point.

Table 03 - Groundwater Quality Index (IQNAS) Result.

Parameter	Q1	Q2	Q3	wi	${Q_i}^{wi}$	${Q_{i2}}^{wi}$	${Q_{i3}}^{wi}$
pH	37,52	30,61	29,60	0,15	1,72242145	1,67062701	1,66224011
Hardness	97,11	97,11	97,11	0,15	1,98650468	1,98650468	1,98650468
Chlorides	70,14	64,87	61,89	0,15	1,89188557	1,86984921	1,85670571
Iron	0,099	0,099	0,099	0,15	0,70687932	0,70687932	0,70687932
Total Solids	82,44	79,69	79,06	0,15	1,93829867	1,92845973	1,92616515
Escherichia coli	Absence (1)	Absence (1)	Absence (1)	0,25	1	1	1
IQNAS					8,8693	8,4592	8,3476
Classification					Unacceptable	Unacceptable	Unacceptable

Source: Modified from Santos et al. (2020).

Thus, according to the values obtained in Chart 03, the Groundwater Quality Index (IQNAS) in the three points was classified as unacceptable, which implies the need to interrupt or restrict the use of water for human consumption. After all, the presence of contaminants in high concentrations can lead to a series of health risks, from gastrointestinal problems to more serious diseases.

In addition, an unsatisfactory IQNAS requires an in-depth investigation to identify the causes of contamination. The sources can be diverse, including industrial activities, domestic sewage discharge, or even natural processes, such as the presence of specific minerals underground.

Identifying the sources of contamination is important for the implementation of appropriate remediation measures. In many cases, restoring groundwater quality requires the adoption of advanced treatment technologies, such as the removal of heavy metals, pesticides, or other organic compounds.

To achieve the last objective of the research, an aquifer vulnerability analysis was carried out using the GOD method, as shown in Chart 4.

Table 04 - Estimation of the aquifer vulnerability index.

G	Or	D	Final vulnerability indices
0.4	0.8	0.65	GxOxD

Revista ARACÊ
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			0.4x0.8x0.65= 0,208
Vulnerability			Low

Source: Modified from Santos et al. (2020).

The wells analyzed presented different depths: 60 m, 30 m and 48 m. According to Table 04, the type of occurrence of groundwater (G) receives a weight of 0.4 because all wells have characteristics of semi-confined, while in relation to the lithologies of the aquifer (O) the weight assigned is 0.8 because it presents characteristics of sandstone and calcarenite. The depth of the water table level (D) receives a weight of 0.65, which is the result of the average of the factors attributed. Considering the depths between 20 m and 50 m, for which a factor of 0.7 is attributed, and the depth greater than 60 m, with a factor of 0.6, the average value obtained was 0.65.

Thus, through the GOD method, the result of the calculation has a low vulnerability class, that is, it is an aquifer where contamination is possible, but at a slow pace.

FINAL CONSIDERATIONS

It is concluded that the values of the analyzed parameters are within the limits established by CONAMA Resolution 396/08 and by Ordinance 888/21 of the Ministry of Health, except for the total coliform parameter. The presence of total coliforms outside the established values may be indicative of deficiency in the structures of the wells, infiltration of contaminated surface waters, or proximity to sources of contamination. According to Menezes (2009), the evidence of coliforms in deep waters of wells can occur in the construction phase, where they are dug, but without adequate sealing. This allows contamination to occur through the infiltration of water containing pollutants or the proximity of septic tanks, which favors the receipt of contaminated effluents.

The Groundwater Quality Index (IQNAS) was classified as unacceptable at the three collection points evaluated. This result highlights the need for corrective measures and monitoring of water quality, as it indicates that there is a possibility that it is not suitable for human consumption. The presence of coliforms above the permitted values suggests possible contamination by microorganisms that can cause diseases, which may have influenced the classification obtained. In addition, water cannot be consumed directly without proper treatment, which restricts its use.

The vulnerability of the aquifer was considered low. This indicates that it has greater resistance to environmental impacts and human activities, ensuring greater protection of

Revista ARACÊ
ISSN: 2358-2472

water resources. According to Santos (2020), an aquifer with low vulnerability is only susceptible to contamination when exposed to pollutants continuously and for long periods. In addition, this method is suitable for rapid vulnerability diagnoses, requiring little detail and being applied on regional scales (COSTA et al., 2022).

Despite the low vulnerability of the aquifer, the IQNAS classified as unacceptable strongly suggests the absence of adequate basic sanitation in the region, or the prolonged exposure to sources of contamination. The presence of fecal coliforms in all the samples analyzed reinforces this hypothesis, evidencing the contamination of groundwater by sewage or other fecal waste.

In this way, the research made it possible to provide important data to understand the quality of groundwater in areas of influence of the Gangan River and to identify possible risks to public health. The IQNAS and aquifer vulnerability data indicate that, although the region has low susceptibility to long-term contamination, the quality of the groundwater in the wells analyzed is already compromised. Expanding the sample, including more wells and parameters, and evaluating the relationship between water quality, public health, and basic sanitation are possible investigations for further studies. This information can contribute to actions aimed at protecting water resources and the proper use of groundwater, which helps to preserve water quality and reduce environmental and health impacts in the region.

Revista ARACÊ
ISSN: 2358-2472

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