



Influence of the lack of a water supply system in the Nova Esperança neighborhood

Influência da falta de sistema de abastecimento de água no bairro Nova Esperança

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1 INTRODUCTION

According to data from the Management Council of the Public Private Partnership Program (PPP), Porto Velho has just over 2% of sanitary sewage and 30% of the population with treated water (the main catchment reservoir being the Madeira River). Being one of the last placed in the national ranking of universalization of basic sanitation. According to the Basic Sanitation Ranking of the 100 largest cities in Brazil, Porto Velho occupies position 98 (2022) and in 2019 it was in last place. The lack of drinking water supply infrastructure as well as a sewage collection and treatment system in Bairro Nova Esperança, causes the population to use alternative means to overcome the deficiency of these services, the supply system by the concessionaire occurs only in part of the neighborhood, especially in the oldest area of the neighborhood, in the younger area located on Avenida Prefeito Chiquilito Erse, the water used comes from wells (simple), in order to supply the lack of water supply. These factors compromise the quality of the water used by these families subjecting them to the risk of consuming water outside acceptable sanitary standards, as Porto Velho does not have a sewage collection and treatment system (except in private housing developments), most of the population uses alternative means to direct residential sewage in general the most used solution are the



pits, which are reservoirs that when executed by unskilled labor are highly susceptible to leaks that end up contaminating the soil and groundwater with sewage. Possible contamination does not only affect the users of a housing unit, all nearby wells are at risk of being contaminated. This work aims to estimate the population that does not have access to treated water with a specific focus on housing units located in the expansion area, in order to verify which portion does not receive water through the Companhia de Águas e Esgotos de Rondônia (CAERD).

2 OBJECTIVE

Analyze the number of households that use water from simple wells for supply. So that at the end the percentage of units that do not receive water through the Concessionaire can be checked.

3 METHODOLOGY

3.1 CLASSIFICATION OF RESEARCH

The Nova Esperança Neighborhood was chosen because it is one of the largest and oldest neighborhoods in Porto Velho, as well as representing the two situations under study, as it includes housing units provided with supply via concessionaire as well as has a significant portion of units that do not have supply by CAERD, which results in a high number of units in relation to the set studied. In recent years the region has shown a great expansion as can be verified by satellite images. In units where there is no supply, the use of artisanal tube wells prevails. In this way, the numbers of dwellings where there is supply through the concessionaire will be recorded, which will be carried out by means of a simple count of the residences or condominiums where there are water meters. Thus, in the units where there are water meters, they will be classified as units with supply by the concessionaire, while in the units where there are no water meters, they will be considered dwellings where the supply is made through wells, but this does not mean that there is a well for each unit, but that they have an indirect supply system.

Figure 01 - Nova Esperança neighborhood, images from September 2009.



Source: Google Earth PRO, created by the author, 2022.

Figure 02 - Nova Esperança neighborhood, images from May 2022



Source: Google Earth PRO, created by the author, 2022.

3.2 GEOGRAPHICAL CHARACTERIZATION

The Nova Esperança Neighborhood is located in the city of Porto Velho, in a region without a defined zone, it does not have a creation law as well as most of the neighborhoods in the capital, its extension is approximately 394 hectares (raised through Google Earth PRO). It is located in the Madeira River Basin, the region has small streams on the banks of the main corridor. According to data from the Porto Velho City Hall, this neighborhood is part of sector 10 together with Bairro Industrial, its formation began in the 1960s, being primarily a ranching site. Like much of the urban relief of Porto Velho, it is a predominantly flat region. There is no official data from the City Hall on the number of people living in this neighborhood. Regarding the infrastructure of water supply and sewage collection, as in much of the city, it suffers from precarious water supply and the absence of a sewage collection and treatment system. These factors contribute to the use



of deep tube wells by the population and the use of cisterns in order to overcome the problems related to lack of water. The places where there is a sewage collection and treatment system are related to the various condominiums in the region.

3.3 UNIVERSE

Single and multi-family homes in the Nova Esperança neighborhood.

3.4 SAMPLE

The samples will be of the simple random type, of the units that have or do not have water meters. The unit with supply through the concessionaire will be considered to have a water meter installed, those that do not will be classified as units with indirect supply through wells.

3.5 DATA COLLECTION INSTRUMENTS

Data collection will be carried out by means of field counting and georeferenced maps, since in several places access is precarious, but it is possible to verify the existence of housing.

3.6 DATA PROCESSING

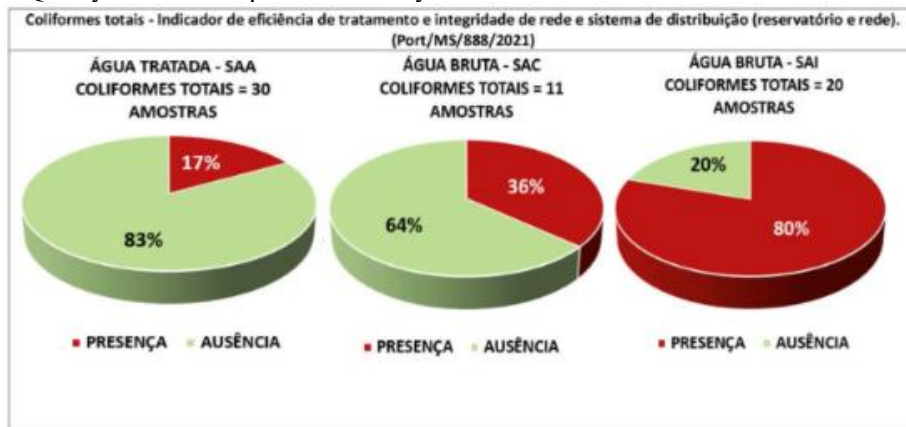
The data collected will be organized in order to demonstrate the units that have a supply system via concessionaire and which units use wells for water supply. The data will be tabulated in order to have a notion of the representativeness of the samples studied in the study region.

4 DEVELOPMENT

According to data from the 1st Environmental Quality Report of the Municipality of Porto Velho (2010/2011), the supply of drinking water and sanitation in most of the municipalities of Rondônia is carried out by the Companhia de Água e Esgoto de Rondônia (CAERD). The water supply of Porto Velho is captured by the Madeira River, near the old town of Santo Antônio, with two water treatment plants, ETA Nova and ETA Velha (located in the Igarapé Bate-Estacas). It is important to note that even among the portion of the population served by CAERD, the use of cisterns is common, as the supply does not happen daily and the lack of supply is common, especially in the most remote neighborhoods. In September 2021, the National Health Foundation (Funasa) monitored

the quality of water in Porto Velho, the analyzes were carried out in partnership with Fiocruz resulting in the presentation of inadequate, insufficient or non-existent treatment in the material collected for analysis. Physical-chemical and microbiological analyzes were performed on 61 samples intended for human consumption, 30 samples of Supply System (SAA), 11 Collective Alternative Solutions (SAC) and 20 Individual Alternative Solutions (SAI). The verifications showed that 60% of the samples from the Supply System showed an absence of free residual chlorine, in addition to demonstrating the presence of bacteria of the total Coliform group and Escherichia coli, this result demonstrates that the samples analyzed could not be used for human consumption. The collective alternative solution represents the portion of the population that is not served by the main supply system, and is generally supplied by small distribution stations managed by CAERD. Some neighborhoods located in the East and South Zola of Porto Velho, have this type of supply. Individual alternative solutions represent the portion of the population that does not have any type of service from the concessionaire, being forced to use improvised solutions such as artisanal tube wells.

Figure 03 - Quality of water samples collected by FUNASA. Source: National Health Foundation (2021).



Source: NATIONAL HEALTH FOUNDATION, 2021

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the city center, and this sewage is dumped directly into the Madeira River without any type of treatment.

Figure 04 - Area with sewage collection system.



Source: Report of the PPP Management Board, Porto Velho, Feb/2022.

The consumer units that have a sewage collection and treatment system, are related to the newer housing developments that had great growth in the construction period of the Santo Antônio and Jirau plants, this period registered an exponential increase in the number of dwellings, which were mostly financed by Caixa Econômica Federal (at the time of the Minha Casa Minha Vida program), these developments were required to have sewage treatment systems, as well as in housing units regularized with the city hall. This context does not occur in common units, built in a formal way, where the use of black pits, or direct dumping of sewage into the streets and canals, predominates. The black pits are dug holes, where the sewage from the dwellings is dumped, in this system the sewage infiltrates directly into the soil, because there is no system that generates the tightness, unlike the septic tanks.

The use of black pits is highly damaging to the water table, as this system consists of dumping sewage in these structures that are excavated without any type of coating, or when they have it, they are not waterproofed in order to protect the soil and the water table. This situation added to the low number of consumer units that are served with treated water, and therefore use deep tube wells, leads to contamination of well water and aquifers. In less developed regions where infrastructure is precarious, the level of contamination is even higher, resulting not only in water contamination but also in the



emergence of diseases in the population. Table 1 shows data on the supply of peripheral neighborhoods in Porto Velho, where there is no supply from the main system.

Table 1 - Wells and supply networks in the city of Porto Velho.

Sector	System	Wells (und)	Reservoirs m ³	EEATs (und)	Network (km)
Pantanal	Pantanal	10	1.000	3	212
	Residencial Cristal da Calama	6	300		
Tancredo	Tancredo	7	2.000	1	80
National	National	0	0	0	19
New Hope	New Hope	0	0	0	22
Mariana	Ulisses Guimarães	6	315	0	216
	Allotment Park Amazônia	3	175		
	Marcos Freire	2	195		
	Ronaldo Aragão Set	2	15		
	Jamari Set	3	150		
	Residencial Bairro Novo	4	500		
South	Odacir Soares Set I and II	2	20	1	242
	Chagas Neto Set I and II	6	0		
	Cidade do Lobo Neighborhood	2	0		
	Cohab Set I and II	2	0		
	Set Cohab III	1	0		
	Residencial Pride of Madeira	8	2.256		
	Residencial Viver Melhor	8	1.890		
Total Independent Systems		72	8.816	5	791

Source: Adaptation from the PPP Management Council, Porto Velho City Hall, Feb/2022.

5 ANALYSIS AND DISCUSSION OF RESULTS

In all, 2,531 housing units were quantified, considering both isolated residences and units that are part of residential condominiums, which are a considerable portion of existing residences, totaling approximately 50.0% of housing units. Of all the units verified, only a small portion related to 32.52% has a water meter installed or has the possibility of installation, but these units that represent only condominiums and not isolated residences do not use the public network as the main source, as they report that the supply is precarious and insufficient, making it necessary to use wells as alternative sources to complement, with this there is an increase in the share of users who depend on wells, but as it is a place where there is a supply system in operation via pipeline, these will be maintained as units that have public supply.



Figure 05 - Marked in green the share of households where no public supply is available.



Source: Own authorship, 2022.

The result is that approximately 68% of the housing units in the Nova Esperança neighborhood are supplied by wells, i.e. more than 1,700 households. This number does not imply the existence of the same number of wells, since not all inhabitants necessarily have a private well, and there may be the possibility of several units sharing the same water source as is the case of residential condominiums or subdivisions, but this does not represent a proportionality between the use of the number of wells, for this it would be necessary to carry out another study even more in-depth. However, this number still represents a high number of wells. Performing a query in the SIAGAS system of the CPRM, it is possible to verify that in this region there are only 6 wells registered for this region, which means that most of the wells are not registered with the competent bodies, this is a problem, because it hides the real data related to the numbers of wells that are properly legalized together with the control bodies. A well cannot simply be built, as well as in a work several studies are necessary, including the elaboration of a technical project for the construction of a well, that is, the work of a technician in the area who is responsible for this service is necessary. The design of a well, provides for the depth of excavation, the flow rate in the different periods among other fundamental information for its operation. Even in more specific cases it is necessary to grant the environmental agencies that may or may not tax the water consumed, this factor varies from place to place.



Table 02 - Registered wells in the Nova Esperança neighborhood.

Point	Location	Basin	Municipality
1100001408	Rua Rio Madeira, Km 2,5 Lot,Residencial Vitória,	Amazon River	Old Port
1100001409	Rua Rio Madeira, Km 2,5, Lot,Residencial Vitória	Amazon River	Old Port
1100001575	Porto Velho	Amazon River	Old Port
1100004169	Cond Nova Alphaville	Amazon River	Old Port
1100004419	Cond, Resid, Alberto Jaquier	Amazon River	Old Port
1100005067	Industrial	Amazon River	Porto velho

Source: SIAGAS System - CPRM, 2022.

A study carried out in 2019 by the Trata Brasil Institute in conjunction with the University of São Paulo (USP) demonstrates the importance of groundwater as well as informs the risks and vulnerabilities to which these water resources are subject, due to the lack of sanitary infrastructure. According to data from the National Sanitation Information System (SNIS), in 2020 the North region has the lowest rate of attendance of the total and urban populations with public water supply and sewage networks (58.90% and 13.10%), the index of Rondônia is 61.60% (for water) and 7.80% (for sewage), while losses in water distribution (2020) are 59.60%, a relatively high value, but common for the northern region of Brazil. Rondônia's per capita water consumption is 157.30 liters/day. In Brazil, groundwater is extracted mainly by tube wells, elements that have greater depth and flow, are employed in larger enterprises such as condominiums, industries and businesses. In greater quantity than tube wells there are dug wells, made in a rustic way, have low depth and larger diameter, are usually lined with shackles or masonry, have lower flow than tube wells and are more subject to soil contamination due to the low depth. One important piece of information pointed out in the study is the number of existing wells and the costs involved in installing them. The study estimates that if the values invested in the construction of all irregular wells are measured, added to the values that would be acquired by the payment of water consumption fees, they would result in a price sufficient for the construction of a complete water collection and supply system in the studied region.

Table 3 - Number of Wells, Installation Costs and Revenue (2016).

No. of Tube Wells (Estimated)	Installation Cost - R\$ (Estimated)	Revenue if well water was provided by WSS -R\$ (Estimated)
2.500.000,00	R\$ 75 billion	R\$ 59 billion/year

Source: Adapted, Trata Brasil Institute 2019.



According to data from the study, the cost of installing the quantified wells in Brazil is equivalent to 6.5 years of investments in water and sewage in Brazil (data for 2016). If this groundwater were distributed by the public service, it would result in an annual revenue of R\$ 59 billion. The lack of basic sanitation, makes constant the discharge of sewage in intermediate systems such as septic tanks, black tanks, sinks, anaerobic filters and even in the open or in water courses. This becomes one of the main sources of soil contamination and consequently of aquifers. In places such as condominiums and subdivisions, this fact is attenuated, as there are own systems for collecting and even treating sewage, but in the case of the most socially vulnerable population, the use of black pits, infiltration ditches and direct launching on the road predominates, which corroborates the contamination of the soil and the groundwater, in these places the distance between the source of sewage disposal / collection and the well is not respected (minimum of 15.00 meters, according to item 5.1 of NBR 7229) and it may occur that a single residence contaminates the perimeter wells.

According to Progenio et al. (2013), in places where black pits are used, the means of waste disposal must respect a minimum distance of 45 meters from the well, but it is hardly possible to achieve such spacing, especially in Porto Velho where the lots have by default dimensions of 10 meters (front) and 30 meters (sides) and people in general are unaware of technical items like this, After all, there is hardly any communication between people who are carrying out conventional constructions, usually each family builds its well without taking into account where the pits / sewage systems of neighboring buildings are located, this makes the problem of groundwater contamination even more critical. In the Nova Esperança neighborhood it can be verified that due to the high number of residences that use wells and the lack of water and sewage infrastructure the possibility of groundwater contamination is quite high, especially where there is the highest concentration of precarious housing (invasions).

6 FINAL CONSIDERATIONS

After quantifying the residences of the Nova Esperança neighborhood, it was possible to conclude that more than 68% of the residences in this neighborhood do not have a public supply system, resulting in an unknown but high number of wells that are mostly irregular since the control system presents only 6 wells registered in a sample of more than a thousand residential units, these factors combined with the lack of sewage collection and treatment system increase the risks of contamination of the groundwater



and thus the proliferation of diseases in the most socially vulnerable population, making it necessary to adopt measures by public entities, with regard to investments in the water supply system and sewage collection and treatment, as well as it is necessary to expand the inspection of irregular wells and create means of raising awareness of society about the importance of groundwater resources.



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