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Historical overview of bathing water quality and current conflicts at Flamengo Beach (Rio de Janeiro)

Histórico da balneabilidade e conflitos atuais na Praia do Flamengo

Panorama histórico de la calidad del agua para baño y conflictos actuales en la Playa de Flamengo (Rio de Janeiro)

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Abstract

Since the 19th century, Flamengo Beach has suffered environmental degradation due to landfills and urban expansion in its coastal environment and the Carioca River basin. This article analyzes the impacts on bathing water quality, in relation to public sanitation policies, management of the Carioca River basin, and urban occupation. The findings highlight temporary improvements in water quality during the Rio 2016 Olympic Games and, after 2022, due to the diversion of the Carioca River's mouth to the South Zone oceanic interceptor, within the framework of Brazil's New Legal Sanitation Framework and the privatization of CEDAE.

Keywords: bathing water quality, Carioca River, basic sanitation

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Resumo

Desde o século XIX, a Praia do Flamengo sofreu agressões ambientais devido a aterramentos e crescimento urbano em seu ambiente praias e na bacia do Rio Carioca. Este artigo analisa os impactos na balneabilidade, relacionados às políticas públicas de saneamento, gestão da bacia do Rio Carioca e ocupação urbana. Os resultados destacam a melhoria pontual da balneabilidade à época dos Jogos Olímpicos Rio 2016 e, após 2022, devido ao desvio da foz do Rio Carioca para o interceptor oceânico da Zona Sul, sob o cenário do Novo Marco Legal do Saneamento Básico e da privatização da CEDAE.

Palavras-chave: balneabilidade, Rio Carioca, saneamento básico

Resumen

Desde el siglo XIX, La Playa de Flamengo sufre agresiones ambientales debido a rellenos y a la expansión urbana en su entorno y en la cuenca del Río Carioca. Este artículo analiza los impactos sobre la calidad del agua para baño, considerando las políticas públicas de saneamiento, la gestión de la cuenca y la ocupación urbana. Los resultados señalan mejoras puntuales en la calidad del agua durante los Juegos Olímpicos de 2016 y, desde 2022, con el desvío del Río Carioca hacia el interceptor oceánico, en el marco del Nuevo Marco Legal del Saneamiento Básico y la privatización de CEDAE.

Palabras clave: calidad del agua para baño, Río Carioca, saneamiento básico



1 Introduction

One of the most traditional and relevant activities in both the daily life and tourism of Rio de Janeiro is the recreational use of beach waters. According to official data from the Ministry of Tourism, in January 2025 alone, the state of Rio de Janeiro received more than 240,000 foreign tourists (Embratur, 2025). Thus, the beach, as a fundamental component of coastal ecosystems, not only plays a vital role in maintaining biodiversity and environmental balance but also constitutes a strategic nucleus for the economic and cultural development of coastal communities. Its preservation, therefore, transcends the ecological sphere, directly impacting tourism dynamics, which are responsible for boosting the local economy and promoting cultural exchanges and building imaginaries of the carioca identity (Andreatta, 2009).

Bathing suitability refers to the condition of the waters in a given location for recreational activities, such as bathing and water sports. This condition is directly linked to water quality for primary contact, meaning that which involves direct interaction with the human body (Brasil, 2000). The assessment of bathing suitability in the state of Rio de Janeiro is carried out by the State Environmental Institute (Inea), based on the concentration of coliform group bacteria present in the water (Brasil, 2000). To ensure user safety, it is essential that the water presents adequate conditions for prolonged contact without posing health risks.

Guanabara Bay, one of Brazil's main coastal ecosystems, is home to several urban beaches that play an important social, environmental, and economic role for the Metropolitan Region of Rio de Janeiro. However, the rapid urbanization process, associated with insufficient sanitation infrastructure and intense industrial and port activity, severely compromises the environmental quality of these areas. In this context, it is crucial to understand the current state of the bay's beaches and identify the main pollution vectors that affect their bathing suitability and pose risks to public health.

In general, the beaches of Guanabara Bay show worrying levels of pollution (Coelho, 2007), with many of them remaining unsuitable for bathing for most of the year. The most critically affected include beaches located inside the bay or confined by headlands, given the low rate of water renewal in these areas (Porto, 2018; Lessa, 2020). In contrast, some beaches present better bathing conditions, such as Flamengo Beach — especially after the project to divert the mouth of the Carioca River — and Vermelha Beach. Both are situated in a region of Guanabara Bay characterized by higher hydrodynamics, which favors the dispersion of pollutants and contributes to the maintenance of water quality (Coelho, 2007; Lessa, 2020). However, even in these areas, bathing suitability can still be affected by heavy rain events, which increase the load of diffuse pollution carried by urban rivers.

It is essential to identify the similarities between Flamengo Beach and other urban areas of the second most populous metropolitan region in Brazil (IBGE, 2022), which share similar challenges in the estuarine dynamics of Guanabara Bay, as well as their differences regarding location and positioning within Guanabara Bay.

Flamengo Beach holds great importance in the historical and geographical evolution of the city of Rio de Janeiro, in addition to being one of the pioneering beaches in the construction of the carioca identity with sea bathing. Since the end of the 19th century, this beach has undergone various changes and environmental aggressions due to land reclamation and urban growth, both in its beach environment and in the Carioca River watershed, in which it is located. Therefore, it becomes relevant to understand the causes and consequences of impacts on its bathing suitability throughout its history.

The objective of this article is to highlight: a) the factors that led Flamengo Beach to reach very low levels of bathing suitability in recent decades; b) the influence of effluent technical networks on the bathing suitability of Flamengo Beach. It was possible to point out that bathing suitability is directly linked to public sanitation

policies, the management of the Carioca River basin, and the urban occupation of the region. The results of this research highlight the specific improvement in bathing suitability around the time of the Rio 2016 Olympic Games and, after 2022, due to the diversion of the mouth of the Carioca River to the Southern Zone oceanic interceptor, under the scenario of the New Legal Framework for Basic Sanitation and the privatization of CEDAE.

2 Study Area

2.1 Carioca River Watershed

The Carioca River is a river situated entirely within the city of Rio de Janeiro. The river has its source in the Tijuca Massif, in an area encompassed by the Tijuca National Park. Its mouth, until May 2022, was located at the southern limit of Flamengo Beach; from that month, the Carioca River had its culvert diverted so that its waters would be directed to the Ipanema submarine outfall (this process will be discussed in more depth later). Even before its diversion, the river was rarely in an open-air state. Shortly after leaving the Tijuca Forest, most of the river is channeled and passes beneath the urban fabric. The Carioca River crosses the neighborhoods of Santa Teresa, Cosme Velho, Laranjeiras, and Flamengo.

Besides its importance when analyzing the impact of its discharge on the waters of Guanabara Bay, the Carioca River holds great historical relevance in the formation and construction of the urban core of Rio de Janeiro. Before the colonial period, the Carioca River was important in the indigenous tradition of the Tupinambá peoples (such as the Tamoios and Temiminós), who occupied the region. These peoples believed in the sacredness of the river's waters, invoking health and spiritual strength (Filho et al., 2016).

Around 1673, the first pipelines were installed, and most of the waters of the Carioca River were diverted, creating an artificial branch to supply the city center, where the population was concentrated until then. The diversion involved works to transport the waters of the river that originated at the foot of Corcovado, passing through Largo da Carioca and ending at Praça XV. The route involved the construction of fountains and the most relevant hydraulic and architectural work of Colonial Brazil, the Carioca Aqueduct, inaugurated in 1750. From the 18th to the 20th century, the Carioca River was of utmost importance for the city's water supply, enabling its development and strengthening (Abreu, 2022).

In the mid-19th century, the Carioca was channeled in an open-air canal after leaving the boundaries of the Tijuca Forest. During the Pereira Passos administration (1902-1906), the Carioca was permanently buried in underground culverts. From the 1970s onwards, environmental issues gained greater prominence in international debates. Consequently, concern for the Carioca River valley caught the attention of local community and non-governmental organizations, which helped with reforestation on slopes and streets permeating the valley, in addition to pressuring municipal and state powers to intensify political and environmental interventions. Community pressure led the municipal government to build, in 1992, a mid-level culvert at the mouth of the Carioca, to relocate its discharge from the sands of Flamengo Beach, which was causing black, oily slicks ("línguas-negras"). This measure moved the river's mouth to a rockfill structure at the southern limit of Flamengo Park, directly into Guanabara Bay. Starting in 1984, the Rio de Janeiro city hall created six Environmental and Cultural Protection Areas within the Carioca River basin, with the aim of establishing means to protect cultural and natural heritage and halt the critical occupation of the valley's slopes (Schlee et al., 2006). According to studies by Schlee (2002), the analysis of vegetation cover and land use in the Carioca River basin between 1972 and 2002 indicated a decrease in deforestation from 1984 onwards. It can be stated that the action of local organizations in environmental awareness and the fight for claims in the governmental sphere, along with the expansion of municipal and state

environmental laws and policies, helped reduce the speed of the local forest loss process. It is possible to think that human actions can be restorative and preventive, rather than being limited to just destructive.

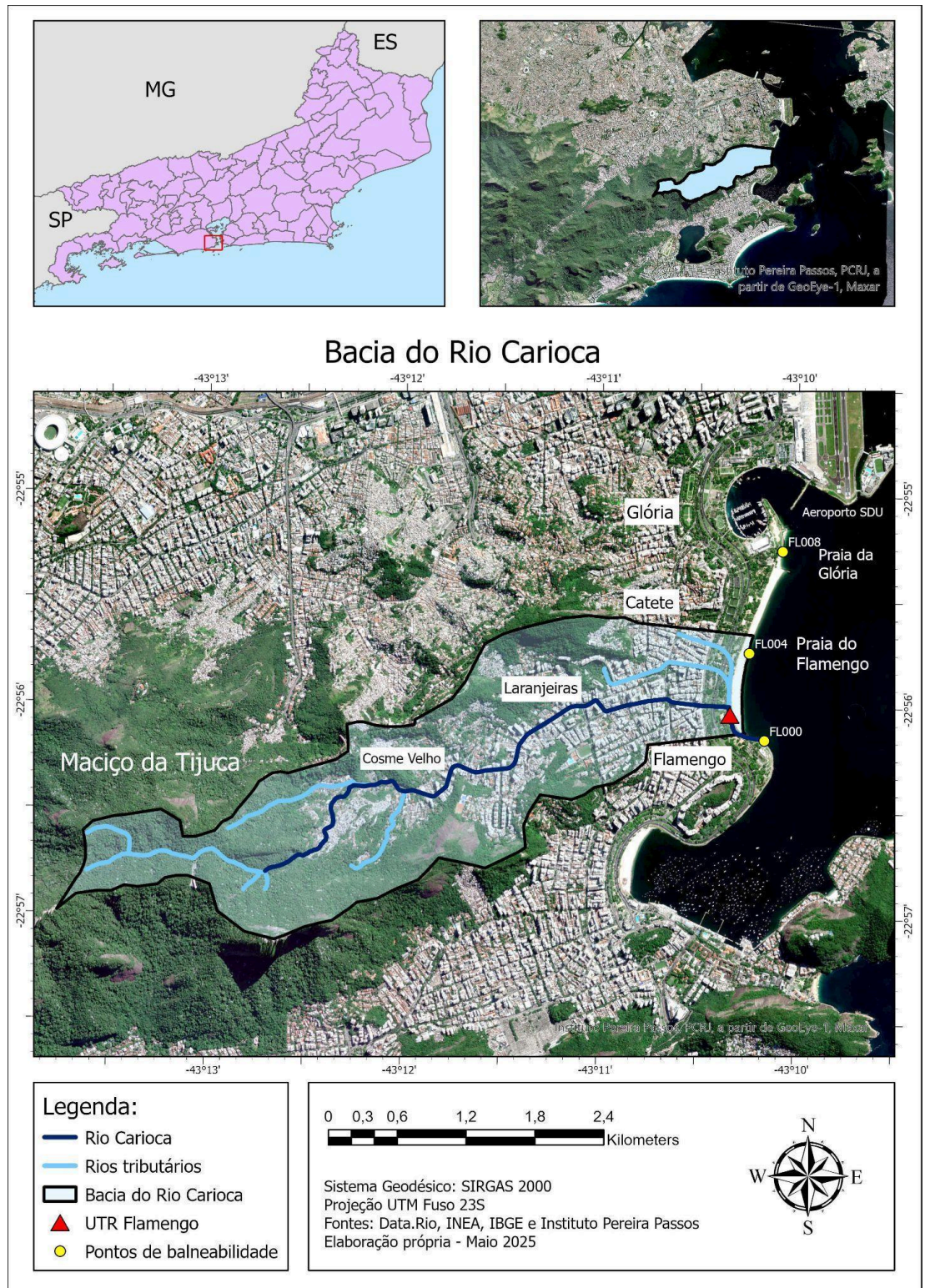


Figure 1: Map of the Carioca River sub-basin.
Source: Data.Rio and Instituto Pereira Passos. Own authorship, 2025.

In the 21st century, in 2002, the state government built a River Treatment Unit (UTR - Unidade de Tratamento de Rio) that performs primary treatment of the Carioca River's waters (Figure 2). The UTR, as pointed out by Schlee (2007), took years to achieve full operation. In 2004, a wooden deck was built over the river in the section

between the UTR and the mouth of the Carioca for pedestrian circulation (Figure 12). The deck prevents the view and the rescue of the memory of the Carioca River, causing this river, which has great historical and cultural importance for the city, to be dissociated from the historical and geographical memory of cariocas.



Figure 2: Photograph of UTR Flamengo.
Source: Personal collection, January 2025.

Nowadays, the Carioca River can be divided into four segments, according to Schlee et al (2006). The first part belongs to its source in the Tijuca Massif, more precisely in the Serra da Carioca. In this segment, the waters are still pure and unpolluted, with the surroundings marked by dense Atlantic Forest vegetation of the Tijuca Forest. This part extends to the first intake structure, called Mãe D'água, where the first traces of degradation can be observed.

Shortly after leaving the boundaries of the Tijuca National Park, it receives pollution from areas that still lack sanitation, such as the Guararapes community. This second segment is marked by intense contamination and the open-air channeling of the Carioca. The third segment is represented by Largo do Boticário, between the neighborhoods of Santa Teresa and Cosme Velho, where the river is channeled and shows high levels of pollution. The last segment corresponds to the portion of the Carioca River that is channeled underground. This part crosses the densely occupied and urbanized area of the neighborhoods of Cosme Velho, Laranjeiras, and Flamengo.

Before its mouth was diverted to the Southern Zone oceanic sewage interceptor, the Carioca River carried the products of irregular sewage discharges and disorderly growth around it. This process intensified the contamination of the Guanabara Bay waters near the beaches of the Flamengo Landfill (Aterro do Flamengo) (Filho et al., 2016) and, very likely, also affected beaches in Niterói with waters from the bay (INEA, 2024). The case of urban contamination of the Carioca River is very similar to cases of other hydrological sub-basins in the city of Rio de Janeiro and its metropolitan region that drain into Guanabara Bay, for example, the Canal do Mangue sub-basin. According to Coelho (2007, p. 20), "the beginning of colonization was also the start of the destruction, not only of the forests that existed on the islands but of the entire Guanabara Bay area." The former president of FEEMA understands that the Portuguese colonial system in Rio de Janeiro and the anthropogenic actions of urban development, from the 17th century to the present day, led to the contamination of carioca and fluminense continental waters and, consequently, to the critical environmental damage of Guanabara Bay.

2.2 Flamengo Beach:

Flamengo Beach is part of the Carioca River sub-basin and the Centro micro-basin, in the South Zone of Rio de Janeiro. It has a beach arc length of 1,660 meters and its width varies between 36 and 66 meters. It is located between the coordinates 22°55'20" S, 43°10'06" W and 22°56'08" S, 43°10'16" W. Throughout the 20th century, its landscape, morphology, and coastline were altered due to successive advances of the city into the sea through land reclamation. The beach is currently located within Flamengo Park; however, originally, it was located along the street of the same name and was smaller in both length and width.

The beach, located on the western edge of Guanabara Bay, exhibits morphological characteristics that reflect the influence of storm surges and the environmental conditions of the region. Although it is a micro-tidal environment sheltered from high-energy waves, the beach is not immune to high-impact events and is considered one of the most dynamic in the bay. The morphology of the beach is directly related to the wave entry zone into Guanabara Bay, where waves undergo modifications as they interact with the region's bathymetry and geomorphology. Due to its location near the bay's entrance and its frontal positioning relative to the arrival of storm waves, Flamengo Beach is more vulnerable to these events, recording significant changes over time. Studies indicate that this beach undergoes substantial seasonal variations in its topographic profiles and sand granulometry. The predominant granulometry is composed of medium quartz sand (51-71%) and fine sand (11-45%), which can change depending on wave energy, the contribution of local outcrops, or human interference, which introduces landfill materials and residues (Silva, 2016). Storm surges occur more frequently and with greater intensity between March and August, representing a risk factor for public and private constructions along the shoreline. Historically, Flamengo Beach has recorded significant storm surge events, such as the one on April 24, 1906, which caused severe damage to the Rio shoreline and is known as the Great Storm Surge ("a Grande Ressaca"). Other notable episodes were recorded in the years 1913 (Figure 3), 1921, 1974, 1980, 1982, 1988, 1997, and 1999, resulting in significant impacts on the local landscape and infrastructure (Santos et al. apud Silva et al., 2016).



Figure 3: Storm surge on Avenida Beira-Mar. Photograph: Carlos Bippus, 1913.
Source: Acervo Instituto Moreira Salles

Flamengo Beach, and all beaches of Guanabara Bay, are in equilibrium with current sea level and climate conditions, as seen in Figure 4. However, the problems faced in this environment are exacerbated by human modifications and inadequate occupation of the coastal strip, making the region even more vulnerable to natural forces. Based on analyses and studies by Silva et al. (2016), Flamengo Beach was classified as having a characteristic morphology, subject to significant variations and highly susceptible to storm surges, differing from the other bay beaches which show moderate or discrete morphological variations. The zone with the highest dynamics in beach width and morphology, and thus greater vulnerability to storm surges, is the middle of the beach arc. Conversely, the part of the beach with the greatest sediment deposition is the southern portion, which has a greater beach width than the center and north of the beach arc (Silva et al, 2016). These aspects highlight the importance of coastal management measures to minimize environmental impacts and ensure the conservation of this essential coastal environment for the city of Rio de Janeiro.

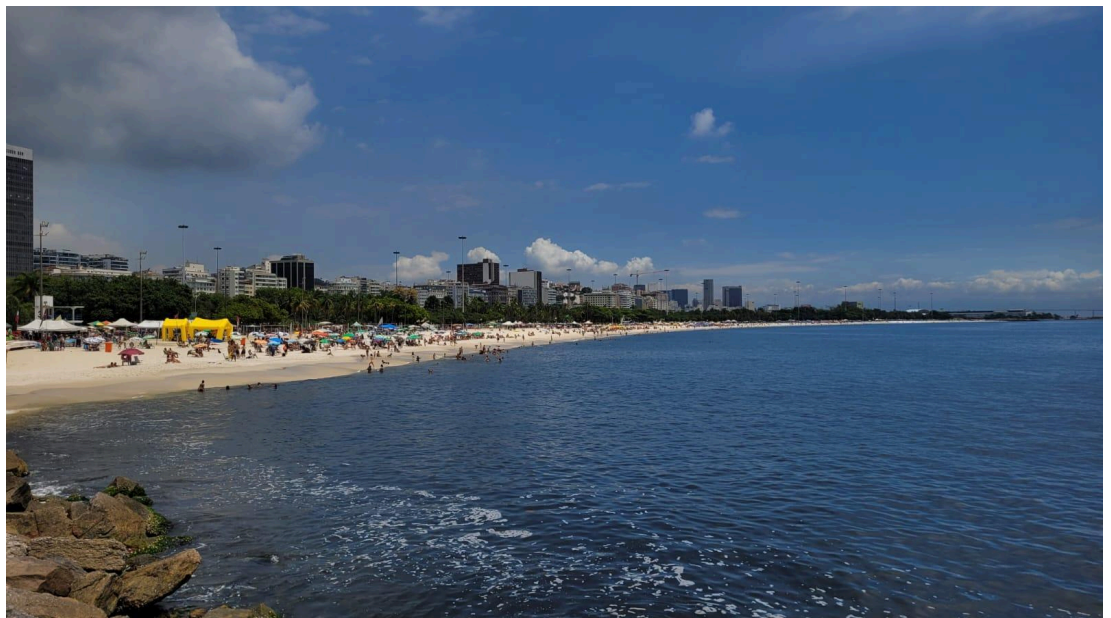


Figure 4: Photograph of Flamengo Beach viewed from the former mouth of the Carioca River, in the southern portion of the beach.

Source: Personal collection, January 2025

3 Regulatory Parameter: CONAMA Resolution No. 274/2000

In Brazil, saline waters, with salinity equal to or greater than 30‰ (such as seawater), are regulated by CONAMA Resolution No. 274/2000. This resolution establishes bacteriological criteria, such as the presence of fecal coliforms, *Escherichia coli*, and enterococci, in addition to measurement parameters involving depth, meteorological conditions, and public density.

Furthermore, CONAMA Resolution No. 274/2000 establishes the classification of waters from beaches intended for primary contact recreation as either improper or proper, with the latter being subdivisible into categories such as excellent, very good, and satisfactory. The water is classified as improper when the value obtained in the most recent sampling exceeds 2,500 fecal coliforms (thermotolerant) or 2,000 *Escherichia coli* or 400 enterococci per 100 milliliters. Results below these quality parameters are considered proper for primary recreational contact (see Table 1).

Table 1: Bathing suitability assessment criteria, according to CONAMA Resolution No. 274/2000.

Bathing Suitability Assessment Criteria – CONAMA Resolution 274/2000		
Classification	Fecal Coliforms (Thermotolerant) (MPN/100ml)	Enterococci (MPN/100ml)
Proper	Maximum of 1000 in 80% of the last 5 consecutive samples	Maximum of 100 in 80% of the last 5 consecutive samples
Improper	Superior to 1000 in more than 20% of the last 5 consecutive samples	Superior to 100 in more than 20% of the last 5 consecutive samples
	Greater than 2500 in the last measurement	Greater than 400 in the last measurement

Source: Table adapted from INEA (2025).

CONAMA Resolution No. 274/2000 also determines that waters are improper when there is: an outbreak of waterborne transmissible diseases; the presence of solid or liquid waste capable of posing a risk to human health and making recreation unpleasant; algal blooms and other organisms until it is proven that they are not harmful to human health; among other factors that contraindicate, either temporarily or permanently, the primary use.

There are several factors that influence bathing suitability, that is, the presence of bacteriological indicators in the beach waters. A major factor affecting urban regions is the presence of pollution. This pollution can come from various sources, such as: nearby systems for the collection, treatment, or disposal of sewage; storm drains and channels discharging directly into the sea, carrying urban and industrial waste, etc. Other factors influencing bathing suitability are the geographical positioning of the beach (as it will interfere with water circulation dynamics), the incidence of meteorological phenomena, and tidal conditions (Valentini, 2021).

In the case of the municipality of Rio de Janeiro and all coastal cities in the state, there is the Inea Systematic Monitoring Program, which monitors the water quality variables of the beaches. Data collection and processing are carried out between 6 and 9 times distributed throughout each month of the year. This database, which has been stored for more than a decade, enables the analysis and interpretation of bathing suitability dynamics and coastal management. And since 2014, the sample collection points have been georeferenced.

In the city of Rio de Janeiro, 44 beaches are monitored, with 64 sample collection points distributed among them. The location and variation in the number of collection points change according to the morphology of the beach. In the case of this study, the Flamengo Landfill (Aterro do Flamengo) has two beaches: Flamengo and Glória. Flamengo Beach, which has been monitored since 2007, has two sampling points: one at the mouth of the Carioca River and another opposite Rua Corrêa Dutra. Glória Beach has one point, near Marina da Glória, which began to be monitored in mid-September 2024, presenting a low number of stored reports. The collection points are georeferenced and can be observed in Figure 5.

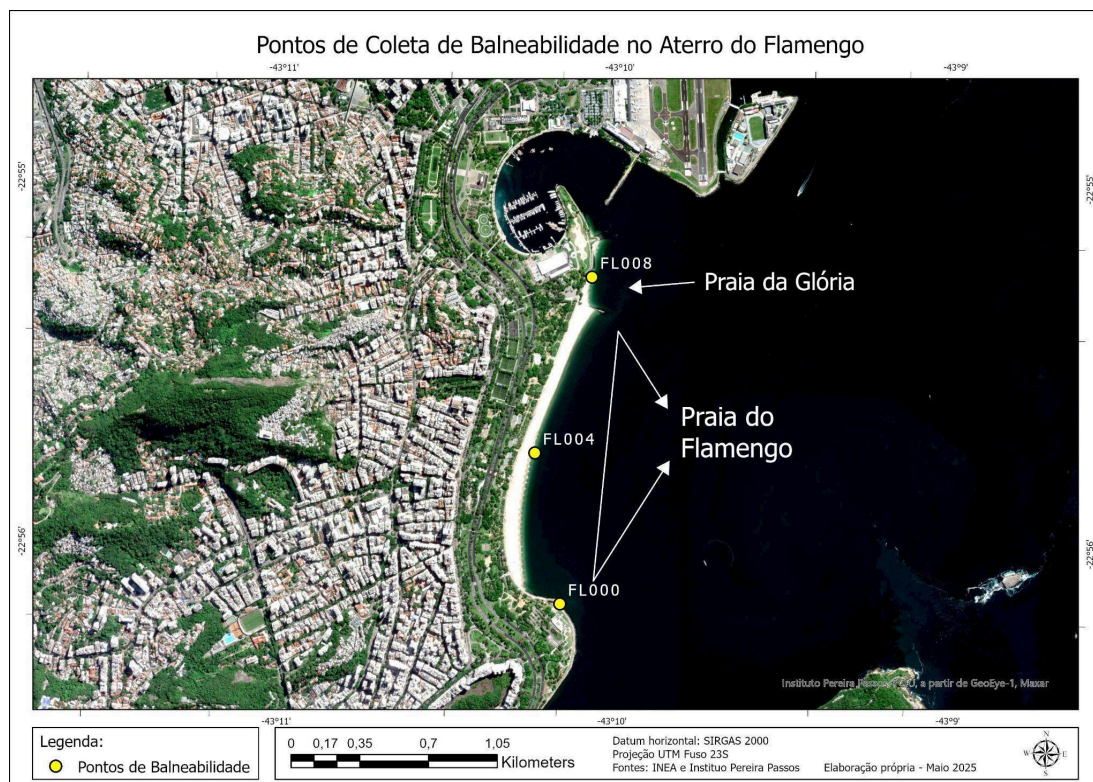


Figure 5: Map of the location of sample collection points for the bathing suitability index of the Flamengo Landfill beaches.

Sources: INEA and Instituto Pereira Passos. Own elaboration.

4 Technical Networks of the Water Use Cycle

For Milton Santos (2006), networks are composed of two main pillars: one that considers material reality and one that considers society. Networks are infrastructures that enable the transport of materials, energy, or information, which act upon a territory characterized by its distribution and form of points, transmission arcs, and their complexities (Curien apud Santos, 2006, p. 176). At the same time, the network is political, social, and geographical, since without its values and materiality, the network is a mere abstraction (Santos, 2006).

For Bakis (apud Santos, 2006, p. 177), there are at least three meanings for the notion of a network. One of them is the network as a concrete projection of lines of relations and connections, where technical networks are not just abstractions but have a visible materiality and are concrete elements of the territory and physical infrastructures that enable connections between different points, facilitating flows and relations of goods, materials, and people in space. The water use network is part of this context. For Santos (2006), networks are animated by flows (dynamism and movement) but do not dispense with their fixed elements (technical bases, infrastructure, and support points); thus, it is possible to draw a parallel with the water use cycle. The water use cycle is animated by the hydrological cycle and human intervention in it (the movement of water in the city, abstraction, treatments, distribution, use, and return). Furthermore, it is composed of its fixed elements, represented by: abstraction, storage, and distribution points; Water Treatment Plants (ETA); Sewage Treatment Plants (ETE); River Treatment Units (UTR); and other hydraulic infrastructures. According to Santos (2006, p. 188), "fixed elements and flows are intercurrent, interdependent." Thus, it can be understood that in the water use cycle, the fixed infrastructure depends on the flows for the existence of its purpose and functionality. Moreover, the relationship between flows and fixed elements in the water use cycle reflects a dynamic of balance between stability (fixed infrastructure) and change (flows). The stability of the infrastructure does not prevent adaptation to new demands and urban changes.

The natural water cycle has been transformed to meet the growing demands of the human population for water resources through deforestation, natural resource exploitation, and urbanization. This cycle consists of five stages: abstraction of raw water from a source; treatment of raw water at a WTP; distribution and use of water by humanity; collection and treatment of sewage at an STP; and discharge of treated sewage into a water body. Abstraction is the first step in the water supply cycle. Raw (untreated) water is withdrawn from sources, which can be surface water (rivers, lakes, and reservoirs) or groundwater (aquifers and artesian wells). The abstraction site usually has structures such as pumps and screens to prevent the entry of large debris. After abstraction, the water goes to a WTP, where it undergoes several stages to make it potable and safe for its intended uses, such as coagulation and flocculation, sedimentation, filtration, disinfection, and pH correction and fluoridation. The treated water is distributed through systems of water mains and distribution networks that reach homes, businesses, institutions, industries, and agricultural areas. After use, the water becomes sewage, containing organic, chemical, and pathogenic waste. It is collected by sewer networks and directed to an STP, where it undergoes various processes to minimize environmental impacts, such as primary, secondary, and tertiary treatments. After treatment, the treated effluent is returned to a water body (ANA, 2021). A temporary alternative for the treatment of degraded urban rivers is the use of River Treatment Units (UTR). These structures, similar to sewage treatment plants, are installed directly in the riverbed, usually near its mouth. In this way, they can treat the water before it discharges into another water body, reducing pollution from upstream areas.

5 Materials and Methods

The investigation into the bathing suitability of Flamengo Beach required the use of different types of sources and methodological approaches, aiming to understand not only the current water quality in the region but also the historical, geographical, and institutional processes that have shaped its environmental condition over time. For this purpose, data of a historical and environmental nature were gathered, allowing for an integrated analysis of bathing suitability.

5.1 Historical Records

The Digital Newspaper Archive of the National Library Foundation (Hemeroteca Digital da Fundação Biblioteca Nacional) and the archive of the newspaper O Globo were used as primary research sources. The former allowed access to a wide range of old periodicals, dating from the late 19th century and throughout the 20th century, covering news, columns, reports, and advertisements documenting urban interventions and environmental issues in the studied region. The O Globo archive contributed a more contemporary view of events, offering articles published between the late 20th and early 21st centuries, especially focused on urban and environmental themes.

The analysis of these materials made it possible to relate technical bathing suitability data with the social and symbolic use of the area over time, revealing the transformations that occurred in the space and their environmental impacts. Thus, the historical records served as a fundamental tool for understanding how physical, political, and cultural factors have shaped — and continue to shape — both the environmental conditions and the way the beach is perceived by society.

5.2 INEA Bathing Suitability Bulletins

The bathing suitability bulletins are provided by INEA, the body responsible for monitoring water quality on the beaches of the state of Rio de Janeiro. These bulletins, made available to the public through the institute's official website, present updated and properly laboratory-processed surveys regularly on the suitability of beaches for recreational bathing, based on microbiological parameters, especially the concentration of fecal coliforms and enterococci, as stipulated by CONAMA Resolution No. 274/2000.

The use of these bulletins allowed for the analysis of the bathing suitability situation at Flamengo Beach from 2007 to the present day, identifying periods when the beach was considered suitable or unsuitable for bathing. These data were fundamental for understanding the dynamics of water pollution in the study area, as well as for evaluating the effectiveness of public policies and sanitation systems that directly impact water quality.

Furthermore, the historical series of bulletins allowed for the creation of tables and graphs, in addition to establishing a temporal comparison, contributing to the identification of patterns of contamination recurrence and possible seasonality. The analysis of this technical data was integrated with other information in the study, such as historical records and cartographic data, allowing for a multidimensional approach to bathing suitability at Flamengo Beach.

5.3 Geographic Data Sources and ArcGIS Pro

The cartographic and spatial base of this study was built from geographic data obtained from public and institutional open-access platforms. Among the main sources consulted are Data.Rio and the State Environmental Institute (INEA). The Data.Rio portal, maintained by the Rio de Janeiro City Hall, provided georeferenced information regarding municipal boundaries, neighborhoods, watersheds, and the city's hydrographic network. INEA provided the location of the collection points used for the bathing suitability analysis at Flamengo and Glória beaches, which were subsequently georeferenced using ArcGIS Pro software.

The manipulation, organization, and visualization of these data were performed in ArcGIS Pro, a geoprocessing tool that enabled the handling of multiple spatial layers, the creation of maps, and the conduction of detailed territorial analyses. Furthermore, thematic maps were produced that visually synthesize the information analyzed throughout the study, facilitating the understanding of the water sample collection areas and the Carioca River basin. Thus, the use of ArcGIS Pro proved essential for integrating environmental and spatial data, promoting a visual and analytical approach aligned with the objectives of this research.

5.4 Current Journalistic Sources

The journalistic sources used in this research were essential for capturing the recent dynamics of processes related to the bathing suitability and environmental degradation of the Carioca River Basin, which flows into Flamengo Beach. The reports allowed for the observation, based on continuous and updated records, of how the pollution problem has been addressed by authorities, the press, the population, and scientific bodies in recent years. The journalistic material was particularly important for identifying reports of non-compliance with environmental regulations, leaks and clandestine sewage dumping, delays in sanitation measures, and failures in environmental recovery programs. Additionally, the reports made it possible to monitor the institutional performance of bodies such as INEA, CEDAE, the concession holder Águas do Rio, the Rio-Águas Foundation, and the Rio de Janeiro City Hall, highlighting advances, omissions, and jurisdictional disputes over time. The articles also reveal the role of the press in public pressure for solutions and transparency, functioning as a mediation channel between society's demands and the actions of the public authorities. In this sense, the journalistic sources were not treated merely as repositories of information, but also as records of the discourses, conflicts, and interests involved in the environmental management of the watershed.

The following outlets were primarily consulted: O Globo (digital), which contributed in-depth reports and medium- and long-term coverage on the pollution of Flamengo Beach and the situation of the Carioca River; G1, Globo's news portal, focusing on frequent updates and coverage of specific events related to the environment and urban infrastructure; Diário do Rio, a digital outlet specializing in matters of the city

of Rio de Janeiro, with opinion pieces and exposes on environmental and urban issues; EuRio, a digital media outlet focused on disseminating socio-environmental initiatives and citizen oversight of topics related to sustainability and quality of life in the city.

6 Results and Discussions

6.1 First Reported Cases of Pollution at Flamengo Beach

Within the newspaper archives, the first indications of more severe pollution emerged from the 1950s onwards. In an initial case from 1957, there is a report of a rupture in a sewage culvert on Pinheiro Machado Street (Laranjeiras). In this instance, the State Government's Sewage Department suggested diverting the raw sewage directly into the Carioca River, which flowed into Flamengo Beach. This measure created conditions unsuitable for bathing until the ruptured sewage culvert was repaired. The lifeguard interviewed for this report stated he was not informed of the measure taken by the authorities and mentioned that had he been aware of the incident, he would have advised bathers not to enter the sea. The newspaper *Diário da Noite*, which broke the story, also stated that Flamengo Beach was a very popular area and that the Health Department should post notices about unsuitable bathing conditions at the beach access points.



Figure 7: Excerpt from news in the newspaper *Diário da Noite*, 1957, edition 06027, page 2.

Source: Fundação Biblioteca Nacional

In January 1970, the newspaper O Globo reported on the contamination of Flamengo Beach via raw sewage improperly discharged into the Carioca River. In the report, the director of the Water Pollution Division informed that the Carioca River suffered from pollution due to the injection of clandestine sewage. To this day, this problem remains largely unchanged.

Rio Carioca, esgoto que desemboca no Flamengo

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Uma autoridade do Governo estadual admitiu, ontem, pela primeira vez, que há poluição em todas as praias cariocas, e não apenas em Botafogo. Falando para o que pensava serem dois habitantes do Flamengo — um repórter do O GLOBO e outro cidadão, este mirador do bairro — o Sr. Orlando Castelo Branco, diretor da Divisão de Poluição de Águas, do Instituto de Engenharia Sanitária da SURESAN, declarou que "as praias de Botafogo, Flamengo e Ramos são muitas vezes de cabeça, sendo bastante poluídas, mas isso não é de se estranhar, porque há o mesmo problema em todas as praias cariocas, embora em menor escala".

— A praia do Flamengo — explicou — é um caso de polícia. O rio Carioca, que despeja suas águas naquela praia, de há muito tempo está poluído em seu curso recebe as efluentes de inúmeras residências, desde o alto do Corcovado. Em consequência, ninguém pode negar que isso ocasiona poluição no Flamengo.

A verdade

Foi-se passou no prédio 121 da Rua Foneca Teles, onde funciona a SURESAN. Antes de serem atendidos pelo diretor da Divisão de Poluição de Águas, o repórter do O GLOBO e o morador do Flamengo passaram pelo Departamento de Registros Sanitários e pelo Departamento de Ilhas e Canais, para depois chegar ao Sr. Orlando Castelo Branco.

A única preocupação do diretor do IES — que acabou de assumir — se mostrava bastante desconfiado — foi saber se os dois pertenciam a alguma entidade, comissão de moradores, associação, ou se eram da imprensa. Ao saber que eram apenas "dois pais preocupados com a saúde dos seus filhos", reconheceu na criança, sorriu um pouco, e passou a falar abertamente.

Não se trata

— O problema do rio Carioca é uma história muito antiga — afirmou —. Tudo tem relação com o planejamento do Parque do Flamengo. Quando se decidiu de fazer uma praia naquele local, por isso o rio Carioca poluiu, logo depois para o mar. Não foi feito qualquer plano para a captação de suas águas, que foram sempre jogadas para o mar. A bem da verdade, o rio Carioca de há muito não é rio, mas um rio morto, tal a quantidade de esgoto residencial que recebe em seu curso. Toda essa matéria é levada diretamente à praia do Flamengo.

Na sua opinião, construir agora um novo interceptador para receber as águas do rio Carioca vai custar muito caro. Também não podemos jogar as dejetos do interceptador de Botafogo, porque ele tem uma vazão de 200 metros cúbicos de água por minuto, em tempo seco. Isso provocaria a saturação da zona do atual interceptador, sem se falar na vazão em tempo de chuva.

Dentro dos próximos quatro meses o IES espera dar uma solução ao problema das praias de Botafogo e Flamengo. Está apenas esperando concluir estudos para iniciar a captação das águas do rio Carioca e dos rios de Botafogo. No Flamengo, a direção não tem

Questão de estética

Enfrentando o fato de ser conhecida a poluição das praias de Ramos e Flamengo, mas ad a de Botafogo ter sido oficialmente interdita, o repórter perguntou ao diretor da Divisão de Poluição de Águas da SURESAN por que foi feita tal discriminação, deixando que a população continue a correr risco de contaminação. Ele respondeu que a não-interdição de Ramos e Flamengo "revolve a um problema de estética. E foi exatamente essa situação que nos obrigou a decretar a poluição da Praia de Botafogo, pois ali as manchas foram provocadas por esgoto se manifestaram em suspensão em meio aos banhistas, chegando até a praia. Naturalmente essa situação não poderia ser tolerada. No caso de Ramos e Flamengo, o material fecal que porventura exista, se apresenta diluído, com menor probabilidade de transmitir doenças".

— Este problema de transmissão de moléstias pela poluição, por sinal, é muito controverso — acrescentou —. Até hoje não se tem qualquer trabalho científico que indique qual o grau de poluição de água que ocasiona doenças. Pelo contrário, há inúmeros trabalhos afirmando o contrário, isto é, que uma pessoa que se banha diariamente em água poluída teria de morrer, e mesmo rotina durante cinco anos seguidos, bebendo diariamente cerca de 20 litros de água para poder sobreviver.

Caso de polícia

De fato, "maradões" do Flamengo, além a guarda do Sr. Castelo Branco sobre a poluição ocasiona ou não doenças, resolve-se por enquanto, pelo menos, não seria possível prevenir agora, interdição das praias, em vez de remediar depois, visando as possíveis vítimas de uma epidemia. Respondendo ao que tanto Ramos como Flamengo são casos de polícia: seria preciso "agarrar pelo tempo" cada uma das praias que vai à praia, e impedi-la de entrar lá. A solução seria colocar guarda em todas elas. O exemplo de Botafogo está em mesmo interdição, conforme acima mencionado.

A interdição das praias, além disso, explicou o diretor da Divisão de Poluição de Águas da SURESAN, caberia à Secretaria de Saúde, que não o faz porque "tem sob pressão constante o único assunto da população".



"O RIO CARIOCA HA MUITO TEMPO FOI TRANSFORMADO EM ESGOTO"

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O Clube de Engenharia convida a todos os interessados para a conferência a ser proferida pelo Secretário de Ciência e Tecnologia do Estado da Bahia, engenheiro professor José Walter Bastiani, sobre "A Política de Ciência e Tecnologia da Bahia", amanhã, dia 28, às 17 horas, no Edifício Edison Passos, à Avenida Rio Branco, 124 — 25.º andar.

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Figure 8: Excerpt from news in the newspaper O Globo, 1970.

Source: Acervo O Globo

A pollution-related accident at Flamengo Beach occurred in 1976 when a student was affected by ship oil dumped into Guanabara Bay, suffering burns and an internal infection. The Diário de Pernambuco newspaper reported that the administration of the Souza Aguiar hospital, where the young man was admitted, notified FEEMA (the former environmental control agency of the Rio de Janeiro state government, which later became part of INEA) and the Port Authority about the case. Besides the student, his friends from the neighborhood, who had likely bathed in the same waters, also suffered from infections.

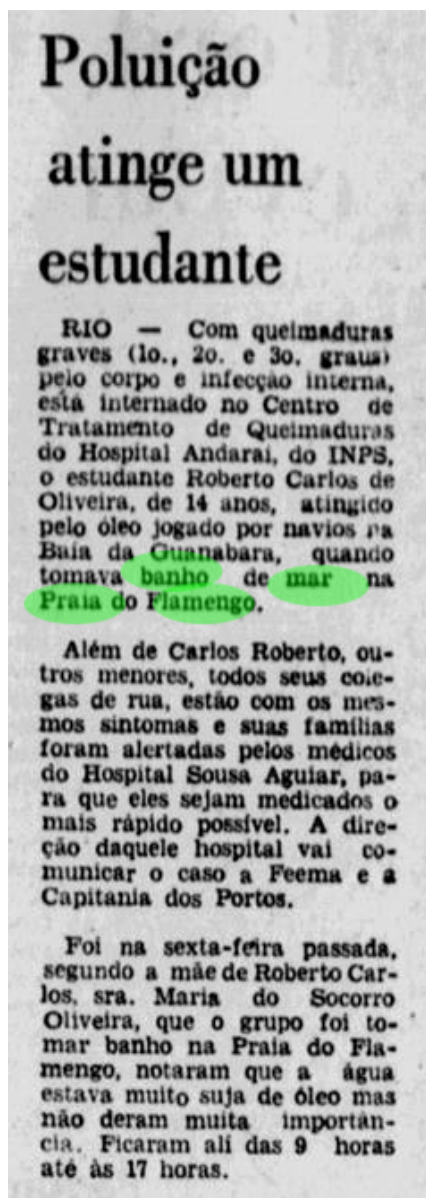


Figure 9: Excerpt from news in the newspaper Diário de Pernambuco, 1976, edition 00208, page 11.

Source: Fundação Biblioteca Nacional

In its July 28, 1987 edition, O Globo denounced the very poor quality of Flamengo Beach. The newspaper emphasized the importance of not bathing in the beaches of Guanabara Bay due to unhealthy bathing conditions. FEEMA, in a joint effort with CEDAE, warned of high coliform levels and the harm to human health caused by ingesting even small amounts of this water. In the report, frequent visitors and workers at Flamengo Beach reported the visibility of feces, debris, dead fish, and dark sands, in addition to the foul smell at the traditional carioca beach.

Praias sujas: o risco de doenças

A ingestão de pequena quantidade de água das praias de Botafogo, Flamengo e Urca pode ser suficiente para causar complicações de saúde. De acordo com a Feema, as praias estão impróprias para o banho e contato com a areia, onde as bactérias das fezes de cachorro são amea-

ças à saúde dos banhistas. Testes realizados com a água provam que o índice de esgoto **in natura** ultrapassou o limite admitido pela Feema. Muitos banhistas, no entanto, preferem ignorar os riscos e frequentam os locais em busca de lazer.

Página Central

Figure 10: Excerpt from news in the newspaper O Globo, 1987.

Source: Acervo O Globo

It is evident that the unchecked urban evolution and growth, coupled with poor sewage management in the city of Rio de Janeiro and its metropolitan region, led to environmental aggression and, consequently, the environmental degradation of the seaside spaces of the Flamengo Landfill.

6.2 The Influence of Effluent Technical Networks on the Bathing Suitability of Flamengo Beach

6.2.1 The Flamengo UTR, the Carioca River Issue in 2022, and the Diversion to the Oceanic Interceptor

River Treatment Units (UTRs) represent a palliative measure for the primary treatment of urban rivers. They are located in the riverbed and help prevent the waters of these rivers from reaching the sea with high levels of contamination, using methods of coagulation, flocculation, and dissolved air flotation. A major criticism of the Flamengo UTR, installed in 2002, is that the adoption of this tactic does not contribute to the depollution of Guanabara Bay but only masks the water surface and does not solve the real water quality problems (Salgado, 2014), in addition to taking a decade to reach full operation.

In March 2022, the Flamengo UTR - Carioca River Treatment Unit at the Flamengo Landfill - was deactivated by the Rio-Águas Foundation, of the Rio de Janeiro City Hall, following the concession of the State Water and Sewage Company of Rio de Janeiro (CEDAE). During the period when the floodgates were open, at least 300 liters of contaminated water per second were left untreated (almost 26 million liters per day). Figures 11 and 12 clarifies the situation experienced by the UTR since the cessation of its activities in March 2022.



Figure 11 and 12: Photographs of the deactivated Flamengo UTR.

Source: Personal collection, January 2025

The impasse worsened due to the division of responsibilities between the state government and the municipality. INEA (state) claims that river management is the responsibility of the Rio-Águas Foundation (municipality), which signed an agreement in the past, while Águas do Rio (state concessionaire) clarifies that the UTRs are not part of its concession contract, although it presented a technical analysis with alternatives for treating the Carioca River. However, river management falls under the state government, while stormwater galleries are the responsibility of the municipality. The Carioca River, which flows almost entirely through a stormwater gallery, suffers even more from the situation: with the UTR out of operation, the floodgates remain open 24 hours a day, allowing untreated sewage to be discharged directly into Guanabara Bay.

The UTRs are not included in the CEDAE concession contract to Águas do Rio, which was not responsible for operating this equipment. The management and maintenance of these state-owned assets had been under the responsibility of the city hall since 2007.

Rio-Águas reported that it returned the operation of the UTR to the state, which is "demonstrably linked to the provision of basic sanitation services under the Águas

do Rio concession." The municipality also stated that the State Secretariat of the Civil House (responsible for coordinating the articulation between various secretariats and government entities), INEA, and the concessionaire assumed responsibility for completing the transfer of the UTR, which was formally handed over on March 9, 2022.

During this period of "buck-passing," Flamengo Beach, an important Rio landmark, received raw sewage and, as a consequence, experienced a significant worsening in its bathing suitability indexes (which had already accumulated many unsuitable reports for years).

To end this impasse, Águas do Rio carried out the diversion of the Carioca River to the Ipanema submarine outfall in May 2022, which was accepted by INEA. The company states that this measure is an alternative solution found to guarantee the water quality and bathing suitability of Flamengo Beach.

However, this measure was not enough to completely stop the pollution of Flamengo's waters. In May 2022, technicians from Águas do Rio and researchers discovered the introduction of clandestine sewage through stormwater drainage connections. These connections are located beneath the wooden deck where the Carioca River flowed after being treated at the UTR. Researchers Maria Lobo (coordinator of the S.O.S. Mata Atlântica Carioca River observation group) and Luciana Falcão (civil engineer and member of the Guanabara Bay Watershed Committee) noted in samples from the same period that the water at the mouth of the Carioca River was darker than at the deactivated UTR itself, evidencing illegal and irregular sewage dumping.



Figure 13: Wooden deck represented by the yellow area, where illegal sewage dumping occurs.

Source: Google Earth, 2025

According to Municipal Complementary Law No. 210 of October 1, 2019, during self-inspections of buildings, the condition of connections to the public sewage system should be verified. The objective was to ensure that, when necessary, corrective actions were adopted. However, scientists Maria Lobo and Luciana Falcão, in a statement to TV Globo on 05/07/2022, stated that the law is not being properly enforced.

Águas do Rio, in May 2022, began diverting the Carioca River to the oceanic interceptor, which collects sewage and stormwater from neighborhoods between Glória and Ipanema and takes them to the Ipanema submarine outfall. Throughout 2022 and 2023, after more than five decades since its inauguration, the concessionaire cleaned sections of the tunnel. This measure was taken to prevent floods, relieve the overload of waste accumulated for over 50 years, and receive the new load from the Carioca River.

Sinval Andrade, superintendent of Águas do Rio, argues that his company's enforcement and the diversion of the mouth of the Carioca River to the Southern Zone oceanic interceptor have improved the bathing suitability at Flamengo and Botafogo beaches. "This provisional measure prevents about 180 liters of sewage per second from being discharged directly into Guanabara Bay. The result can be seen on Botafogo and Flamengo beaches, which, this year (2022), have had days of crystal-clear water. Our challenge, however, is to make this bathing suitability constant, by eliminating the clandestine connections. The process requires everyone's participation," said Sinval in a statement to the *Diário do Rio* newspaper in December 2022.

6.2.2 Overview of INEA Bathing Suitability Bulletins

Using the data from the bathing suitability bulletins for Flamengo Beach, available on the INEA website, a graph was constructed representing the annual percentage of bulletins classified as suitable for bathing in relation to the total bulletins issued from 2007 to 2024. From this material, it is possible to observe: the highest percentages of suitable bulletins in the years 2016 (43%), 2023 (35%), and 2024 (80%); the most significant increases, such as from 2015 to 2016 (6% to 43%), from 2022 to 2023 (17% to 35%), and especially from 2023 to 2024 (35% to 80%); and the sharpest declines, such as from 2016 to 2017 (43% to 8%).

It is noted that in the bulletins provided by INEA from 2007 to 2012, there are occurrences of classifications such as "recommended with restrictions." In these cases, to standardize with subsequent bulletins, they were considered as suitable, just as INEA itself considered them in its annual reports on the percentage of suitable bulletins, which include the entire series since 2007.

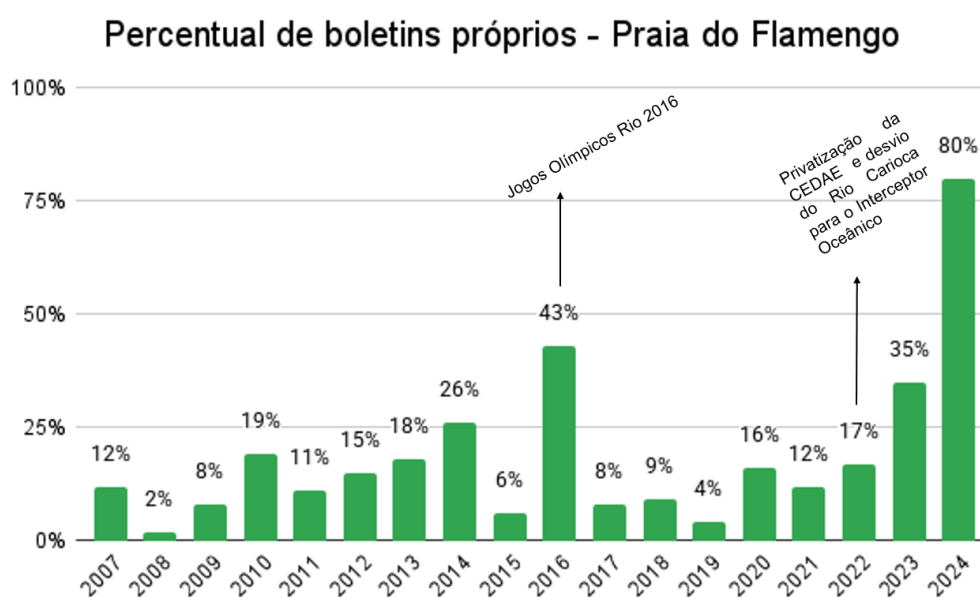


Figure 13: Annual percentage of suitable bathing suitability bulletins for Flamengo Beach (2007-2024).

Source: Own elaboration, 2025.

These oscillations between sharp improvements and deteriorations are related, respectively, to the creation of policies and programs for the depollution of Guanabara Bay and Flamengo Beach and their discontinuation. These programs were also created in a context of immediate and specific improvement of the beach's bathing suitability. The case of 2016, the year of the Olympic Games in Rio de Janeiro, can be pointed out, when the city received approximately 1.17 million tourists (Corrêa, 2016) and Guanabara Bay was used for sailing competitions in the Marina da Glória area. It was in the public interest to specifically improve the environmental issue plaguing the waters of Guanabara Bay (mainly in the Center and South Zone, tourist areas), so that the international reputation of the city and the country would not be degraded. Thus, the Rio de Janeiro City Hall and the Olympic organizations used palliative measures to improve water quality for the Olympic event, such as waste containment with eco-barriers and eco-boats and the development of sewage collection and treatment flowing into Guanabara Bay by approximately 427% (Brasil, 2016). And as observed in subsequent years, this engagement in the bay's depollution belonged exclusively to the Olympic period, and there was a discontinuation of a long-term project.

When Rio de Janeiro was chosen to host the 2016 Olympics in 2009, the largest depollution program for Guanabara Bay, the PDBG (Guanabara Bay Depollution Program), had already been discontinued for two years. Launched in 1994, the PDBG was a partnership between the state and federal governments, with initial funding of US\$793 million — US\$350 million from the IDB (Inter-American Development Bank), US\$237 million from the JBIC (Japanese Bank for International Cooperation), and US\$206 million from the state government. Emerging in the context of the relevance of the environmental agenda on the world stage, the PDBG divided its activities into five pillars: sanitation, macro-drainage, solid waste, environmental projects, and digital mapping. According to Coelho (2007, p. 69), "the PDBG was practically a basic sanitation program, with an emphasis on sewage collection and treatment, as a first step in reversing the pollution of the bay [...]". The PDBG suffered from a lack of administrative continuity, delays, and poor resource management; thus, it failed to fulfill the promises made in the 1990s (Coelho, 2007).

The PDBG had a successor, also with support from the IDB and the Rio de Janeiro State Government (totaling an initial budget of US\$640 million), launched in 2012, the PSAM (Environmental Sanitation Program), focused on sewage treatment in municipalities around Guanabara Bay, with the aim of depollution and environmental preservation in the region. Not very different from its predecessor, the PSAM also faced delays in its targets until the concession of CEDAE to private companies, which emerged in the context of the new legal framework for basic sanitation.

6.2.3 Legal Framework for Basic Sanitation (2020)

The main objectives of the new legal framework for basic sanitation, approved in 2020 by Law No. 14,026, are the universalization of basic sanitation services for the Brazilian population by 2033, regulatory coherence, and the encouragement of private participation through concessions and public-private partnerships in the sanitation sector in Brazil (Melo, 2023). In this context, the privatization of CEDAE (RJ) to various private groups took place, due to support for the regionalization of services and the encouragement of free competition. In the case of the study area of this work, the responsible concessionaire is Águas do Rio (a company of the Aegea group). The concessionaire's promise after taking over is an investment of R\$19 billion in the municipalities under its control (Águas do Rio, 2023). Investments for the depollution of Guanabara Bay are R\$2.6 billion. The objectives are the construction of sewage collection belts around the bay, treatment of urban rivers that flow into Guanabara Bay, expansion and modernization of STPs, cleaning of the Southern Zone oceanic interceptor, among others.

Years after the concession, environmental indexes in Guanabara Bay showed improvement, due to investment in expanding sewage collection and treatment

systems in the municipalities bordering the bay. Therefore, the change in the environmental aspect of the waters of Flamengo, Botafogo, Urca, and Paqueta Island is notable. The concessionaire stated that sewage collection and treatment coverage in the Center and South Zone reached 100% by the end of 2024. However, in poorer areas under Águas do Rio's control, this scenario is not repeated. The North Zone of the capital up to São Gonçalo still suffers from the lack of treatment of its urban rivers and the dumping of thousands of liters of leachate from deactivated dumps. These facts evidence that, so far, the largest investments are concentrated in the richer regions of the bay, such as the Center and South Zone of Rio de Janeiro and Niterói.

In the first half of 2025, the city halls of Rio de Janeiro and Niterói, with support from the federal and state governments of RJ, presented a bid dossier for the two cities to host the 2031 Pan American and Parapan American Games. The document includes the desire for various investments in infrastructure, sustainable development, and useful legacy. In the context of the new legal framework for sanitation, the city halls note that Guanabara Bay is in a process of gradual depollution and cites the goal of the Legal Framework for Sanitation that, by 2033, 90% of the sewage in Águas do Rio's control areas will be collected and treated. Furthermore, if the cities are chosen to host the Games, the target will be met two years earlier, in 2031. The depollution of Guanabara Bay is a state-level responsibility, but the city halls count on the support of the current state governor to carry forward the responsibilities of the investments outlined in the bid dossier.

7 Final Considerations

This study has brought together techniques and disciplines from various fields of Geography, consistently aiming to promote a comprehensive and integrated geographical understanding of seawater quality at the historic Flamengo Beach in Rio de Janeiro, designated for leisure and primary contact recreation. Multiple geographical perspectives were employed to understand both the historical processes and current situation of Flamengo Beach. The integration of Urban Geography, Coastal and Environmental Management, and Historical Cartography enriched this research through the interdisciplinary approach that Geography facilitates.

The rapid urban expansion and lack of adequate planning for population growth have resulted in numerous negative environmental impacts along the coastal area of the Flamengo Landfill. The absence of effective and widely-accessible basic sanitation policies throughout Rio de Janeiro's history, coupled with inadequate waste disposal practices, has significantly contributed to the pollution and environmental degradation of both Flamengo and Glória Beaches.

Furthermore, disordered urbanization and irregular occupation of riverine and coastal areas have intensified damage to local ecosystems, compromising water quality and marine flora and fauna. The dumping of clandestine and untreated sewage into the Carioca River basin exacerbates the problem, rendering the Flamengo Beach environment unhealthy for decades and harming both biodiversity and the population's quality of life, including their right to leisure access.

The classification of Flamengo Beach as unsuitable for bathing for many decades can be understood as a consequence of poor environmental and urban territorial management in both the Carioca River basin and Guanabara Bay, resulting from neglect and negligence by public authorities. For centuries, they have allowed pollution of various types and from multiple sources to enter Guanabara Bay's waters. The blame is not exclusive to the public sector; private entities also bear significant responsibility for environmental aggression against Guanabara Bay, with pollution vectors originating from industries, refineries, port activities, and construction operations.

Flamengo Beach has only rarely seen its bathing conditions classified as suitable. These almost exceptional occasions likely occurred due to the need for immediate, targeted improvements in water quality, as witnessed during the 2016 Olympic Games. During this period, a sharp improvement in INEA's bathing suitability reports was observed, followed by a marked deterioration in the year after the Olympics. This pattern highlights both the discontinuity in depollution plans for Flamengo Beach and Guanabara Bay, and the interest in maintaining suitable bathing conditions only during the months surrounding August 2016, when the sporting event took place.

In the current scenario, Flamengo Beach is demonstrating historically significant results regarding bathing water quality. Following a period of bureaucratic disputes over responsibility for the Flamengo UTR in the post-CEDAE concession environment, the measure implemented by the concessionaire Águas do Rio to divert the mouth of the Carioca River to the Southern Zone oceanic interceptor proved fundamental to the positive bathing suitability reports after 2022. The years 2024 and 2025 (up to this study's publication) have shown excellent percentages of suitable ratings.

Despite the improvement in bathing conditions at Flamengo Beach resulting from the diversion of the Carioca River to the oceanic interceptor, this remains a palliative measure—a "stopgap solution." The Carioca River ecosystem continues to suffer damage, though this is now less visible to the public. This measure does not address or eliminate the pollution sources affecting the Carioca basin, which continues to suffer from improper disposal of sewage and waste that pollute water bodies and their banks.

To reverse this pattern of environmental damage, the implementation of public policies from the municipal government, the Rio de Janeiro state government, and the concessionaire Águas do Rio is essential. These should focus on sanitation, rehabilitation of degraded rivers and beaches, and enhanced control over land use and private activities that harm ecosystems, at both the Guanabara Bay scale and the Carioca River basin scale. Ideally, this would involve creating a new Guanabara Bay Depollution Program—this time more stringent and punitive toward those who degrade the bay—with greater commitment from all stakeholders involved. A new PDBG should also feature substantial federal investment alongside significant contributions from municipal and state authorities.

Beyond large-scale efforts focused on Guanabara Bay, pollution source control at smaller scales is necessary, as demonstrated by the Carioca River diversion to the oceanic interceptor, despite its palliative nature. Municipal authorities and concessionaires must monitor such cases and seek non-palliative measures that address structural problems equitably, regardless of the municipality, zone, or economic status of resident populations. This proposal complements current Guanabara Bay depollution planning under the new Legal Framework for Sanitation through public-private partnerships with concessionaires, alongside additional investments that may materialize if the Rio-Niterói bid for the Pan American and Parapan American Games proves successful.

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