



Impacts of clandestine sewage connections on drainage channels in Aracaju-SE

Impactos de las conexiones clandestinas de alcantarillado en los canales de drenaje de Aracaju-SE

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Abstract: Basic sanitation is extremely important for people's quality of life. However, various actions have a negative impact on sanitation in cities. Among these actions is the discharge of untreated sewage into drainage channels. Several drainage channels in the city of Aracaju-SE have been found to receive clandestine discharges of untreated sewage. Given the above, this article aims to carry out a literature review on the impacts caused by the discharge of untreated sewage into the drainage channels of Aracaju-SE. To carry out this work, the bibliographical research methodology was adopted, consisting of a review of the literature related to the theme of clandestine sewage connections in drainage channels and the various impacts generated by this action. The research used books, course conclusion papers, scientific articles, and other sources. The results show that *in natura* sewage discharges into drainage channels have negative impacts on public health, the environment, and the structures of the urban drainage system. It is concluded that investment in basic sanitation should be treated as a priority, as it is directly correlated with public health and environmental quality.

Keywords: *Urban drainage, Public health; Investment.*

Resumen: El saneamiento básico es extremadamente importante para la calidad de vida de la población. Sin embargo, varias acciones tienen un impacto negativo en el saneamiento de las ciudades. Entre estas acciones, podemos mencionar la descarga de aguas residuales no tratadas en los canales de drenaje. Se observa que varios canales de drenaje de la ciudad de Aracaju/SE reciben descargas clandestinas de aguas residuales no tratadas. En vista de lo anterior, este artículo tiene como objetivo realizar una revisión bibliográfica sobre los impactos causados por la descarga de aguas residuales no tratadas en los canales de drenaje de Aracaju/SE. La metodología adoptada para este trabajo fue una investigación bibliográfica, que consiste en la revisión de la literatura relacionada con el tema de las conexiones clandestinas de alcantarillado en los canales de drenaje y los diversos impactos generados por esta acción. Para la investigación se utilizaron libros, trabajos de tesis, artículos científicos, entre otras fuentes. Los resultados muestran que la descarga de aguas residuales crudas en los canales de drenaje tiene impactos negativos en la salud pública, el medio ambiente y también en las estructuras del sistema de drenaje urbano. Se concluye que la inversión en saneamiento básico debe ser tratada como una prioridad, ya que está directamente correlacionada con la salud pública y la calidad del medio ambiente.

Palabras clave: *Drenaje urbano, Salud pública; Inversión.*

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Received for publication on 2024/04/04; approved on 2023/10/25.

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INTRODUCTION

According to Costa and Guilhoto (2014), environmental sanitation includes a set of activities related to water and sewage treatment, waste collection, and hygiene practices. Basic sanitation plays a fundamental role in people's quality of life and in the development of communities and societies as a whole and can be defined as a set of measures (drinking water supply, sewage disposal, urban cleaning and solid waste management, drainage, and urban rainwater management) whose aim is to preserve the environment and promote collective health, as well as ensuring quality and the right to a dignified life. (Bilibio, Da Silva, Navarro and Da Silva, 2021).

Still, according to Bilibio, Da Silva, Navarro, and Da Silva (2021), even though it is a fundamental right and guaranteed by the Brazilian constitution, it can be seen that in many regions the sanitation system is considered precarious or even non-existent, especially in regions that are difficult to access or on the outskirts.

A common practice, that is extremely harmful to human health and the environment, is the dumping of raw sewage into urban drainage channels. There are countless clandestine connections to sewage networks that compromise the physical structure of the network, causing countless damages to sewage networks, causing environmental damage, and in times of torrential rainfall can cause sewage to flow back into homes (Brk Ambiental, 2022).

Because of the above, this article aims to carry out a literature review on the impacts caused by the discharge of untreated sewage into the drainage channels of Aracaju-SE.

THEORETICAL BACKGROUND

Sanitary sewage system

Ordinance No. 1,917, of August 9, 2019, from the Ministry of Integration and Regional Development, defines sanitary sewage as a system "consisting of the activities, infrastructures, and operational facilities for the adequate collection, transportation, treatment and final disposal of waste, from the building connections to its final discharge into the environment".

As far as effluents are concerned, it starts with collection through the sewage network, which must be treated, with a view to environmental preservation and society's quality of life. Disposing of raw sewage without prior treatment can lead to the proliferation of insects, health problems for the population, affecting productivity and the economy, as well as polluting hydrous bodies (Lins, 2010).

The proper disposal of effluents is of fundamental importance for public health, as it aims to control and prevent diseases related to the inappropriate use of water, which can be avoided through solutions

aimed at eliminating sources of contamination. This avoids various problems such as soil contamination and the pollution of water sources which are generally used to supply water (Funasa, 2015).

The implementation of a sanitary sewage system in a city or community aims to achieve a number of objectives such as: fast and safe sewage removal; sewage collection; treatment and proper disposal of treated sewage, bringing benefits such as the conservation of natural resources; improvement of local sanitary conditions; eliminating as far as possible sources of contamination and pollution; reducing the resources used to treat diseases; reducing the costs of treating water for supply (Leal, 2008).

Urban drainage system

Urban drainage can be defined as a management system designed by the public authorities of a given municipality to collect rainwater and provide its flow through concrete galleries that are usually connected to the rainwater channels to a watercourse capable of receiving it; it also consists of the street sidewalk, curbs and gutters, gutter inlets, drainage galleries, detention, and infiltration systems in the lots, trenches and ditches, among others (RGS Engenharia, 2021).

Its importance lies in the fact that it prevents and/or minimizes risks, which are eminently exposed to populations, and can also prevent possible damage caused by floods, which generally occur mainly in lower-lying areas. In addition, it minimizes the exposure of riverside communities that are subject to flooding or are close to watercourses, providing urban development in a harmonious, articulated, and environmentally sustainable way (Barbosa, 2023).

Discharge of sewage into drainage channels in Aracaju-SE

The Code of Works and Buildings of the city of Aracaju-SE (Aracaju, 2002) presents some solutions for buildings located in areas where there is no sanitary sewage treatment system, including the combined use of a septic tank, anaerobic filter, chlorination unit, and connection to the rainwater network, when available. Unfortunately, in several parts of the city's canals, this requirement is not met.

Moreira and Messias (2020) collected and analyzed water samples from 11 (eleven) points distributed in drainage channels in the city of Aracaju-SE, and the result attests to the spillage of clandestine sewage *in natura* in these channels, presenting a worrying scenario of lack of supervision by public agencies. A similar situation was found by Vieira et al (2021) in the urban drainage channel of Avenida Anísio Azevedo, in the city of Aracaju-SE.

Santana, Santos, and Leahy (2015) identified critical points of environmental degradation and clandestine connections in a stretch of canal located on Avenida Airton Teles and cited the overflow of sanitary sewage through clandestine connections as one of the aggravating factors in the canal's situation.

METHODOLOGY

To carry out this work, a bibliographic review was adopted as the research instrument, which consists of surveying and understanding concepts related to the theme of clandestine sewage connections in drainage channels and the various impacts generated by this action. In terms of nature, this research is classified as basic (purely theoretical and the main instrument is the literature review); in terms of objectives, it is classified as exploratory (it seeks greater familiarity with the topic), and in terms of procedures, it is classified as bibliographical (it uses previously published materials)

The sources used in this research were: books, course conclusion papers, and scientific articles, among other sources. Bibliographical research is part of the academic environment, and its main purpose is to improve and update knowledge through scientific investigation of works that have already been published (Sousa; Oliveira e Alves, 2021). The impacts generated by the clandestine discharge of sewage into drainage channels, found in the sources consulted, were compiled and divided into three categories: public health and society, the environment, and drainage channel structures, which are presented in the results and discussions.

RESULTS AND DISCUSSION

Impacts on public health and society

Teixeira et al (2014) carried out a study on the impact on public health due to basic sanitation deficiencies in Brazil from 2001 to 2009; the results showed that deaths resulting from diseases related to inadequate basic sanitation corresponded, on average, to 13,449 deaths per year, the annual average of cases of compulsory notification due to diseases related to inadequate basic sanitation was 466,351 cases, with an expense of R\$ 30,428,324.92 in medical consultations during this period. In this same study, an annual average of 758,750 hospitalizations due to basic sanitation deficiencies was identified, with a total expenditure of R\$2,111,567,634.61 in the period. These results show unequivocally that poor or inadequate sanitation has a negative impact on public health and society, causing countless losses. According to Medicina S/A (2023), on average, a 1 percentage point increase in water and sewage coverage reduces public health spending on water-related diseases by 1.5%.

Impacts on the environment

The lack of sewage treatment contributes significantly to the negative environmental impacts of most cities. These impacts are due to man's anthropic actions and the lack of investment in sewage systems and treatment plants, causing sewage to be connected to the rainwater network through

clandestine connections, which ends up transporting an abundance of pollutants to the receiving hydrous bodies (Tucci, 2005; Tucci, 2001).

According to Tucci (2005) and Esteves (1998), domestic and industrial sewage loads contain the main nutrients and emerging pollutants that contaminate water sources and produce the effect of eutrophication, and unbalancing aquatic ecosystems.

When sewage is improperly discharged into water bodies, there is a reduction in dissolved oxygen and the proliferation of algae due to the presence of organic matter, which causes eutrophication, i.e. this phenomenon is due to the excess of nutrients accumulated in the aquatic environment, which causes a decrease in local oxygen (Tera, 2014).

Impacts on the structures of the urban drainage system

According to Guabiroba (2012), when concrete structures come into contact with sewage, they suffer severe deterioration as the sulfur compounds are transformed into H₂S (Hydrogen Sulfide) by anaerobic bacteria. This agent, although not aggressive, is oxidized by aerobic bacteria, giving sulfuric acid as the final product. The cement gradually dissolves and degrades the concrete.

One of the most common forms of chemical degradation in urban rainwater galleries is biogenic corrosion due to the presence of hydrogen sulfide gas since residential and industrial sewage is often dumped illegally into the galleries, which should only contain rainwater (Aguar and Baptista, 2009).

According to Souza and Ripper (1998), all waters are, to a greater or lesser degree, aggressive to concrete, but aggressiveness increases when the water is polluted with chemicals or residential sewage. These same authors indicate that concrete can suffer degradation through biological processes resulting from the chemical attack of acids (production of carbon dioxide) generated by the growth of plant roots or algae that settle in cracks or large pores in the concrete, or by the action of fungi, or by the action of sulfides present in sewage.

CONCLUSIONS

Based on the results obtained, we can conclude that:

- a) Investing in basic sanitation has a major economic impact, as it saves much more money than the investment, by reducing the cost of hospitalizations and treatment for diseases caused by a lack of basic sanitation;
- b) To preserve the ecosystems and maintain the environmental quality of the drainage channels in the municipality of Aracaju-SE, it is of fundamental importance to minimize negative environmental impacts, and for this to happen the correct prevention of pollution or

environmental degradation must be carried out with the proper treatment of sewage, using an environmentally appropriate system;

- c) Public bodies should draw up educational campaigns to make the population aware of the benefits of building an infrastructure capable of receiving sewage and separating it from urban drainage channels. They should also warn that sewage with clandestine connections can generate numerous problems that can affect everyone's well-being and quality of life;
- d) Understanding these chemical processes and their consequences is essential for the proper planning and maintenance of urban infrastructures, to prevent the degradation of macro-drainage channels and guarantee their efficient functioning.
- e) In addition, control and monitoring measures are necessary to prevent improper discharges and ensure the integrity of these systems, which are of great importance to the urban environment.

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