

# PROPOSAL OF MITIGATION STRATEGIES FOR STORMWATER AND SANITARY SEWER SYSTEM FAILURES THROUGH URBAN WATER MODELING IN THE MUNICIPALITY OF MARICÁ

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## Abstract:

*The current study aims to initiate a discussion regarding the interactions between stormwater and sewage networks in a coastal lowland city. The research employs mathematical modeling, utilizing a quasi-2D multilayer model, to simulate three sewage system scenarios, each representing distinct sanitation scenarios. This discussion holds significant importance in gaining a deeper understanding of the challenges arising from the absence of a sewage collection network and the complexities involved in implementing a separate sewer system. The results obtained through the modeling process will be utilized to explore opportunities for more effective urban waters management, leading to a reduction in undesirable interactions between urban stormwater and sanitary sewage networks.*

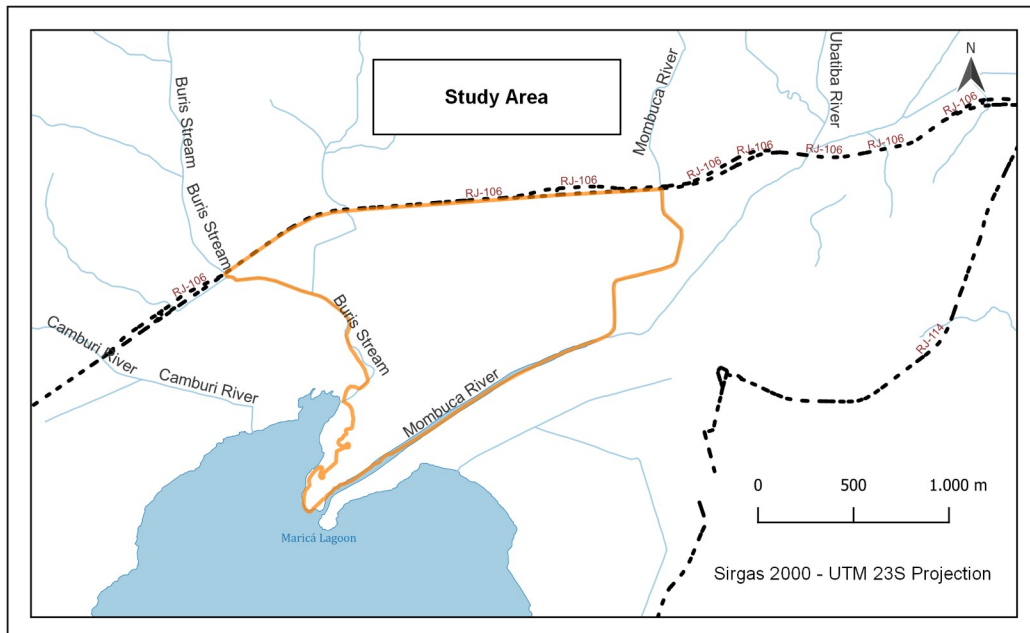
**Keywords:** Flow, ModCel, Modelling, Sanitary Sewage, Urban Drainage.

## 1 Introduction

As reported by Caprario and Finotti (2019), the increase in the frequency of flood and the number of people affected by them has gained significant attention in recent years. This increase is believed to be a consequence of unplanned urbanization and anthropogenic changes in the environment, among others. It is important to highlight that floods consist of an overflow of drainage systems and watercourses, leading to the concentration of water in urban infrastructures such as backyards, streets, sidewalks and other areas. In most cases, rainwater does not impact the place where it precipitate but rather downstream locations of the city where the drainage system is deficient or non-existent (Caprario; Finotti, 2019). Moreover, many municipalities lack sewage collection systems, leading to water body contamination. This contamination intensifies during rainy periods, exacerbated by clandestine discharges into watercourses. In this context, the “Geosmina Crisis” (G1, 2021) in the Metropolitan Region of Rio de Janeiro can be highlighted. This water crisis is characterized by the release of a volatile organic compound produced by heterotrophic

bacteria or cyanobacteria in aquatic environments with high nutrient concentrations, especially in untreated sewage-receiving water courses (UFRJ, 2020). Therefore, the need to examine the interaction between sewage and stormwater systems and its potential impact on water bodies environmental quality became evident. The chosen study area was the territory around the downstream reach of Mombuca River in Maricá city, located near to urban central area of the municipality and the Marica Lagoon (see figure 1).

**Figure 1.** Study area.



Source: Authors.

## 2 Research Methodology

The research development will be subdivided into method stages, as following:

1. A literature review aimed at establishing a theoretical foundation.
2. Characterization of the municipality of Maricá, with a specific focus on the areas of Mombuca, Ubatiba, and Itapeteiu.
3. Mathematical modeling using a quasi-2D multilayer model called MODCEL (MIGUEZ, 2001; MIGUEZ *et al.*, 2017).
4. An assessment of the feasibility of implementing the Dry Weather Capture System, Unitary System, and Separator System, as well as the creation of a reservoir to manage rainy periods.
5. Development and application of an indicator to assess the current state and project scenarios, including issues related to drainage and sewage system failures across the territory.

For the theoretical foundation, the study will be based on legislative literature at the international, national, state, and municipal levels in order to contextualize the measures adopted in different locations around the world and on different scales, beyond recent scientific papers. For the municipal characterization stage of the Maricá territory, hydrologic, hydrographic, topographic and socioeconomic data will be collected from the responsible government institutions in order to understand the environmental sanitation problems in the

study area, calibrate the hydrodynamic model and understand the social vulnerability status of the exposed population in the analyzed region. This modeling is being developed in the MODCEL software (Miguez; Mascarenhas, 2001; Sousa, 2017). Finally, the results obtained through the modeling process will be utilized to explore opportunities for more effective urban waters management, leading to a reduction in undesirable interactions between urban stormwater and sanitary sewage networks.

### 3 Conclusion and expected outcomes

Finally, it is expected that the products of the research developed will add value to society and help in solving problems arising from urban drainage and sewage systems, present in most Brazilian regions and which greatly degrade water bodies. The discussion is cutting-edge and aligns with the strategies adopted by the Metropolitan Region of Rio de Janeiro to advance the expansion of the sanitation system coverage in the state, aiming to a better result in reverse the pronounced environmental degradation of water bodies witnessed over the past decades.

### 4 Acknowledgment

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### 5 References

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