

## **Fecal sludge management (FSM) planning and implementation in Santa Catarina / Brazil – regional service provision**

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### **Highlights:**

- Provide FSM as a public service plays an important role in the sanitation environment.
- Promote FSM regions can improve CAPEX allocation and OPEX by optimizing distances and reducing oversized facilities.
- Spread Fecal Sludge Treatment Facilities can help market development and service provision.

**Keywords:** Sanitation services; safely managed sanitation; onsite sanitation in small cities.

## **INTRODUCTION**

Providing safely managed sanitation for all requires stakeholders to think beyond business as usual, switch paradigms and consider a range of solutions encompassing onsite facilities, FSM and simplified sewerage approaches. This means that sanitation is more than providing infrastructure, it is about promoting a suite of services. This trajectory requires a mindset change on the financial, policy, regulatory and social dimensions, and harmonize sanitation solutions with related urban services. Bhagwan et al (2019) reported this disjunction between infrastructure provision and management of the investment in Africa and Berendes et al (2017) exposed that both wastewater management and FSM represent the next challenge in sanitation service provision and estimated that, at least, 1.8 billion people will require FSM worldwide. The role of onsite systems was historically neglected because they were usually thought of as temporary, until the implementation of conventional sewer. But even where there is a high coverage index, onsite solutions will continue to be used in a “sort of specific cases” and in the last two decades, FSM gained relevance to achieve SGD, especially where centralized approaches proved to be financially prohibitive. In Santa Catarina the first steps are being taken to recognize onsite systems as part of sanitation environment by the implementation of a FSM masterplan in 147 municipalities. This paper presents and discusses the challenges of its implementation in small cities, performing a universalization trajectory by the recognition of FSM public services.

## METHODOLOGY

This work took into account the sanitation contracts and agreements between small municipalities and CASAN, especially the clauses that guide sanitation services provision for FSM. Also, a spatial analysis was conducted with the use of QGIS, presenting the Wastewater Treatment Plants (WWTP) operated by CASAN, the municipalities urbanized areas with contracts or agreements with FSM provision, the water and road network. The distances between municipalities and WWTP were estimated using Google Maps app treated in Microsoft Excel. FSM regions were created by distance to a WWTP when it does not exceed 70 km. If one or more municipalities overcome this parameter a dedicated Fecal Sludge Treatment Facility (FSFT) was considered and located to minimize distances and to spread those facilities all over the territory. After the FSM groups were created the pondered distances for each group was calculated multiplying the number of households by the city distance to the treatment facilities divided by total FSM group households. In addition, a SWOT matrix is presented, pointing out the authors perception about FSM implementation.

## RESULTS AND CONCLUSIONS

Figure 1 shows the spatial distribution of 38 FSM regions, 8 of these regions were planned to send the fecal sludge to dedicated facilities and other 30 took advantage of current WWTP to perform wastewater and fecal sludge coprocessing. The pondered distances calculated ranged from 2 to 59 km with an average distance of 24 km, as shown in Table 1. The program is considered to achieve 156,275 households (Table 1), with an estimated population of 450,000 PE (person equivalent) that live in cities 112 with less than 6,000 households. Most cities (51%) have less than 1,000 inhabitants and most households are situated in cities with less than 2,000 households (Table 2). The program implementation is an opportunity to provide sanitation services through FSM in several small cities and improve Santa Catarina sanitation indexes with a small CAPEX by developing the market in observance to citywide inclusive sanitation perspective.

**Table 1: FSM Groups characteristics. (HH – households | N– Number of Municipalities into the FSM Group | Dist – Relative pondered distance)**

Group	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G12	G13
HH	3.341	2.968	5.007	1.234	6.148	2.476	4.736	6.770	1.849	4.563	15.416	11.459	1.687
N	3	3	3	2	5	2	3	4	1	1	6	7	1
Dist	10	25	16	29	57	22	31	27	27	16	53	24	27

**Table 1: FSM Groups characteristics. Continuation.**

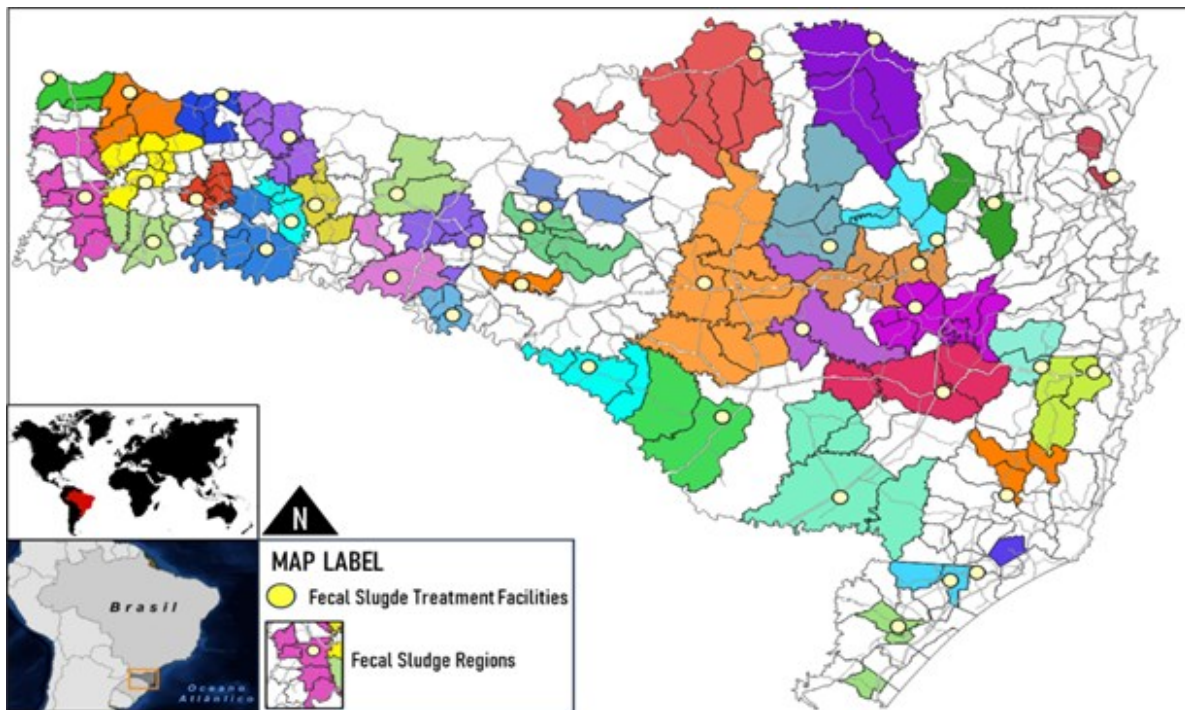
Group	G14	G15	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26
HH	2.276	2.965	1.842	5.166	5.295	3.622	1.076	7.204	3.433	775	3.278	898	3.838
N	2	3	1	6	1	6	2	3	3	1	4	1	2
Dist	9	32	22	27	31	28	27	21	19	2	22	26	3

**Table 1: FSM Groups characteristics. Continuation.**

Group	G27	G28	G28	G30	G31	G32	G33	G34	G35	G36	G37	G38	Total
HH	1.395	1.190	16.035	1.520	6.220	2.137	442	9.892	5.235	980	1.107	800	156.275
N	1	2	6	2	6	3	1	4	5	2	2	2	112
Dist	31	6	24	20	13	59	26	17	30	34	25	20	24

**Table 2: Cities categories distribution. (HH – households | N– Number of Municipalities into the FSM Group)**

	Up to 500 inhab	Up to 1.000 inhab	Up to 1.500 inhab	Up to 2.000 inhab	Up to 2.500 inhab	Up to 3.000 inhab	Up to 4.000 inhab	Up to 6.000 inhab
HH	8.340	26.065	19.305	27.492	15.906	16.426	17.552	25.189
% HH	5%	17%	12%	18%	10%	11%	11%	16%



**Figure 1: Santa Catarina FSM proposed Regions.**

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