



Fig. 1: Project Location

1 Project Specification

Type: Assistance to wastewater service by scheduled septic tank cleaning in Rio Grande do Sul - Brazil

Period:

Start: May 2014

Implementation & Planning: 2015 to 2017

Design & Feature: 2018

Approved: November 2019

Operation Start expected by: 2020

Scope/Category: The company intends to assist 2 municipalities: Ajuricaba and Entre-Ijuis, by the end of 2020 and other 22 municipalities by the end of 2022. In the medium and long term, implementing this type of service to every municipality that operates with CORSAN where this model makes sense is expected.

Location: 275 municipalities obtaining sewage service from CORSAN in Rio Grande do Sul State

Institutions responsible for the Project:: CORSAN – Rio Grande Sanitation Company

AGERGS – State Regulation Agency for Public Services Delegated in Rio Grande do Sul

FAMURS – Federation of Rio Grande do Sul Municipal Associations – Public Ministry – Rio Grande do Sul State

2 Purpose and Cause of the Project

- General Objective of the Project

Enabling a proper sewage service in rural and urban areas less densely populated without any collection network, through regulation and complementation of service provider activities.

- Specific Objectives

- Developing and implementing a sustainable service supply model for wastewater service in areas with individual solutions (without collection network), by performing scheduled fecal sludge collection and treatment activities

- Establishing responsibilities and procedures that enables an appropriate management from individual sewage solutions to wastewater treatment.

- Regulating inclusion of scheduled fecal sludge collection activities retained by individual solutions, within the scope of service providers.

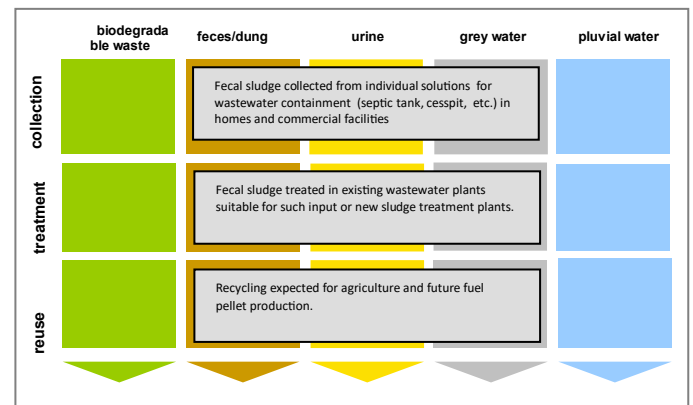


Fig. 2: Sanitation components applied to this project

3 Location and Conditions

This initiative is focused on Rio Grande do Sul municipalities, whose sewage service is provided by CORSAN, involving 275 municipalities, equivalent to 55% of the state.

Rio Grande do Sul State is located in the southern edge of the country. It is bordered by Argentina to the west, Uruguay to the south and Santa Catarina State to the north. According to the Brazilian Geography and Statistics Institute (IBGE) estimation in 2018, population is 11,329,605 inhabitants. From this population, approximately 86% lives in urban centers while 14% live in the countryside. However, considering municipal distribution, it is observed that 222 municipalities (45%) in the state have more rural than urban population. This state has an approximate area of 281,707.15 km². Its demographic density is 42.2 inhabitants/km², -the greatest in the South and the 13th largest in all 27 federal units in the country. Annual average temperature in the state varies from 14°C to 22°C. Rainfall is well distributed during the year, with annual accumulations from 1000 mm to more than 2000 mm.

Institutional Agreement and Sanitation Conditions:

According to basic sanitation administration in Brazil, subscribed by Law 11445/2007, municipalities are responsible for different sanitary aspects (water supply, drainage, solid waste management and pluvial water management) either by direct service by public management, or delegation to service suppliers. In 2017, according to AtlasEsgotos data, published by National Water Agency (ANA), in Rio Grande do Sul State, CORSAN is responsible for providing sewage services in 275 municipalities; this is 55% of the state sample. In all of these cases, service regulation is performed by AGERGS.

In Rio Grande do Sul State, according to 2018 data provided by National Sanitation Information System (SNIS), 32% of total population have access to sewage network, while in urban areas this percentage rises to 37%. According to the same source, this is only 26% of wastewater generated in the state, regarding volume of water consumption.

4 Project Background

Brazil has a great deficit about universalizing drinking water and sanitary sewage supply as proposed by the United Nations (ONU). As evidenced by the National Basic Sanitation Plan (PlanSAB) issued for public consultation in 2019, although delays in water supply are worrisome, the situation regarding sanitation is even worse, because only 48% of homes on a national basis have access to wastewater collection and treatment or proper individual treatment solutions. In the rural area, based on the National Rural Sanitation Program 2019, the percentage of inhabitants having precarious sewage service is 54%, while 25% do not have any type of service. By analyzing wastewater treatment situation in the country, three great deficits in this sector are evident: service to small municipalities; service to towns with scattered population (periurban and/or rural); and concern about precarious and/or unplanned services.

In Rio Grande do Sul State, along with the national scenario afore mentioned, there is a worryingly deficient service, especially in rural areas where implementing large collection networks is generally unviable, both economically and technically speaking. In these areas, most services are rendered through individual sewage systems, particularly cesspits. However, in most cases, these installations are rudimentary cesspits not considered safe and proper wastewater management systems, that may cause soil and underground water contamination - according to local conditions.

Management of accumulated fecal sludge under these solutions is made in different ways: deactivation and discharge of a pit once is filled; local disposal by their own residents or on-demand hiring septic tank services, with undefined frequency. When properly collected and transported for treatment, fecal sludge is sent to wastewater treatment plants that may not always receive this material. Besides, a great amount of collected material is not treated before being disposed. Therefore, it is disposed in an unsafe and improper way. In view of these conditions, in order to provide a proper sewage service to towns depending on individual solutions, improving fecal sludge handling chain and implementing a dynamics for individual solution verification were required to avoid impacts to public health and the environment.

Facing this scenario, between 2015 and 2017, CORSAN began a more comprehensive survey about this situation and how to act in order to contribute with universalization. Potential of this enterprise to improve sludge collection and transport services, by supporting pit cleaning service organization was validated. Thereafter, actions towards sludge management models were made possible in a first pilot project in Atlantida do Sul, a district in Osorio Municipality involving 4,000 homes for occasional use (summer).

5 Applied Technologies

This initiative is intended to complement the list of sewage services from a service provider by introducing systems based on fecal sludge management through actions directed to: verification of individual solutions; fecal sludge collection, transportation and treatment, and destination of processed material for recycling or final disposal purposes. Therefore, this initiative had the purpose to: develop a business and operation

model for scheduled fecal sludge collection; align and get approved by regulation entity and Public Ministry; get municipal management to define criteria for model implementation.

This way, municipalities that decide to adopt either temporary or permanently this sewage service modality in the corresponding Municipal Basic Sanitation Plan (PMSB), may count on services for scheduled fecal sludge collection offered by service provider. Complementary to services offered, sludge collection and transportation activities are performed by CORSAN on a regular basis, from homes to treatment plants (they can also count on authorized subcontracted services).

Starting activity to verify individual solutions is a significant contribution to enhance treatment for these systems. In cases where no appropriate systems are available and they have rudimentary pits, for example, municipalities will be able to link supporting programs to install these systems by using a Municipal Sewage Fund proposed by the initiative (this action is a planned but not compulsory opportunity).

Scheduled collection is a solution for public sludge management services to be financially sustainable. The cost of cleaning a sewer and transporting collected sludge, which are usually expensive for users who activate this service whenever necessary, now gets reduced to monthly fees (for water and sewage service together). Besides, it is possible to reduce unit cost for sludge collection and transportation due to scale economy enabled when suppliers of a septic tank have regular services guaranteed, strategic logistics and a homogeneous distribution of demands along the year.

Regarding fecal sludge treatment, this initiative relies both on material treatment in existing Wastewater Treatment Plants (PTAR) and construction of new potential plants. Treatment solution must be defined according to local conditions in each territory, as well as capacity and location of existing stations. When no more capacity is available in PTARs nearby for sludge delivery, and/or they are located at inconvenient places to transport sludge, new treatment plants will be implemented. CORSAN has a sludge treatment plant, named by the organization "Central de Pozo" (central pit), that is under licensing process. Regarding disposal and recycling, the company has a perspective that in the future, materials will be sent to compost and disinfection practices, so they can be implemented in agriculture or energy recovery through incineration or fuel pellet production. Currently, these materials are sent to final disposal by subcontracted companies, or sent for composting.

6 Project Setup

After considerations and surveys performed by CORSAN, determining aspects for individual solutions to be considered as appropriate so they effectively contribute to service universalization were identified. Development lines that focus on designing a sustainable business model when organizing internal processes and alignments related to legal aspects, and service regulation, were defined from these aspects.

Modeling sewage systems is a very complex and widely debated topic that involved technical studies, discussions with stakeholders and a pilot project. In order to define operational costs for septic tank cleaning service proposed by CORSAN, data from National Civil Construction Costs and Indexes

Investigation System (SINAPI) that show unit costs for truck transportation, material vacuuming and labor employed for these activities were used. SINAPI prepares reference quotes for engineering works and services according to standards and reference criteria, and employs average prices practiced by the market. The pilot action performed in Atlantida do Sul District, Osorio Municipality, became really significant on this matter, because its results worked as a data source that helped defining time and cost for the whole state. Through this practice, identifying costs, even lower than initial estimation was possible.

Regarding validation and approval of this model, a series of discussions were held with different institutional actors involved in the project and related to environment or sanitation matters such as Public Ministry: National Health Foundation (FUNASA), Federation of Rio Grande do Sul Municipalities Associations (FAMURS), State Sanitation Council (CONESAN) and State Foundation for Environmental Protection (FEPAM).

This proposed model includes the following parts:

- Municipal Sanitation Planning and Management

In order to move forward on implementation of services related to fecal sludge management, AGERGS has determined that this service will be offered to municipalities that define individual solutions for sanitary sewage as a form of assistance in their corresponding Municipal Sanitation Plans (PMSB). The standards even demand specification on the PSMB about the scope of this solution as complete or partial in its geographic area, as well as if it will be a permanent or temporary solution, considering for example, the Directing Plan and urban density expected.

- Price Modeling

Scheduled services for septic tank cleaning will be charged through monthly payments, along with the cost of survey studies to adapt this system that will include every direct and indirect cost for service provision, as well as corresponding taxes. Despite individual solutions are responsibility of each homeowner, according to National Law No. 11445/2007, CORSAN foresees in the program the implementation of a Municipal Sanitary Sewage Fund that will subsidize improvements to service chain including proper systems for individual solutions.

Part of income collected by CORSAN will be allocated to the Municipal Sanitary Sewage Fund, a management fund established between CORSAN and AGERGS, created by municipal law, and intended to subsidize activities related to individual systems to reach effective universalization of sanitation services in participating municipalities. Actions to be performed include: inspection to any individual solution adopted in real estates; environmental education assigned to get people aware about the need for regular cleaning; adjustments to individual solutions; diagnosing impact caused by individual solutions; and individual solution registration.

- Initial Communication with Users and Program Disclosure

CORSAN will notify the user by mail about an inspection to evaluate access and conditions for individual home solution to perform cleaning system activities. The first notice must provide the following information:

I. Schedule the inspection with the user, within 120 days after

being notified.

II. Cost for inspection and cleaning services, as well as collection type.

III. Incentive policies presented by CORSAN.

IV. Fine incident and corresponding amount in case of user absence after re-scheduling the inspection.

V. Occasional charge for service availability, starting date and corresponding cost in case of non-compliance for septic tank cleaning scheduled.

- Inspection

After receiving a program notice as initial communication, the user must contact CORSAN through corresponding communication channels to schedule the inspection. If the user does not organize the inspection schedule within 120 days after notice, CORSAN must perform at least an inspection attempt, duly tested, independently from scheduled event, within 30 days. If the user is not present at the time scheduled for inspection, a notice will be issued for a new scheduling after its reception. In case of a recurrent absence, CORSAN is authorized to apply a fine including three times the cost of the inspection, notwithstanding the user duty to schedule a new appointment. The inspection must be performed by the company with their own or subcontracted personnel or even by associations in municipalities according to opportunity or economic criteria defined by CORSAN.

During inspection, access conditions to individual systems will be assessed, and if possible, adaptation from the functionality point of view and the constructive pattern will be verified. If the solution does not have an appropriate access to perform cleaning activities, the user will be notified to provide an adjustment within 90 days. In order to assure a better effectiveness and coordination to this first inspection, an incentive system for the user has been established. This incentive includes:

I. Exemption to pay cleaning fee within the 180 days after the first cleaning service when inspection requirement is performed within 30 days after receiving CORSAN notice.

II. Exemption to pay cleaning fee within 90 days after the first cleaning service when inspection requirement is performed between 31 and 60 days after receiving CORSAN notice.

III. Exemption to pay cleaning fee within 30 days after the first cleaning service when inspection requirement is performed between 61 and 120 days after receiving CORSAN notice.

Collection

Once the inspection is performed, and no obstacles to perform the service are found, the user will be presented a contract for sanitary sewage service through scheduled cleaning for individual systems. The user might program the first cleaning activity; therefore, when an inspection without any inconvenient is performed and the contract has been signed, the user will be offered three alternative dates to schedule the cleaning activity in alternative shifts, according to routes and availability of CORSAN in the region. The month for the first cleaning event will be considered as the date for regular service.

After performing the first cleaning for individual systems, CORSAN will schedule consecutive cleanings on an annual basis, except in cases when the user presents an individual sanitary solution with technical conditions for cleaning at intervals

later than a year (a maximum interval of five years). In this case, the user may require an assessment to change cleaning frequency. CORSAN will perform an inspection to the property and within 60 days after requirement has been received, it will evaluate if the frequency change is valid or not.

The company is also responsible for keeping a register of individual solutions where inspections and cleaning activities are performed, including information such as installation frequency, date of last inspection and date of last cleaning activity.

- Transportation

CORSAN will use their own, subcontracted or authorized trucks to perform transportation service, always under guidance and supervision from the company regarding transportation and safety standards. After preparing route services, the truck will proceed to a PTAR or the closest tank center to dispose waste in a proper manner, requiring the Waste Transport Manifest (MTR) from the transporter, in compliance with valid environmental legislation.

Trucks with a capacity of 12 m³ will be used according to service calls per trip. Initially nine homes per truck were considered since average volume vacuumed per home is around 1.25 m³. However, an average number of six users per cleaning route was agreed, because this is a new service and therefore, a risk of demand frustration and inefficient routes is present.

Average time for transportation service includes operative actions such as calling a user, handling access barrow, using tools to open the pit cover, connecting hoses, cleaning the site, etc.

- Treatment

CORSAN is responsible for contacting duly authorized wastewater treatment plants or exclusive plants to receive collected pit sludge. When appropriate, the treatment will be performed in existing conventional wastewater treatment plants, as long as they have enough treatment capacity to received sludge and/or they are located in convenient and strategic locations for sludge transportation. If required, new plants for fecal sludge processing, next to existing PTAR or in their own locations will be implemented, configured and dimensioned. These systems will be substantially different from current wastewater treatment processes, involving proper steps and dimensions for fecal sludge loads.

In this sense, CORSAN has already designed a tank central plant that is currently under licensing process. This proposed system has a sludge supply tank, followed by a pre-treatment section (closed grid box and sand to avoid odor impact), and two parallel homogenization and decantation tanks (for sludge thickening) with a decanter from where dense portion goes to a drying screw press and the supernatant liquid part goes for treatment to a line of optional ponds for maturation. While dry sludge is destined to compost along with tree pruning material and sawdust, drying lixiviate, along with supernatant from previous step, move to a sequence of tanks from where treated effluent follows an infiltration system onto the soil. Treatment capacity of this plant is 80 m³/day (about six trucks per day) equivalent to assisting 20,000 homes.

- Recycling/ Final Disposal

CORSAN anticipates sending processed sludge for nutrient recovery to be applied in agriculture, energy recovery through incineration and fuel pellet production, and blocks and tiles production, among others. In all cases, these processes are out of the operational scope of service provider, who may however prioritize destinations in every location.

Currently, sludge resulting from wastewater treatment plants is sent to dumpsites for final disposal by third parties. However, in some cases it has already been recycled in agriculture through composting and disinfecting systems by applying hydrated lime.

7 Recycling Type and Level

This initiative has not yet achieved significant progress regarding regulation of recovery practices or systems for the operation, but different ways are being studied to take advantage for energy and/or nutrients for agriculture. Currently, sludge is sent to PTAR as solid waste by subcontracted companies that in some cases discharge it in dumpsites and others to be used as compost. From alternatives considered for the future regarding energy value, alternatives such as sludge incineration or pelletization to produce fuel with this material are also considered. Regarding nutrient recovery, easier systems based on composting and lime application for disinfection purposes, and also more intensive systems that produce more balanced products in terms or nutrients considering specific additions beyond sludge material are present.

8 Other Project Components

Previous scheduled cleaning service is started for individual systems, CORSAN is responsible for performing a social communication and environmental education campaign in every municipality that formally authorizes this service, to introduce a solution for sanitary sewage. This campaign is intended to make citizens aware about benefits derived from cleaning tanks, as well as its importance regarding environmental preservation and improvement of sanitary conditions for the population.

Furthermore, during design and development stages of this initiative, participation of every actor in the Project, either from CORSAN itself or relevant public entities, through meetings and events became very important for its implementation.

9 Costs and Financial Aspects

The following table shows costs for scheduled cleaning of individual systems under three categories: Social Residential, Basic Residential and Subsidized Commercial. Approved amounts have coverage, on a state basis, for municipalities under agreements with AGERGS that implement scheduled cleaning service for septic tanks.

Category	\$/month	\$/year
Social Residential (RS)	\$ 3.47	\$ 41.66
Basic Residential (RB)	\$ 8.77	\$ 105.23
Commercial (C1)	\$ 8.77	\$ 105.23

Estimates for monthly payment:

- Total monthly direct costs per home = \$ 4.45
- Total monthly indirect costs per home = \$ 1.97
- PIS/COFINS (Taxes)= \$ 0.65 monthly per home
- Inspection = \$ 1.15
- Incentive for connection to system = \$ 0.45
- Final rate per home/month = \$ 8.68

* Values in American Dollars considering 2019 average annual exchange rate.

Taking into account that Regulation anticipates the lowest fee for Social Residential category, service sustainability regarding representativeness of this category in each municipality must be evaluated by verifying subsidy dependency for this service. Regarding inspection costs, there is a fee already approved by AGERGS for inspection in building installation of \$ 13.81, updated in June 2019. So, CORSAN intends to adopt the same fee for required technical inspection in the process, by dividing this amount in 12 months, thus resulting in the monthly fee of \$ 1.15.

Regarding assignation of amounts collected by CORSAN, quantities mentioned below will be destined to the Municipal Sanitary Sewage Fund, to be created by municipal law:

- I. 5% (five percent) of monthly income for sewage services regarding schedule cleaning of septic tanks.
- II. 100% (one hundred percent) of monthly charge for cleaning service available for individual solutions (this is the amount collected when cleaning was not possible in a home because of resident responsibility).

It was also established that 1% of the fee will be destined to create a Municipality Compensation Fund, a resource to be financed to municipalities where a Tank Central Plant is present (plants dedicated to fecal sludge) and/or a PTAR receiving effluents from other places.

The system operation based on scheduled sludge collection implies a series of procedures related to different stages of the process, from inspection and registration of individual solutions to treated sludge delivery. These activities include planning, management, tasks related to sludge collection and transportation, operation of treatment systems themselves and service monitoring.

Planning activities are related to the way certain stage of the service chain will be undertaken by organizing inspection, and sludge collection, treatment and disposal activities. Hence, questions on who is responsible, what tools must support service inspection and monitoring activities are defined. Management implies a continuous follow up monitoring of services, organizing inspection information and registries, and verifying effectiveness and development of sludge collection, transportation and treatment activities. Once users have been communicated, they must contact CORSAN through their communication channels to schedule the inspection. During the inspection, individual system implemented is verified, identifying compliance with NBR 7229 and NBR 13969 standards and/or any criteria defined by licensing agency and considered relevant. Once the system is considered appropriate, cleaning frequency, which may vary from one to five years according to characteristics present and technical evaluation performed, must be established. A basic frequency of one year for system cleaning will be considered, except for cases where the user expresses and validates that his individual

solution has appropriate technical conditions for cleaning to be performed later than a year.

Once the inspection has been performed, and no obstacles to perform the service have been found, a contract for sanitary sewage service through scheduled cleaning for individual systems will be signed. The user will be offered three alternative dates to schedule the first cleaning activity, according to routes and availability established by CORSAN or other subcontracted companies. This service will be performed by vacuum trucks owned by CORSAN or subcontracted companies. In the latter case, always supervised and monitored by service provider and requiring compliance with safety standards.

Once service route has been completed, the cleaning truck will proceed towards the PTAR or the closest Tank Central to discharge collected material. This step involves monitoring sludge entry, performance of each treatment step, and sending process byproducts: from material contained during preliminary treatment to sludge and wastewater treated.

10 Operation & Maintenance

The first point established is dialogue and alignment with different parties involved in sewage service supply provided from the first stages of the project. In this case, CORSAN has established a close relation with FAMURS and AGERGS regarding studies and discussions on service model and regulation, but only involved state public ministry in more advanced stated of the project, which caused some delay in validation and approval process. For the next projects, the need to include the Public Defender Office, National Water Agency (ANA) and Federal Public Ministry, seeking to add complementary and even divergent perspectives in these discussions was identified.

The second point established the relevance of having an efficient communication involving internal and external events in order to generate understanding and support to the initiative, besides avoiding restrictions and difficulties. From acquired experience, an active organization of these events had very positive impacts to initiative progress, especially regarding vision and internal processes in CORSAN, with direct support from company stakeholders.

Another relevant aspect was modeling new service fees. For a long time, a way to establish a unique fee for different ways of wastewater treatment, applicable to economies with or without access to collection network and with individual solutions was intended. However, this format was not approved by the regulating entity, which decided to adopt its own model for scheduled collection service, considering sludge collection and transportation costs.

11 Experiences and Learned Lessons

During development of this project, some lessons became very relevant and critically important for the success of implemented systems. Some of these lessons came through validation of aspects already thought of in the initial phases of this initiative, while others arose as confronting issues because certain aspects had not been considered from the beginning of the project.

12 Sustainability Assessment and Long-Term Impacts

A basic assessment was performed (Table 2) to indicate which of all five sustainability criteria regarding sanitation, (according to Document 1 in SuSanA Vision) this project has its strengths in and what aspects were not outlined (weaknesses).

Table 2: Qualitative Reference about System Sustainability.

Sustainability Criteria	Collection & Transportation			Treatment			Transportation & Reuse		
	+	0	-	+	0	-	+	0	-
Health & Hygiene	X				X			X	
Natural and Environmental Resources	X				X			X	
Technology & Operations		X			X			X	
Economics & Financing	X				X			X	
Institutional & Sociocultural		X			X			X	

Regarding sustainability aspects assessed, the main view and innovation of this project includes sludge collection and transport for individual solutions in a scheduled manner, under the control of a water and sewage service provider.

Accordingly, taken measures have a great impact on **health and public hygiene, environment and natural resources**, since this tends to reduce the incidence of irregular sludge disposal on land and water bodies, and therefore minimize contamination risks. This initiative also involves important progress in this chain stage on sight of financial and economic aspects, with specific models for service sustainability.

From the **technological and operational** point of view and **institutional (more than sociocultural)** aspects, means proposed for collection and transportation stage are not great innovations but provide with significant progress through new management activities to be performed by the company. Regarding treatment, this initiative is intended to establish specific plants for fecal sludge treatment that significantly will contribute in cost reduction for system implementation and operation, use new technologies and operational procedures and involve significant progress to reduce consumption of resources during operation activities. Since this action has not been yet implemented, only foreseen until now, these aspects were considered of moderate force in this initiative.

From the point of view regarding transportation and recycling of byproducts from sludge treatment, which have a great potential to make these systems viable, reduce operational costs and increase environmental performance, efforts for this initiative have been modest until now. Some studies were performed for future sludge recycling and consequences for internal company procedures, but at incipient stage.

13 Available Documentation

Rio Grande do Sul. *Minuta de Resolução Normativa. Agência Estadual de Regulação dos Serviços Públicos Delegados do Rio Grande do Sul, 2009. Available at: <(https://agergs.rs.gov.br/upload/arquivos/201910/29121931-20190903091836minuta-ren-limecimento-programa-da-de-fossas-versao-apos-cp-ap.pdf)>. Accessed on August 1, 2020.*

14 Entities – Organizations - People

CORSAN: Thiago Prestes – Chemical Engineer
E-mail: thiago.prestes@corsan.com.br
Telephone: +55 51 32155859

Case Study for SuSanA Projects

Sewage Service through Scheduled Pit Cleaning in Rio Grande do Sul

SuSanA 2020

Prepared by: Tomaz Kipnis, Pedro Pastor & Paulo Castro (SAO – Integrated Sanitation | tomaz@saoprojects.com)

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