The Aim is to treat sewage in the short term

Caxias do Sul, the second most populated municipality of Rio Grande do Sul, has an industry oriented economy and aims to increase the percentage of treated sewage from the current 6% to 100%. The city, marked by Italian colonisation, aims jointly with the Federal University of Rio Grande do Sul, for an integrated plan regarding sanitary sewage and rainwater drainage. The intent is to use the current collection network of mixed sewage that covers 85% of the city. The sewage will be transferred to the central collection network, still to be constructed, and then directed to the future treatment plants. In order to reduce its dependency on large dams, Caixias do Sul seeks alternative sources of water to meet the needs of the city.

A heavy industrial centre and important tourist attraction in the mountains of Rio Grande do Sul, Caxias do Sul is located 760 metres above sea level on a boundary of the hydrographical basins of the Cai and das Antas Rivers that belong to the Hydrographical Area of the Guaiba River. The city is far from big water springs, therefore water supply is guaranteed by means of small rivers dams. The current springs have enough capacity to supply the municipality until to 2010. Thus, Caxias do Sul is looking for alternatives in water supply.

The second most populated municipality of the state of Rio Grande do Sul serves close to 99% of its population with a public water supply network. The situation of the sanitary sewage in the municipality, however, is still far from a universal supply system. Only 6% of the collected sanitary sewage is treated. To change this situation, Caxias do Sul adopted the Sanitary Sewage Master Plan, summarised in the "Conception Study of the Sanitary Sewage Master Plan of Caxias do Sul". The study was conducted by Professor Francisco Bidone, from the Hydraulic

CAXIAS DO SUL, Rio Grande do Sul

Population estimate, 2005: 404,187 inhabitants / Index of urban water service: 99.8% / Index of urban sewage treatment service: 6% / Index of waste collection and treatment: 100% / Index of selective collection service: 100% of the urban area / Water consumption measurement index: 100% / Number of water connections: 96,778 / Number of sewage connections, collection removal and treatment 4,157; collection and removal 76.569 / Rate of analyses for the presence of coliforms outside the limit: 0.17% / Length of water supply network: 1,200km including major and minor pipelines and distributors; absolute separation type: 65,611m (as of October 2005) / Length of sewage collection network: 750,000m / Total cost of the service per m3 invoiced: R$ 2.01 / Average tariff charged: R$ 2.01 per m3 / Index of invoice revenue loss: 61.18% / Productivity Index: 3.58 workers per thousand water and sewage connections / Gross annual operational revenue (direct and indirect): R$ 35,329,157.75 / Gross annual expenses with the service: R$ 29,838,503.04 / Annual utilisation expenses: R$ 29,359,759.76 / Infant mortality rate: 12.69 per thousand live births

Source: SNIS 2003, IBGE 2000

Research Institute of the Federal University of Rio Grande do Sul (UFRGS), through a contract between the Water and Sewage Municipal Service of Caxias do Sul and the Support Foundation of UFRGS.

The Sanitary Sewage Master Plan (PDES), the first developed by the municipality, deals with collection, removal and treatment of sewage. In order to implement the plan various factors had to be considered, such as the geology and geography of the municipality, population density, and its evolutionary pattern for the next 40 years. The study on sanitary sewage was conducted jointly with the Urban Drainage Master Plan and aims to prevent further environmental damage caused from decades of effluents discharge in the waterways of the municipality. The challenge is to achieve this sooner rather than later and at the smallest possible cost. Contrary to what happens in most of the cities of Rio Grande do Sul, the Sanitary Sewage Master Plan of Caxias do Sul foresees the use of the mixed system collection network that is installed in 85% of the urban area. The study proposes that this network be used as central collector and interception network, which will forward sewage to the treatment plants.

In the mixed system, as in Caxias do Sul, the sanitary sewage mixes with rainwater. In the absolute separation system, sanitary sewage is collected separately from rainwater.

According to the author of the study, the solution adopted can reduce construction costs by nearly 50%, compared to the construction of absolute separation network, and achieve "higher agility, environmental and health benefits".

The director of SAMAE of Caxias do Sul, Marcus Vinicius Caberlon, points out that "the plan incorporates the current and future development of the city and permits the use of public investments in an organized and efficient fashion, defining the guidelines of projects and work on sanitary sewage treatment in the short, medium and long term. It is a directional instrument for the Public Authority and community, and can be a useful fund raising tool".

The Sanitary Sewage Master Plan was transformed into law in 2002. In December 2003, a fee was instituted by law for the collection and removal service through the unitary system. Since 2004, the Autonomous Service started collecting a fee from the users of the mixed unitary network, a sanitary sewage fee fixed at 40% of the water tariff value.

The inability to register the unitary network and the population's resistance to pay the new fee, which is illustrated by the large numbers of processes requesting exemption, further complicated the application of the collection fee on sanitary sewage services. While sewage services are a responsibility of SAMAE, a municipal autonomous authority founded in 1966, the drainage network is a responsibility of the Works Secretary. This situation demonstrates the need to clarify the responsibilities between the municipal bodies regarding the maintenance of the micro-drainage network.

Mixed versus absolute separation system

Since 2001, Municipal Order 5,675 made the installation of absolute separation collection networks in the new residential complexes obligatory. The new areas installed local sewage treatment systems, which after the regulation of the area by the municipality, are maintained and operated by SAMAE.

The history of sanitary sewage in Caxias do Sul is still considered new. Until 1996, only four kilometres of absolute separation network in the city centre existed. The municipality invested SAMAE's budget resources and the Social Action Sanitation Programme (PROSEGE), to install the absolute separation sewage system and the Sewage Treatment Plant (ETE) in the Serrano district, which is located in the collection basin responsible for supplying 23% of the population of Caxias do Sul.

Although the municipality's Works Code requires the installation of septic tanks, the direct release of the sewage in the drainage network is a common practice. Six percent of the generated sewage is treated, mainly around the water collection and supply basins and in the adjacent settlements, and more recently, in the new residential complexes. Currently, sewage treatment is carried out in three medium sized Sewage Treatment Plants: Dal Bo, Serrano and Vitoria, and four local systems: Marianinha de Queiroz, Millenium, Sao Lucas and Iguatemi. Four additional local systems and one medium size Sewage Treatment Plant are under construction.

There is a reluctance to accept the mixed system technique presented by the Master Plan. This occurred because the mixed system is considered less efficient when compared to the separation system due to occasional odours, operational difficulties in Sewage Treatment Plants, and in periods when the sewage overflows to the entrance of rainwater. However, its adoption reveals immediate environmental and health benefits. The mixed system, as in Caxias do Sul, where it is already installed in 85% of the city, is less laborious regarding construction and maintenance and requires considerably smaller investments. The absolute separation system needs a separate, specific network, thereby increasing construction costs, while the extensive work involved upsets the population for long periods of time. Besides, the mixed system does not prohibit the use of the existent absolute separation system.

SAMAE already received the approval of R$ 14 million in funds for the execution of part of the work for the first stage of the Master Plan. Of this amount, R$ 6 million were granted by BNDES, and R$ 4 million were SAMAE's matching funds as agreed upon in the financing contract. These resources are destined for the Tega System, which includes the installation of 6,596 metres of interceptors, flow divergence boxes and a Sewage Treatment Plant with a treatment capacity of 220 litres of sewage per second. The system should receive an additional R$ 4 million from SAMAE.

The Federal Bank Caixa Economica should finance R$ 3.2 million, with a disbursement of R$ 800,000 as matching funding from SAMAE for the Canyon System, which is composed of the central collection network, flow divergence boxes and a Sewage Treatment Plant with treatment capacity of 40 litres of sewage per second. The Canyon Sewage Treatment Plant is currently in the bidding process.

The total cost requires an initial investment of around R$ 36 million. The project should reach 40% of the city's population and be completed within ten years. The second phase of the plan foresees the adoption of the Absolute Separation System, which requires the construction of a specific sewage network.

When the works start, the construction of interceptors and central collectors will take into account the landscape of the municipality. The first planned sewage treatment plants will reach areas with higher population densities, a fact that, according to the technicians, demonstrates a better cost and benefit relationship. In the first phase of the plan's implementation, that is the installation of the mixed system, the 41 collection basins of the city will include 17 sewage treatment plants and 39 central collectors.

Losses

SAMAE has been trying to reduce major water losses occurring in the city. Around 60% of the water production is not counted in the revenue, partly due to physical losses. Construction of the North Zone Reservoir began in April 2005, as part of the Pro-Sanitation Programme called North Area Supply System, and was planned by the Autonomous Service.

The project foresees the installation of an open type water treatment plant with treatment capacity of 50 litres of water per second. As the general manager of SAMAE, Marcus Vinícius Caberlon explains, "the treated water will be stored in underground armed concrete reservoirs, with a capacity of 500 cubic meters. The reservoir will be the pumping point for the new elevation station which will forward the water to another armed concrete

reservoir with a storing capacity of 1000 cubic meters of water". He further clarifies that the reservoir will be the central point of water supply for the north area of the city.

As part of the strategy to achieve full use of the existent water supply system of the city, SAMAE is duplicating the capacity of the Water Treatment Plant, Parque da Imprensa, which supplies 63% of the municipality's population. The expansion project includes the execution of 20 sub-projects including civil and hydraulic works, optimisation of treatment plants, purchase of new equipment, automation and modernization of the analysis and control systems of treated water. The project, with a total cost of R$ 3.2 million, was financed by CEF with matching funds from the municipality.

Water Museum

The Water and Sewage Autonomous Municipal Service of Caxias do Sul (SAMAE) created the Water Museum, where visitors have the opportunity to learn the history of sanitation through images. The operation of the water treatment plants is illustrated in a scaled down model.

As a contribution to the formation of the citizen's identity, history has to be shared with society and serve as an educational, not only as a reflection, instrument.

One of the objectives of the Caxias do Sul Water Museum is to increase the population's awareness through demonstrating the challenges their ancestors faced when they put together the first infrastructure projects for modern cities.

For SAMAE, the school community is the best direction of new perceptions and attitude changes in the environmental safety area.

Use and Occupation of Land

The land use of basin which is used for water catchments to supply to people in the municipality of Caxias do Sul is regulated by Law nº 2,452 of 1978 that foresees "the use and occupation of land for the protection of springs, waterways, water reservoirs and other resources in the municipality's interest".

The Law was recently revised to adapt to the new challenges presented by the illegal occupation of areas and real estate expansion. The main characteristic of the new instrument is that it facilitates a different model of land occupation taking into consideration critical environmental issues.

The central objective of the new legislation was oriented to the main urban basins, which are mostly exposed to unregulated occupation. The new proposal, reviewed by a multidisciplinary working group formed by SAMAE and the Municipal Secretaries of Planning, Environment, Urban Development and Agriculture, involved integrated studies on surface and underground waters, determined land use restrictions according to the environmental fragility, and established acceptable levels of land occupation.

The group proposed the division of the municipality's areas in four categories, namely: critical, high, moderate and low.

Rainwater drainage system's sludge is used for the recovery of the area of Water Treatment Plant

SAMAE of Caxias do Sul has been using the sludge appearing in the rainwater collection basin to recover degraded areas of the Faxinal Dam's reception basin, which is responsible for around 60% of the municipality's water supply.

The degradation of the area was caused by clay removal that was used for the insulation of the dam, a fact that provoked erosion, fractures and materials sedimentation inside the dam.

With the collaboration of Marcio Gasparetto