

## **AQUAPOLO**

### ***ABOUT AQUAPOLO***

Aquapolo is the largest enterprise for the production of industrial reuse water in South America, and fifth largest on the planet. Result of a partnership between Brookfield and SABESP (Basic Sanitation Company of the State of São Paulo), provides for a contract 650 liters per second of reuse water for the Petrochemical Complex of the ABC Paulista Region. This is equivalent to supplying a city of 500 thousand inhabitants, such as Santos, for example.

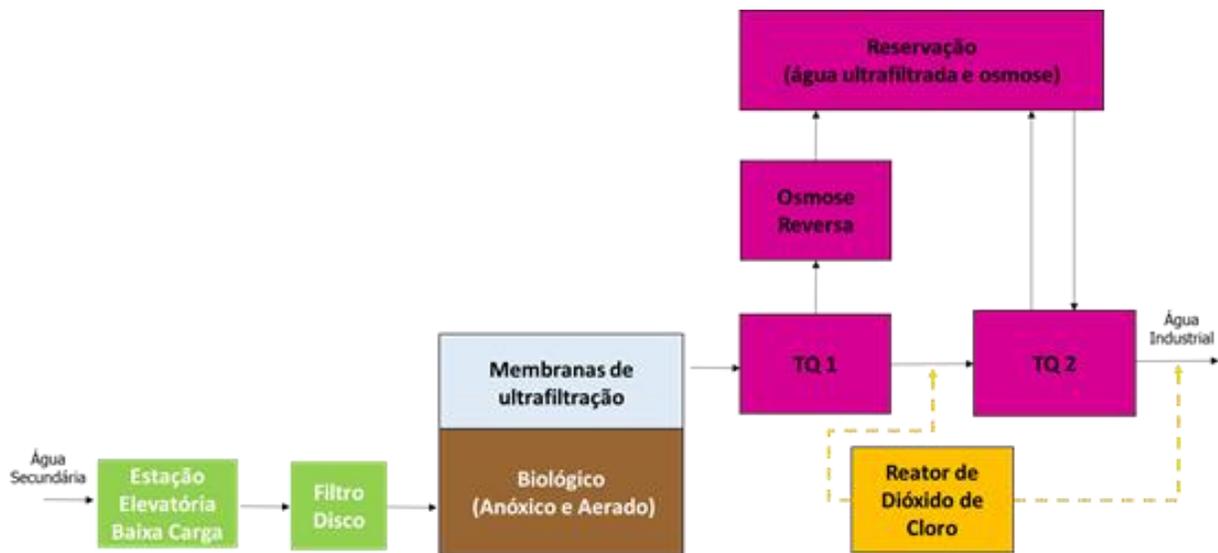
Modern and sustainable design, Aquapolo is able to produce 1,000 liters per second of reuse water, using the most advanced and complex technological processes available. With every liter of water produced in its facilities, another liter of drinking water is saved.

Highly mechanized, the work developed by Aquapolo begins at Sabesp Elevation Stations that pump to sewage treatment plant of the Metropolitan region of Sao Paulo. In these places, sensors were inserted that determine the level of toxicity of the cargo that will reach the sewage treatment plant in the short term. After the treatment process, the flow that would be destined to Córrego dos Meninos (water course to where the water is sent after the treatment in the sewage treatment plant) would be 2,000 liters per second. Aquapolo, however, deviates 650 liters per second for its operation.

The parameters and water quality that should be reached at the end of the whole process were determined by the Petrochemical Complex itself, which uses it to clean cooling towers and boilers, mainly. For the conduction and distribution of the water produced, a 17km adductor was built, which leaves São Paulo and passes through the municipalities of São Caetano do Sul and Santo André until reaching a distribution tower in Capuava, Mauá, where the Pole is. From there, a 3.6 km distribution network delivers water to each of the customers. The adductor was designed to allow derivations, enabling the attendance of possible customers present along its route.

Aquapolo industrial water production station, EPAI, with a treatment capacity of 650 L /, and its pumping and preliminary treatment process (disc filters), tertiary biological system, with aerated and anoxic chamber, which has as its main principal. Of ammoniacal nitrogen, nitrate and organic load, followed by ultrafiltration by submerged membranes, aiming to reduce suspended solids and turbidity.

In order to guarantee adequate salinity for boilers and cooling towers, part of the water is treated by reverse osmosis and then blended (water ultrafiltration and osmosis). Before final pumping the water is disinfected by chlorine dioxide. Following is the Aquapolo process flow chart in Picture 1.



Picture 1 - Flow diagram of Aquapolo's industrial water production process

The water after being treated in the EPAI is sent to the Equilibrium Chimney, located at Braskem UNIB 3, by an adductor, through three sets of motor pumps from the Elevation Station. This pipe, made of carbon steel with a coating of 900 mm in diameter, covers 17 km and passes through the municipalities of São Paulo, São Caetano do Sul and Santo André, as can be observed in picture 2.



Picture 2 - Aquapolo adduction system

After the chimney, the industrial water is distributed according to picture 3, in a distribution network of 3.5 km.



Picture 3 - Industrial water distribution system of the Capuava petrochemical complex.

## **SABESP**

### **ABOUT SABESP**

Sabesp is a mixed-capital company responsible for providing water and sewage service in 366 municipalities of the State of Sao Paulo, and it's considered one of the largest water and sewage service provider companies in the world based on the number of customers.

Populations of 28.8 million people are directly and indirectly supplied with water and 23.2 million people have sewage collection.

The company, in partnership with private companies, also operates in other four municipalities: Mogi-Mirim, Castilho, Andradina and Mairinque; it also provides consulting services in Panama, Honduras, and Nicaragua, being in the first two Countries in partnership with Latin Counsult.

In addition to the basic sanitation services, Sabesp is enabled to operate in other markets, such as drainage, urban cleaning and solid waste management services and energy.

In order to offer quality services the company keeps a giant structure and, in the last five years, it invested around R\$ 14.4 billion and it plans to do so, from 2016 through 2020, around R\$ 12.5 billion to go forward in fulfilling its commitment with sustainable and responsible universalization of water and sewage services in its region of operation until 2020.

In 2002, the Company joined the Novo Mercado of the BM&FBOVESPA, which is the listing segment in Brazil with the highest corporate governance requirements. In the same year, we registered our common shares with the Securities and Exchange Commission, or SEC, and started trading our shares in the form of American Depositary Receipts – Level III ("ADRs") on the New York Stock Exchange, or NYSE under the symbol "SBS".

### **Mission**

"To provide sanitation services, helping to improve the quality of life and the environment."

### **Vision**

"To be a global benchmark in the provision of sanitation services in a sustainable, competitive and innovative manner, focused on clients."

## **Water treatment**

*The Water treatment plants (WTP) Sabesp operate as true factories to produce potable water. Of the 214 stations: 28 supply the Metropolitan Region of São Paulo, and the other 186 provide water to the municipalities of the interior and coast of the State.*

Currently, 111 thousand liters of water are treated per second. It is a very expressive number, but it can still increase. Extension projects and improvements in supply systems are in progress.

### **SABESP WTP RIO GRANDE**

#### **ABOUT SABESP WTP RIO GRANDE**

Rio Grande - It is an arm of the Billings Dam. It produces 5 thousand liters of water per second and supplies 1.5 million people in Diadema, São Bernardo do Campo and part of Santo André.

The installation of ultrafiltration membranes is a state-of-the-art technology already used in countries such as the United States, Israel and Singapore, was implemented by Sabesp in WTP RIO GRANDE. The Rio Grande produces 500 liters of potable water per second

# **SANASA**

## **ABOUT SANASA**

### **Mission**

Contribute to the quality of life of the population, attending with excellence to the basic sanitation needs of Campinas and region, undertaking and promoting socio-environmental actions.

### **Vision**

Being a company of excellence, committed to transparency and ethics, aimed at universalization of sanitation in Campinas, using cutting edge technology.

SANASA, is a mixed-capital company whose majority shareholder is the Municipal Government of Campinas. It is responsible for the water supply (collection, adduction, treatment, reservation and distribution of potable water), collection, removal and treatment of domestic sewage in the municipality of Campinas.

Campinas takes water from the rivers Atibaia and Capivari. Atibaia River supplies 95% of the city and Capivari River 5%.

Currently Sanasa caters 98% of the urban population of Campinas through 5 treatment plants (WTP 1 and 2 in Swift, WTP 3 and 4 in Sousas road, with water captured in the Atibaia River, and WTP Capivari, Next to Road Dos Bandeirantes with water coming from Capivari River). The set of water treatment plants has a production capacity of up to 4530 liter per second

The water distributed by SANASA is produced in five treatment plants (WTP), which are supplied by two different springs, in addition to three small wells.

All SANASA water treatment plants are of the conventional type, using physico-chemical processes for the purification, including clarification units (flocculators, decanters and filters), disinfection (chlorinators and ammonia) and polishing PH and fluoridation), the latter as a prophylactic measure to reduce the incidence of dental caries in the infant and juvenile population.

The water distributed by SANASA is produced in five treatment plants (WTP), which are supplied by two different sources, plus three small wells.

### **Sanasa Today**

Sanasa Campinas was one of the first sanitation companies in Brazil to add fluoride to water treatment.

The result was a significant decrease in the incidence of caries in the population. This pioneering, to a certain extent, reveals the ability of the public authority of Campinas to invest in actions that result in a model for the country.

This type of action has guided the conduct of Sanasa. According to the ranking of the best companies in Brazil, published by the Valor 1000 magazine of 2012, the Campinas sanitation company was named the 6th best in the sector in Brazil and the first municipal company in the country.

Location of Campinas

Population: 1.173.370 million inhabitants

Area: 796.4 Km<sup>2</sup>

Northern boundary: Jaguariúna

East boundary: Pedreira, Morungaba and Valinhos

Southern boundary: Itupeva and Indaiatuba

Westbound: Monte Mor

Northwest boundary: Sumaré, Hortolândia and Paulínia

Districts: Sousas, Barão Geraldo, Joaquim Egídio and Nova Aparecida

The municipality of Campinas has a territorial area of 796.4 km<sup>2</sup>, occupying the urban area an extension of 388.9 km<sup>2</sup>. Its population is more than 1 million inhabitants, 98% of it established in the urban area.

Campinas has a subtropical climate of altitude, with hot and humid summer and mild and almost dry winter. The average annual precipitation is 1,380 mm, 75% of it distributed over the semester October / March. The average temperature is on the order of 22 ° C. Relative air humidity - annual average - is 72.1% and the average sunshine in the year is 2,628 hours.

As for the hydrography, Campinas is located integrally in the Tietê River Basin, receiver of the waters of its direct margin tributaries, the Piracicaba River and the Capivari River. In its northern part, Campinas is crossed by the Jaguari and Atibaia Rivers, formers of the Piracicaba River, from its confluences in the municipality of Americana.

In the western part of Campinas, we highlight Ribeirão Quilombo, whose springs are located between the districts of Chapadão and Amarais, and flow into the left bank of the Piracicaba River after crossing the municipalities of Sumaré, Nova Odessa and Americana. In the South, Campinas is crossed by

the Capivari River, a direct tributary of the Tietê River, after developing by the municipalities of Monte Mor, Capivari, Rafard and Mombuca.

The internal drainage network of the municipality, composed of streams and streams, is very dense, all convergent for the three large sub-basins mentioned (Atibaia / Jaguari, Quilombo, Capivari), responsible for the depletion and transport of rainwater and water.

SANASA was one of the first Latin American companies to implement MBR system for municipal wastewater treatment: EPAR Capivari II designed to treat wastewater from 176,000 inhabitants.

The first step of the pretreatment is multi-rake bar screens (15mm bars), followed by rotary drum perforated plate screens (2mm punched hole) and settling grit chambers. After pretreatment, sewage flows by gravity to the bioreactors.

There are two bioreactors in the plant, one was built during the first stage of construction and started up in 2012. The other one, that was part of second stage of construction, was commissioned in November of 2014. Since then the plant has capacity to treat 360 L/s (daily average flow). Each bioreactor is followed by three membrane trains.

The bioreactors are operated in parallel. They are divided in four zones: anaerobic (1,687m<sup>3</sup>), anoxic (1,687 m<sup>3</sup>), aeration tank (4,278m<sup>3</sup>) and deoxygenation (728m<sup>3</sup>). The mixed liquor, with designed suspended solids concentration ranges from 8 to 10 g/L, is then pumped from aeration tank to ultrafiltration trains. The type of membrane used is submersed, hollow fiber with 0.04 µm nominal pore. Return sludge from membrane trains flows to deoxygenation zone.

Each membrane train has circa 150m<sup>3</sup> volume and 12,000 m<sup>2</sup> filtration area, corresponding to 72,000m<sup>2</sup> filtration area in the whole plant. Average flux is 19 LMH, but during peak flows it can reach 29 LMH.

The high quality of treated effluent (permeate) is shown by process stability and excellent analyses results achieved during the whole period of operation: BOD below 1.5 mg/L, TSS below 5 mg/L and turbidity below 0.5 NTU. Due to removal efficiency obtained in microbiological parameters no other disinfection procedure was need to meet discharge permits.