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Barranquilla's Water Distribution System: A First Detailed Description

José Angulo[a,*]

[a]*Triple A S.A. E.S.P., 8th Avenue 5th Lane, Barranquilla, Colombia*

Abstract

Due to its great industrial and economic development, and its privileged geographical position, Barranquilla has always been one of the most important cities of Colombia. For this reason, Barranquilla is one of the most populated urban conglomerates in the country, having the obligation to ensure the coverage of public services to about 2 million people.

Since 1992, the company Triple A S.A. E.S.P. has been responsible to manage, design and operate the Water Distribution System (WDS) that supplies treated water to the city, which must also supply water to 6 other municipalities in the region. To accomplish this task, the WDS has specialized facilities in each of the main stages of the process: collection, purification and distribution. Refering to collection, the system is able to take directly 7.5 m^3/s from the Magdalena River, the principal waterway of Colombia. To achieve this, the system has a dock, a headrace channel and two pumping stations of low pressure. The water is conducted through cast iron and reinforced concrete pipes, from the pumping stations to treatment plants.

To perform the potabilization process, the system has 5 Water Treatment Plants (WTPs) to ensure redundancy and security in the network. The plants have capacities ranging from 0.5 m^3/s to 3 m^3/s and its operations are based in the conventional treatment train of mixing-flocculation-coagulation-sedimentation-filtration-disinfection. Plant No. 5 can be highlighted, which has the largest capacity and consists of four modules. Regarding with the distribution, after the water potabilization process takes place in the main WTP, the treated water is pumped by the action of four high pressure pumping stations (6.5 m^3/s including all the municipalities covered by the network) and is transported from the WTPs to other pumping stations located at strategic points in the city where the water is distributed to points of demand and also pumped again to another pump station located at a higher ground level to attend the new urbanizations in zones with higher elevations. This not allow a correct functioning of the distribution system by gravity.

Additionally, Triple A has a laboratory of water quality control, accredited by ONAC (The National Agency for Accreditation of Colombia) and IDEAM (Institute of Hydrology, Meteorology and Environmental Studies of Colombia) and authorized by the National Institute of Health in which all the characterizations required in the current Colombian legislation are performed. With the historical record of this monitoring, technical staff of Triple A is able to understand the dynamics of the river and variations in the water quality in order to identify changes that require the implementation of corrective actions.

* José Angulo. Tel.: 57 (5) 3614–207.
E-mail address: jangulo@aaa.com.co

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1. City's brief description

1.1. Location

Barranquilla is the capital of Atlántico department in Colombia. It is the fourth most populous city in Colombia and is located on the west bank of Magdalena River, to 7.5 km from its mouth in the Caribbean Sea. Barranquilla is located at latitude 10°59'16" at Equator north and a longitude of 74°47'20" at Greenwich west, with reference to "Plaza de la Paz", ground zero of the city. In 1993 it was constitutionally defined as especial, industrial and port district. It is the main economic center of Colombian Caribbean Region; commerce and industry are the most important economic activities.

Fig. 1. Barranquilla's location

1.2. Hydrography

- *Surface water*

Surface water are composed by seawater from the left fringe of the western breakwater at the mouth of Magdalena River to the border with Puerto Colombia, and fresh water with the Magdalena River and its effluent ("Los Tramposos", "La Ahuyama", "Las Compañías") and lacustrine water like Mallorquin Swamp. The city is divided lengthwise in two slopes: the eastern water drain into the Magdalena River and the western water drain into the Lion Stream that flows to Mallorquin Swamp.

- *Groundwater*

North of the city, from 11° north latitude, is part of a region with high possibilities of rainwater infiltration, while the southern sector belong to a low infiltration zone with poor soil and high possibilities of flood by rain.

1.3. Topography

The urban area is built on a plane slightly sloped whose extreme heights, according to Agustin Codazzi Geographic Institute, are 4 meters above sea level at east side and 120 meters at the west.