World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 5.924

DRINKING WATER AS THE MAIN FOUNDATION AND KEY TO SUSTAINABLE DEVELOPMENT: CASE STUDY CATSKILL TREATMENT PLANT- DELAWARE

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Article Received on 25/11/2021 **Article Revised on 15/12/2021** **Article Accepted on 05/01/2022**

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ABSTRACT

Ensuring easy and safe access to drinking water is a matter of vital importance in all the world's metropolises, as well as a competitive market between ETAPs (Drinking Water Treatment Stations) or water treatment plants. Catskill-Delaware is an innovative drinking water treatment plant that works with 90% of New York's water, supplying the city with a total of 2 billion gallons per day making it the largest drinking water treatment plant in the world. world, having a large capacity for water storage with 87.6 m^3/s. From a hydraulic basin, the water is transferred to the treatment plant, passing through an ultraviolet disinfection that, as explained by Wright and Cairns, "ultraviolet light is a disinfection alternative to the use of chlorine and ozone in many potable and wastewater applications", being this an excellent alternative for the disinfection of water, wastewater and industrial waters (Aguilar et al, 2015). This treatment plant has a route of approximately 19 kilometers, going from New York to Westchester, where the treatment plant is located, being used from 2012 to the present, this work was carried out because the council decided to open a research for the greater efficiency of the processes that are carried out in these plants, according to Martin Jessica "The monitoring project of the septic systems of Catskill Watershed Corporation was developed to meet this need",Giving a solution to the management and effectiveness of drinking water allowing it to be friendly to the environment by recycling and

processing wastewater and promoting the sustainable development initiative proposed by the United Nations.

KEYWORDS: Drinking water, sustainable development, Catskill-Delaweare.

1. INTRODUCTION

The objective of this article is to collect information to publicize in detail the Catskill-Delaware work and its important participation in the growth and sustainable development of New York City. This research project contributes to the knowledge and understanding of the different fields of civil engineering, through the technological advances of the time to carry out such an important work, which benefited a considerable part of the American population (Barro, 2021).

First, important aspects and details of the system will be discussed, such as that it transports water from an extensive watershed in New York State through tens of kilometers of tunnels to the Kensico Reservoir and thus details its different points of view. Between history, geology, topography, structural design, costs, benefits to the population, among other aspects. Subsequently, topics such as the quality of the water offered by the plant and the Catskill-Delaware ultraviolet water treatment facility will be discussed, which became operational in October 2013, being the largest ultraviolet (UV) disinfection facility in the world, the which is located downstream of the Kensico Reservoir within the cities of Mount Pleasant and Greenburgh in Westchester County and has a water treatment capacity of 2.24 billion gallons per day (BGD) (Aguilar et al, 2015), (Smith, 2021).

In addition, it is known that the owner of this plant is the New York City Department of Environmental Protection, responsible for its maintenance and conservation to ensure the regular operation of the facilities and to verify the correct management of the water found in it by what will deal with issues related to sustainable development and environmental preservation that unlike other common plants this one does.

Finally, a relationship will be made between the SDGs, the corporation in charge of Catskill-Dellaware and the exponential advance of the city of New York since this article seeks to demonstrate that drinking water is the main foundation and responsible for development in general. of the city and that since planning activities for the project that began in 2002, construction that began in 2006 and initial treatment activity began that in 2012 the facility

serves more than nine million people in New York and created approximately 740 construction jobs and 40 permanent jobs, so the total construction cost of $ 1.5 billion is unmatched by all the profits and benefits it has brought with it since then (Chaves, 2018).

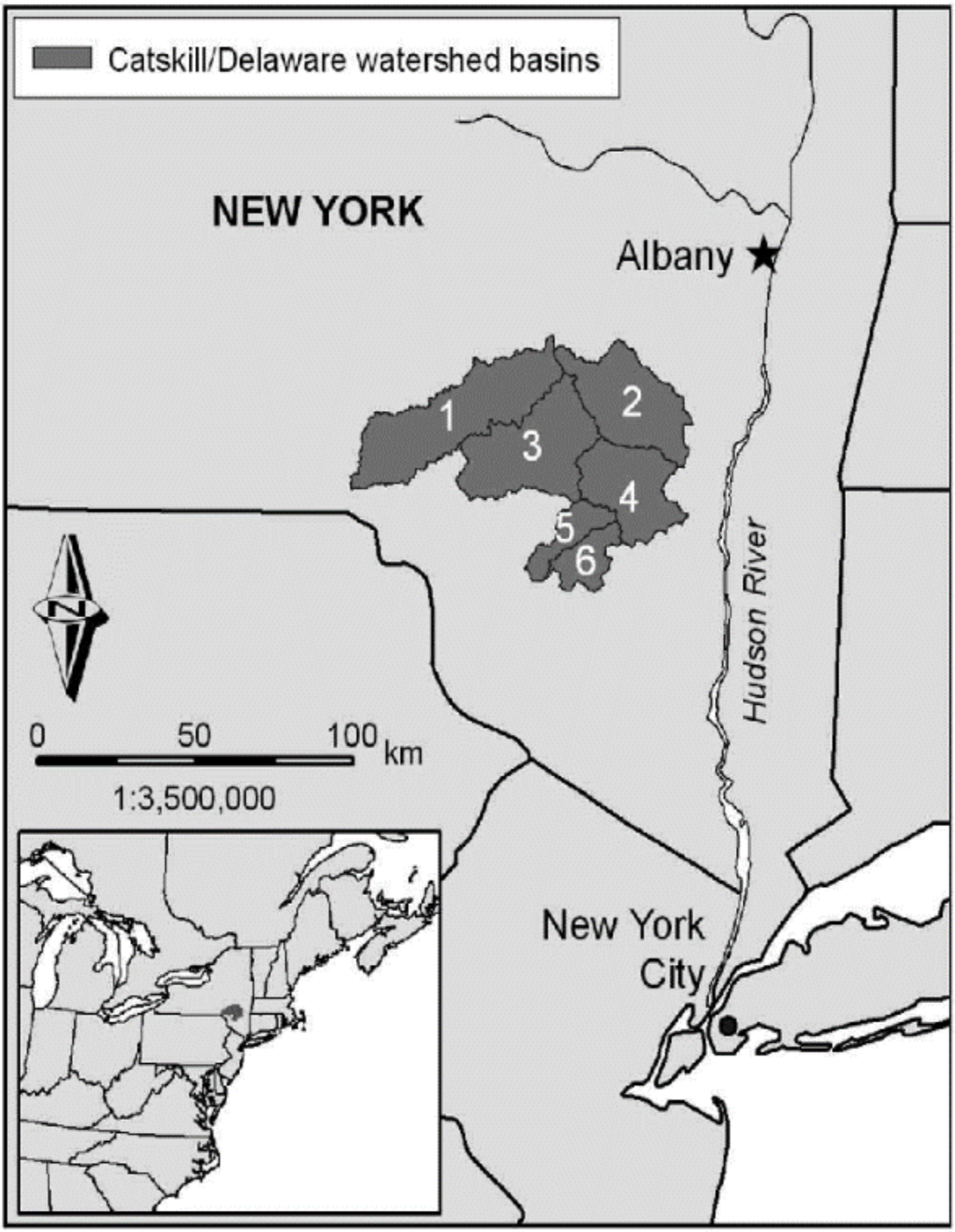

Figure 1: Location.

2. MATERIALS AND METHODS

The research corresponds to a theoretical documentary search aimed at analyzing and collecting information in different sources when analyzing the search for documents, in each of the databases a certain number of documents was preselected with the inclusion and exclusion criteria, those that did not they were taken into account there was no allusion to thematic nuclei (Donoso, 2011), (Galusha, 1999).

For the organization of the documents, a database in Word was created in order to develop the research article on the Catskill-delaware advanced drinking water treatment system that was implemented by the city of New York that has very few Natural water sources, also filtering capacities in wetland ecosystems and water were being threatened by development, runoff from agricultural lands and impervious surfaces. Implementing water treatment as a watershed protection program to conserve and restore natural filtration services as a more cost effective means of maintaining the quality of the treated water (Wright., 2008).

Figure 2: Map of the watershed and aqueducts of New York City.

3. RESULTS AND DISCUSSIONS

The corporation responsible for this large water treatment plant in New York City "The Catskill Watershed Corporation" announced that the results obtained were 2000 million gallons of drinking water per day, performing ultraviolet disinfection in this process, which allows end with 90 and 99.9% disinfection, giving a quite satisfactory result taking into account the amount of water that is treated daily. Despite not being a common method in a filtration plant, it is something very positive because ecologically it helps in the preservation of the environment since the water is filtered without the need to use chemical agents that threaten the ecosystem in the that the plant is located, in addition (Tamayo, 2020).

These ecologically positive balances in the Catskills-Delaware plant are attributed to the measures that were taken from the beginning by those responsible for the project since among its objectives it was sought to take measures to protect the air and reduce the carbon footprint through the use of fuels composed of a small amount of sulfur in order to achieve its main objective of generating more drinking water in the shortest time possible without damaging the environment, for this reason the plant is beginning to be remodeled in such a way that it continues to be stable with the environment but also efficient when working (Whatershed, 2021).

Based on these objectives and that The Catskill Watershed Corporation defines itself as “a Local Development Corporation created to protect water quality in the New York City basin west of the Hudson River; to preserve and support the communities of the basin; and to strengthen the region's economy” different approaches that the plant has in accordance with the sustainable development objectives were discussed and determined (Agut, 2015). The first approach is objective 6: Guarantee the availability of water and its sustainable management and sanitation for all; at the plant it is developed in the use of UV disinfection instead of filtration which resulted in significant water savings for New York City, it provides about one billion gallons of safe drinking water daily to more than 8.6 million New York City residents and the millions of tourists and commuters who visit it throughout the year. It also supplies about 105 million gallons a day to roughly 1 million people living in Westchester, Putnam, Orange and Ulster counties. In total, New York City's water supply system supplies high-quality drinking water to nearly half of the population of New York State. Approximately. In total, New York City's water supply system supplies high-quality drinking water to nearly half of the population of New York State (Rodríguez, 2018), (Gil,2018).

As a second approach, ODS focuses on objective number 3: Guarantee a healthy life and promote well-being for all at all ages, oriented on the strategies for disinfection of drinking water through the use of ultraviolet (UV) light, which is an alternative. From disinfection to the use of chlorine and ozone in many treatment applications in drinking and waste water, the treated water will be distributed through the pipes of each house that can be administered a shock treatment with chemical disinfectant to ensure that the water disinfected with UV It is delivered to the tap without residual chemicals or heterotrophic bacteria for the consumption of the inhabitants of the city without causing alterations in health. The third approach is found in goal number 15: Sustainably manage forests, fight desertification, stop and reverse land degradation, stop the loss of biodiversity; which in turn involves objective 8: Promote inclusive and sustainable economic growth, employment and decent work for all, in New York the natural filtering capacities of ecosystems, wetlands and waterways were being threatened in which the The city faces the potential of significant investment in a treatment plant causing benefits in open spaces and rural character, increasing opportunities for agriculture and forestry businesses, it meets objective number 13: Adopt urgent measures to combat climate change and its effects, Since the care of the air implemented for the fuel plant with low sulfur amount is sought,

Finally, the plant is focused on objectives 9: Build resilient infrastructures, promote sustainable industrialization and foster innovation, and 12: Guarantee sustainable consumption and production patterns. Sustainable consumption and production consist of doing more and better with less, infrastructural modifications and the use of the space in which it is located has generated that the progress of the city is so great because both work and energy consumption For water filtration it is much less than what it commonly is, therefore much more water is filtered with very little daily work generating a great impact on the city since there is a greater probability that anyone will have the opportunity to access drinking water and is equitably distributed everywhere.

4. CONCLUSIONS

Catskills-Delaware Wathershep works with 3 New York water reservoirs, which are Croton , Catskill and Delaware, which transports water through basins and these have a path of 201 km. It had a 3-year construction period starting in 1937 and ending in 1940, cost savings during the construction and operation of the plant were essential.

Catskills-Delaware Wathershep is the drinking water treatment plant that can disinfect the most water, allowing its UV disinfection facilities to reuse the water. Catskills-Delaware Wathershep works with the water of 90% of New York, this makes it the drinking water treatment plant that more liters of water enter the plant for its due treatment.

UV disinfection consists of treating the water by means of radiation that enters through mercury lamps and allows these to kill a large percentage of microorganisms that inhabit the water.

UV disinfection of drinking water offers many unique and significant benefits. Unlike chemical disinfectants, UVs do not add toxic chemicals to drinking water or promote the formation of mutant gene and carcinogenic by-products.

The treatment plant complies with some SDGs, in these the objective number 3 is evidenced, which consists of seeking well-being and promoting sanitary measures to humanity, the second objective that is evidenced is 6, that seeking sanitation and cleanliness in water, the third objective that is evidenced is number 8, which seeks economic growth in New York City, the third objective is 13, since it complies with the care of the climate, and finally objective number 15, which seeks resources for the care of the environment. The probability that this treatment has when going through the water by UV rays is 90 to 99.9 percent, which allows guaranteeing its operation.

REFERENCES

1. Aguilar Barajas, Ismael. Mahiknecht, Jürgen. Kaledin, Jonathan. Kjellén, Marianne. Mejía Betancourt, Abel. Water and cities in Latin America: Challenges for sustainable development. Tecnológico de Monterrey, Inter-American Development Bank, 2015.
2. Agut, MDPM, & Del Pilar, M. (2015). Sustainable Development Goals (ODS, 2015-2030) and Post-2015 Development Agenda based on the Millennium Development Goals (2000-2015). Valencia: University of Valencia.
3. Barro, Argemino. Water, the pride of New Yorkers. New York: The Daily Agora of Water, 2021.
4. CDM Smith Advancing large-scale drinking water treatment. New York: New York Department of Environmental Protection, 2021.
5. Chávez, JAV Water quality and sustainable development. Peruvian Journal of Experimental Medicine and Public Health, 2018; 35: 304-308.

6. Fredes Donoso, Pablo. Validation and certification of water disinfection equipment by ultraviolet radiation. University of Santiago de Chile, physics department, 2011.
7. Galusha, Diane Liquid Assets: A History of the New York City Water System. Fleischmanns, New York: Purple Mountain Pres, 1999.
8. Gil, CG Sustainable Development Goals (SDGs): A Critical Review. Roles of Ecosocial Relations and Global Change, 2018; 140: 107-118.
9. HB Wright & WL Cairns (ND). Water disinfection by means of ultraviolet light. Trojan Technologien Inc: London, Gore Road, 3020.
10. Martin, Jessica S. A model predicting the potential pollution attributable to residential on-site wastewater treatment within the Catskill / Delaware watershed. State University of New York College of Environmental Science and Forestry: ProQuest Dissertations Publishing, 2008.
11. NYC Whatershed Croton & Catskill / Delaware Watersheds. New York: Watershed Agricultural Council.
12. Rodríguez Araujo, Magda Alejandra. Chaparro Millán, Wendy Tatiana. Vargas Ramos, Jair Andrés. Actions against climate change, a comparative vision between Bogotá and Dubai. Pilot University of Colombia, PhD Edgar Ricardo Monroy Vargas, 2018.
13. Tamayo, U., Castillo, J., Bustamante, S., Pizzutilo, F., László, V., Maliatsina, I., & Martinovic, M. EFFECTIVENESS OF RESPONSIBILITY TEACHING IKDI3 STRATEGY AND COOPERATIVE LEARNING PROJECTS ALIGNED WITH THE SDGs. Innovative Teaching Experiences, 2020.