

# SANITATION STRUCTURES FOR THE GUANI RIVER AND THEIR CONTRIBUTION FOR IMPROVING WATER QUALITY IN LAKE PÁTZCUARO, MICHOACÁN, MÉXICO



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## OBJETIVE



One of the sanitation problems in the city of Patzcuaro, Mich., is the contamination of the Guani River, which crosses the city. As with most urban rivers in Mexico, garbage and raw sewage are directly discharged into the river. This creates sources of infection and is unsightly for locals and visitors alike.

During the 40's, the Guani River had a constant flow of clear water from the discharges of a hydropower plant south of the city of Pátzcuaro. In those years, the Guani River had excellent environmental and ecological conditions, contributed to biological development, offered a suitable habitable environment for plants and animals whose habitat was the river, and provided for all the needs of human inhabitants as well. However, over the years, the environment began to change due to population growth, technological development, and the industry and its processes. In addition, the hydropower plant ceased operations. As a consequence of all of the above, the crystalline water began to turn grayish, and the Guani River became a wastewater collector and a waste depository, producing sources of infection and unsightly areas for local inhabitants and visitors.



The Guani River originates in the southeastern part of the city of Pátzcuaro. It runs 7.5 km to the north, crossing the city and finally reaching Lake Pátzcuaro. The micro watershed has an approximate area of 25 km<sup>2</sup>, covering the whole municipality of Pátzcuaro. Figure 1 shows the Guani River and the urban area it crosses, whose growth has been towards the south and to the right bank of the river.



Figure 1.- The city of Pátzcuaro, crossed by the Guani River.

# THE ENVIRONMENTAL PROBLEM

The Guani River is 7.5 km long. It has been invaded by homes along its path, trash and 251 discharges of raw sewage are poured into it.



In order to contribute to mitigate the environmental problem, the Mexican Institute of Water Technology (IMTA) made field trips, an inventory of all the discharges into the Guani River, and a selection of the main discharges to be interconnected to a collector reaching into a wastewater treatment plant (WWTP) known as San Pedrito.

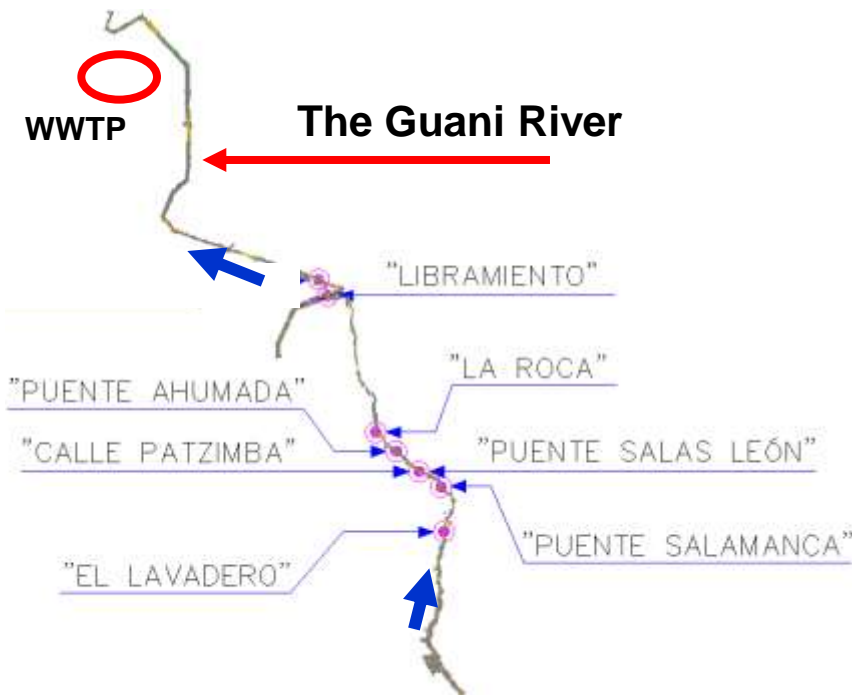


## DESCARGAS KM 0+000 AL 1+000

DESCARGA	X	Y	Z	KM	MARGEN	OBSERVACIONES
1	226973.3902	2158377.6787	2207.3170	0+001.537	DERECHA	AZOLVADO
2	226795.7796	2158566.8486	2199.0900	0+262.738	IZQUIERDA	Ø T. CONCRETO=0.38m
3	226657.3233	2158801.7645	AH=2189.1370	0+499.266	IZQUIERDA	CAJON L=1.40xh=0.90
4	226716.2103	2158870.3639	2186.8250	0+583.710	IZQUIERDA	Ø T. CONCRETO=0.30m
5	226760.5574	2158947.2008	2179.2030	0+673.217	IZQUIERDA	Ø T. CONCRETO=0.30m
6	226771.4216	2158961.4260	2176.8280	0+694.562	IZQUIERDA	Ø T. CONCRETO=0.25m
7	226799.4762	2159231.5167	2169.8400	0+973.941	DERECHA	Ø T. CONCRETO=0.25m
8	226782.3566	2159242.0281	2170.5860	0+991.725	IZQUIERDA	Ø T. CONCRETO=0.25m
9	226793.2439	2159251.2699	2169.5600	0+997.800	DERECHA	Ø T. CONCRETO=0.25m

251 discharges of raw sewage

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**Seven sites were identified to build interconnections to the main sewer**



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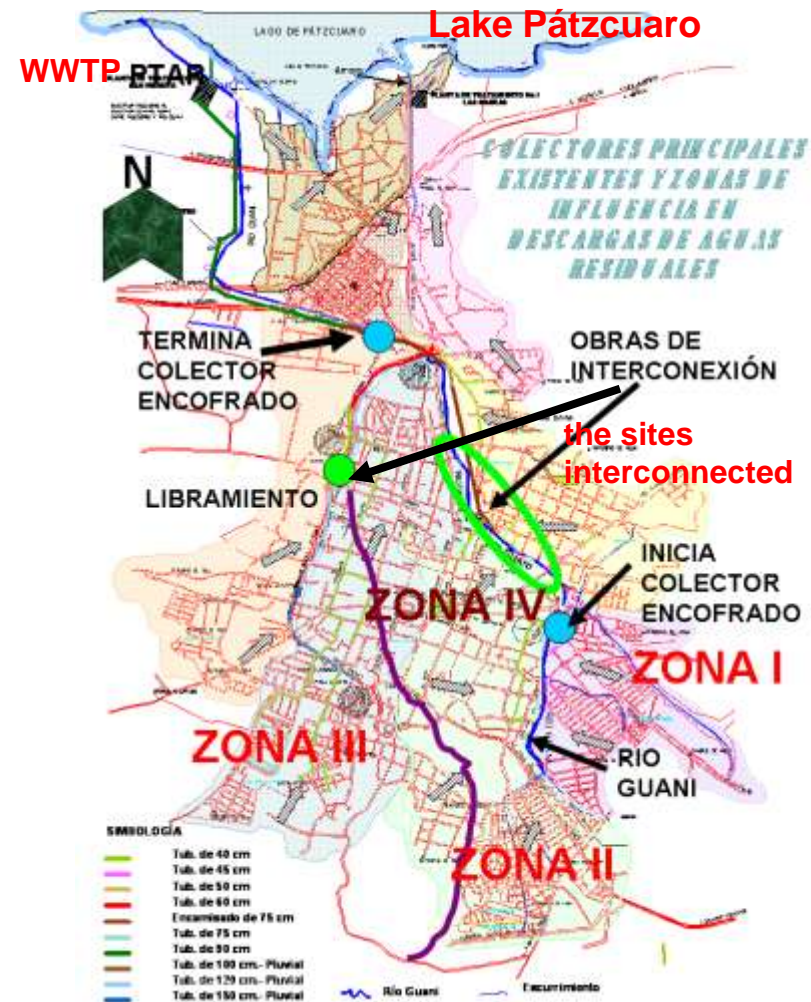
## The interconnection structure



With this interconnection, a total flow of 65 l/s was collected. Table 1 shows the flows measured at each of the sites interconnected to the collector that reaches the WWTP.

Table 1 Results of the flows measured in field

II o.	SITE	YIELD (l/s)
1	El lavadero or Caja Recolectora	15
2 & 3	Salamanca bridge, Benigno Serrato Street and under the Salamanca bridge	10
4	Salas León bridge	4
5	Ahumada bridge	4
6	La Roca	5
7	Collector at the road to Santa Clara del Cobre	27
	<b>TOTAL</b>	<b>65</b>



The city of Pátzcuaro

# RESULTS

With the seven interconnection structures, the Guani River improved its environmental condition: fewer wastewater runoffs between structures were observed and the large puddles of stagnant wastewater began to dry up despite the still existing open-air discharges, although these have a small and intermittent flow.



The flow collected with the selected interconnections contributes also to the full use of the installed capacity of the plant, which is 100 l/s, and to preventing the contamination of Lake Pátzcuaro, since it reaches this important water body as treated wastewater.



**wastewater treatment plant  
(WWTP) known as San Pedrito**



With these drainage and sanitation structures, the contamination due to open-air discharges and sewers was reduced, and the environmental conditions of the river improved, since wastewater stagnancy, which causes foul odors and waterborne diseases such as gastrointestinal infections and dengue fever, was also reduced. In addition, the flow into the San Pedrito WWTP increased from 40 l/s to more than 100 l/s, thus making a better use of its operation capacity and therefore treating a greater volume of water in order to prevent the contamination of Lake Pátzcuaro, which has an enormous touristic potential.

It would be sensible to consider tourism as one of the alternatives for the use and profiting of the ravine (referred to the watercourse of the Guani River) with the environment being the main user and by using a natural space in an urban setting for the benefit of its inhabitants and visitors.



**The Guani River**



**The ravine AMANALCO  
City: Cuernavaca  
Province: Morelos, México**



**The ravine AMANALCO; City: Cuernavaca; Province: Morelos, México**



# CONCLUSIONS



In order to maintain and make a better use of these structures, it is recommended that the appropriate agencies of the federal, state, and municipal governments enforce current environmental laws and regulations.

The interconnection structures improved the environmental conditions by decreasing the amount of wastewater, drying the riverbed and preventing foul odors.

There should be greater awareness among the population in general to avoid the contamination of the river. In addition, maintenance programs should be enhanced.