

INTERNATIONAL BOUNDARY AND WATER COMMISSION  
UNITED STATES AND MEXICO

Ciudad Juarez, Chihuahua  
July 25, 1988

JOINT REPORT OF THE PRINCIPAL ENGINEERS  
CONCERNING THE CONVEYANCE, TREATMENT AND FINAL DISPOSAL OF SEWAGE  
FROM NOGALES, ARIZONA AND NOGALES, SONORA EXCEEDING THE  
CAPACITIES ALLOTTED TO THE UNITED STATES AND MEXICO AT THE  
NOGALES INTERNATIONAL SEWAGE TREATMENT PLANT  
IN CONFORMANCE WITH MINUTE NO. 227

To The Honorable Commissioners  
International Boundary and Water Commission  
United States and Mexico  
El Paso, Texas and Ciudad Juarez, Chihuahua

Sirs:

In accordance with your instructions, we respectfully submit for your consideration this report concerning the conveyance, treatment and final disposal of sewage from Nogales, Arizona and Nogales, Sonora in excess of the capacities that were allotted to the United States and Mexico at the Nogales International Sewage Treatment Plant, by the terms of Commission Minute No. 227, entitled "Enlargement of the International Facilities for Treatment of Nogales, Arizona and Nogales, Sonora Sewage", dated September 5, 1967, approved by the two Governments.

EXISTING FACILITIES

The sewage generated by the cities of Nogales, Arizona and Nogales, Sonora is conveyed by gravity through a trunkline in the territories of the United States and Mexico for treatment and final disposal in an international sewage treatment plant located 8.8 miles (14 kilometers) north of the international boundary, as shown in Exhibit A.

The international trunkline consists of: 1) A principal collector in Mexico, 18 inches (0.46 meters) in diameter and 7,200 feet (2,200 meters) long, to convey to the international boundary the sewage collected by the sewage system of the City of Nogales, Sonora, and 2) A principal collector in the United States having a variable diameter of 21 to 33 inches (0.53 to 0.84 meters) and 8,146 feet (2,483 meters) long to convey the sewage collected by the sewage system of the City of Nogales, Sonora along with that of Nogales, Arizona.

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The international sewage treatment plant at Nogales is made up of two aerated lagoons, three secondary treatment lagoons and a chlorine contact chamber with effluent discharge to the Santa Cruz River. The plant was constructed in 1972 by the United States Section, International Boundary and Water Commission and the City of Nogales, Arizona, under supervision of the Commission, in accordance with Minute No. 227. In that international agreement, of the total plant capacity of 8.20 million gallons per day-mgd (359 liters per second-lps), a capacity of 3.25 mgd (142 lps) was allotted to the United States and a capacity of 4.95 mgd (217 lps) was allotted to Mexico. A site plan and hydraulic profile of the existing Nogales International Sewage Treatment Plant is shown on Exhibit B.

PRESENT AND FUTURE OPERATING CONDITIONS

Present Flows: We examined the record of inflows into the international sewage treatment plant at Nogales, and observed that for the period from July 1, 1986, through June 30, 1987, the total average annual inflow amounted to 8.764 mgd (384 lps), of which 3.278 mgd (144 lps) corresponded to the United States and 5.486 mgd (240 lps) corresponded to Mexico.

Future Flows: We examined the information of the appropriate entities in the two countries about the probable sewage treatment and final disposal needs in the two cities. It is expected that for the year 2000 and beyond, the city of Nogales, Arizona will generate some 2.6 mgd (114 lps) of sewage greater than the present capacity of 3.25 mgd (142 lps) allotted to that city, and that the city of Nogales, Sonora will generate some 5.62 mgd (246 lps) of sewage greater than the present capacity of 4.95 mgd (217 lps) allotted to that city in the international plant.

Capacity of International Trunkline: We examined the design data of the international trunkline, as it relates to the availability of capacity to convey the future sewage of the two cities to the international sewage treatment plant. We observed that, under the terms of Minute No. 227, the capacities of the international trunkline allotted to the United States and Mexico amount to 6.50 mgd (285 lps) for the United States and 9.90 mgd (434 lps) for Mexico.

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Thus, we concluded that the total sewage conveyance capacity allotted to Mexico in the international trunkline has not been exceeded, such that volumes of up to an additional 4.95 mgd (217 lps) over and above that capacity allotted to Mexico in the international plant may be conveyed through this line.

Treatment Plant Capacity: From an analysis of the volumes treated at the international plant during 1987, we concluded that the capacities allotted to each country at that plant are being utilized to their maximum, such that consideration should be given to the expansion of the capacity allotted to each country at the international plant, as an alternative that each country should take into account for the disposal of the sewage that will be generated in the future by the cities of Nogales, Arizona and Nogales, Sonora.

INTERNATIONAL PLANT EXPANSION

The proposed expansion contemplates modification of the existing aerated lagoon system with a shorter detention time than the present process of 20 days at a flow of 8.20 mgd (359 lps). The expanded plant contemplates secondary treatment to include primary treatment, filtration and disinfection. The change in process from the present treatment requires modification of the existing aerated lagoons by a complete mixed lagoon process and modification lagoons of the secondary lagoons to a partial mixed lagoon system with aeration. The operation units defined as common works for the United States and Mexico in this expansion will be those of screening, grit removal, complete mix lagoons, partial mix lagoons, and sludge drying. Filtration and ultra-violet disinfection will not form part of the international plant. A site plan and hydraulic profile of the proposed Nogales International Sewage Treatment Plant expansion is shown on Exhibit C. Exhibit D describes the operation units, design specifications and principal characteristics for the proposed expansion's aeration systems.

Based on available information about future Nogales, Arizona and Nogales, Sonora sewage volume generation, we considered it necessary that for the case of Nogales, Arizona, the treatment capacity be expanded by 2.60 mgd (114 lps) to provide for a total of 5.85 mgd (256 lps) and for the case of Nogales,

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Sonora, considering the conveyance limitations on the trunkline, its treatment capacity be expanded by 4.95 mgd (217 lps) to provide a total treatment capacity allotted to Mexico of 9.90 mgd (434 lps), with which the international treatment plant will have a total capacity of 15.75 mgd (690 lps), once the expansion has been completed.

Upon approval by the two Governments of this proposed expansion, it is believed that construction work could start in December 1988, so that the expanded international plant could enter into operation in 1990 with a treatment capacity of 15.75 mgd (690 lps). We suggest that construction work and that of operation and maintenance concerning the expansion of this international plant to provide the additional capacity as may be allotted to the Governments of the United States and Mexico to satisfy future treatment needs up to the total volume of 15.75 mgd (690 lps), be supervised by the Commission.

Division of Construction Costs: We reviewed the estimate of costs provided by the United States Section Principal Engineer for the construction of the proposed expansion of the Nogales International Sewage Treatment Plant. Considering the economy of scale, the incremental cost contemplated by United States authorities to handle the additional capacity of 2.6 mgd (114 lps) for the city of Nogales, Arizona is about \$700,000, United States currency.

On the basis of economy of scale, the incremental cost of an additional capacity of 4.95 mgd (217 lps), would be about \$1 million, United States currency, which would be the cost corresponding to Mexico to expand the treatment capacity allotted to Nogales, Sonora of 4.95 mgd (217 lps) to 9.9 mgd (434 lps).

Division of Operation and Maintenance Costs: We examined the distribution between the United States and Mexico of the operation and maintenance costs of the existing plant carried out under the terms of Minute No. 206, entitled "Joint Operation and Maintenance of the Nogales International Sanitation Project", dated January 13, 1958, approved by the two Governments, as well as the division of operation and maintenance costs proposed by the Principal Engineers in their joint report of March 18, 1957, adopted by the Commission in Minute No. 227. We find that the bases for distribution of operation and maintenance costs in Minutes No. 206 and No. 227 should also apply to the additional capacity allotted to Mexico of 4.95 mgd (217 lps).

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SEWAGE COLLECTION WORKS

We reviewed the information provided by the Mexican Principal Engineer, regarding the plans prepared by the Secretariat for Urban Development and Ecology (SEDUE) for the rehabilitation and expansion of the sewage collection system of Nogales, Sonora. Those plans propose that all of the city's sewage be collected, concentrated and conveyed by gravity, through a trunkline in Mexico that flows northward by gravity to the international boundary.

For the small collectors, some 5.6 miles (9.1 kilometers) would be replaced with 8 inch (20 centimeters) diameter concrete pipe, and some 53 miles (84.85 kilometers) of the same type and size of pipe would be installed in areas not presently served. These small collectors will feed to a sub-collector system of pipes ranging in diameter from 10 inches to 18 inches (25 centimeters to 45 centimeters) and length totaling to 18.8 miles (30.31 kilometers). The sub-collector system will in turn feed into four principal collectors of 24 inches (61 centimeters) diameter and length totaling to 5.6 miles (9.09 kilometers).

We observed, that if undertaken in a timely manner to concentrate the sewage generated from Nogales, Sonora, up to a volume of 9.9 mgd (434 lps) into the international trunkline, the plans will provide a satisfactory solution to the border sanitation problem resulting from untreated sewage which crosses the international boundary from sewage line breaks and unsewered areas discharging into the Nogales Arroyo.

We also found that to satisfactorily prevent a similar border sanitation problem, the Commission conclude, in the earliest possible time, technical arrangements suitable to the United States and Mexico to convey by gravity sewer lines those sewage flows from Nogales, Sonora that cannot be incorporated in the international collector in Mexico, such that the Government of Mexico may concentrate these flows near the international boundary in the existing collection system in Nogales, Arizona, for treatment at the international plant as part of the additional capacity allotted to Mexico.

Also, with the goal of preventing a border sanitation problem of untreated sewage discharging into natural drains that cross the boundary in this area, special measures should be considered by each country to assure immediate

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repairs in the event of breakdowns in the sewer collection systems, taking care that in the event of extended sewer line repair periods immediate temporary measures be taken to prevent the discharge of untreated sewage into the natural drains that cross the boundary in this area. We believe it would be practical for the Commission to consider that in special cases of sewer line breaks, it may be necessary that one country request the cooperation of the other country through the Commission. We suggest that such cooperation could best be carried out by the Commission utilizing personnel and equipment provided to the Commission by the two Governments.

We also consider it proper that the construction and maintenance of the works planned by the Secretariat of Urban Development and Ecology of Mexico, to rehabilitate and expand the Nogales, Sonora sewage collection system be jointly observed by representatives of the Commission in those aspects relating to the concentration of Nogales, Sonora sewage in the international trunkline for conveyance to the international plant.

RECOMMENDATIONS

Based on the above considerations, we make the following recommendations:

1. That the additional capacity at the Nogales International Sewage Treatment Plant, considered for Nogales, Sonora be no greater than 4.95 mgd (217 lps), which with the existing allotted capacity to Mexico of 4.95 mgd (217 lps) would have a total capacity of 9.90 mgd (434 lps), which is the maximum capacity allotted to Mexico in the international trunkline.
2. That determination of the construction cost for the additional capacity of 4.95 mgd (217 lps) corresponding to Mexico in the treatment plant expansion be based on the economy of scale involved in the construction costs to authorities in the United States for upgrading the plant and for increasing the treatment capacity corresponding to Nogales, Arizona.
3. That based on economy of scale, the incremental cost for an additional capacity of 4.95 mgd (217 lps), would be about \$1 million, United States currency, which would be the cost corresponding to Mexico to expand the treatment capacity allotted to Mexico from 4.95 mgd (217 lps) to 9.9 mgd (434 lps).

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4. That the bases for the division of the operation and maintenance costs of the existing plant under Minute No. 206, entitled, "Joint Operation and Maintenance of the Nogales International Sanitation Project", dated January 13, 1958, and Minute No. 227 entitled "Enlargement of the International Facilities for Treatment of Nogales, Arizona and Nogales, Sonora Sewage", dated September 5, 1967, apply to the common works involved in the international treatment plant expansion. These common works have been previously identified in this report.
5. That the plans of Mexico to concentrate the sewage generated from Nogales, Sonora into the international trunkline, be executed in a timely manner to resolve the border sanitation problem resulting from untreated sewage crossing the international boundary into the Nogales Arroyo channel that discharge from sewer line breaks or unsewered areas in Nogales, Sonora channel.
6. That to satisfactorily prevent a border sanitation problem, similar to that described in Point 5 above, attention should be given to conveying by gravity sewer lines the sewage flows from Nogales, Sonora that the Government of Mexico may concentrate near the international boundary into the collection system in Nogales, Arizona, for treatment in the international plant as part of the additional capacity allotted to Mexico.
7. That to prevent a future border sanitation problem of untreated sewage discharging into the waters of the natural drains that cross the boundary in this area, the two countries consider special measures to ensure immediate repairs to breakdowns in the sewage collection systems, including immediate temporary measures to prevent discharge of untreated sewage into these drains in the event repairs require an extended period of work, and that in special cases of one country requesting the cooperation of the other country, such cooperation be carried out by the Commission utilizing equipment and personnel provided to the Commission by the two Governments.
8. That the design, construction, and operation and maintenance of the works for expansion of the international plant up to a total capacity

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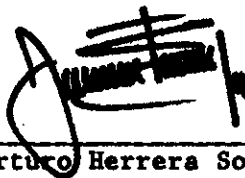
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of 15.75 mgd (690 lps) be carried out as soon as possible and under the supervision of the Commission under the agreement in force.

9. That construction and maintenance works planned by the Secretariat of Urban Development and Ecology to rehabilitate and expand the city of Nogales, Sonora sewage collection system be jointly observed by representatives of the Commission in those aspects concerning concentration of City of Nogales, Sonora sewage in the international trunkline for conveyance to the Nogales international plant.

RESPECTFULLY,

  
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Jose S. Valdez  
U.S. Section Principal Engineer

  
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Arturo Herrera Solis  
Mexican Section Principal Engineer