

Border Environment Cooperation Commission

Comprehensive Sewerage Collection and Treatment Systems Project in Ciudad Acuña, Coahuila

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I. General Criteria

Type of Project. The project consists of the rehabilitation and expansion of the sanitary sewer system and the improvements to the sewage treatment system.

Location of Project. Ciudad Acuña is located in the northern part of the State of Coahuila; it is the county seat for the Municipality of the same name. It is separated from Del Rio, Texas by the Rio Grande; therefore it is located within the Border Region defined as the 100-km zone on both sides of the border. The current population of Cd. Acuña is approximately 113,194, and is expected to reach 295,000 people by the year 2018.

Project Description and Tasks. The project consists of improving sewerage services to Cd. Acuña, including the construction of a wastewater treatment plant (WWTP), with a capacity of 5.71 million gallons per day (mgd) per second, to reach about 75% coverage. In 1998, it was estimated that sewage collection coverage was about 49.4%. The objective of the 20-year project is to reach 100% coverage.

The new WWTP will replace an old oxidation lagoon system that was originally designed in the 1960's to handle 3.42 mgd. The lagoons are not operating since they are clogged up. Additionally, the urban area has encroached upon the existing WWTP site, which presents various negative health implications

The population growth rate in Ciudad Acuña in the last few years has surpassed the construction rate of additional environmental infrastructure, particularly in the sanitary sewer system and sewage treatment capacity.

Furthermore, the parts of the city that do have sewer service in most cases experience problems because of the age of the system, negative slopes, and other factors.

The lack of a storm sewer system is also a contributing factor to the deficient operation of the sewage system, mainly due to infiltration, which causes overflows and backflows of raw sewage.

The project consists of the closure of the existing WWTP, the construction of new collectors, sub-collectors, a pump station, and a new WWTP (activated sludge).

Compliance with International Treaties and Agreements. The project will have positive transboundary impacts, since the improved effluent will continue to be discharged into the Rio Grande. Its implementation will comply with the treaties between Mexico and the US, particularly those related to sanitation and directed by the International Water and Boundary Commission.

II. Human Health and the Environment

Human Health/Environmental Needs. About 77.4 % of the population of Ciudad Acuña is served with a public water supply (about 90% of the population receive water either through the main distribution system or delivered via water wagons). The water quality complies with Mexican federal regulations, as set forth by the Mexican norm NOM-127-SSA1-1994.

However, within the context of sewage treatment, the community faces a serious problem, considering that only 49.4% of the residents are served by a sewage collection system. The portion of the population without the service uses septic tanks and/or privies.

The Mexican National Water Commission (C.N.A.) considers various parameters for assessing fines relative to effluent discharge violations. The effluent characteristics of the existing wastewater treatment process exceed C.N.A.'s discharge limits corresponding to Biochemical Oxygen Demand (BOD). Additionally, in 1994 the IBWC conducted a study and determined that wastewater treatment along the US-Mexico border was deficient and needed to be improved. Thus, the Acuña project will address this concern.

According to the Health Department of Ciudad Acuña, of the different diseases that have been detected in the region, 13 of them are waterborne diseases and related to the sanitary sewer.

Environmental Assessment. As part of the project studies, in March 1999 an environmental assessment was prepared and submitted to the National Institute of Ecology (INE) of the Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP). On April 14, 1999, the INE issued its ruling authorizing the implementation of the sanitation project of Ciudad Acuña. Further, a document addressing the requirements established by the National

Environmental Policy Act (NEPA) was prepared and submitted to the Environmental Protection Agency of the United States (EPA).

The EPA has reviewed the above documents and prepared an environmental assessment (EA) and a Finding of No Significant Impact (FoNSI). The EA and the FoNSI are currently undergoing a 30-day public review period, which will conclude on the first week of March 2000. It is necessary to have the FoNSI to enable the EPA to approve the financial scheme relative to the Border Environment Infrastructure Fund (BEIF) that would be proposed by the North American Development Bank (NADB).

In March, 1999, the consulting firm of "Servicios de Ingeniería e Informática" prepared an EA that was presented to the public on June 19, 1999, to inform the public about the cumulative impacts of the project.

In the EA, it is mentioned that some of the activities will take place in urban areas, while the WWTP site is located in a natural reserve. To mitigate the impacts, a reforestation program will be implemented to create a buffer zone. The WWTP effluent will be discharged into the Rio Grande, downstream from Amistad Lake. The impact of the effluent will be positive, considering that the BOD5 (30 mg/l) and total suspended solids (30 mg/l) of the flow will be lower than those currently being discharged. Further, there are three sampling points for determining current concentrations of BOD5 in the Rio Grande and at La Amistad Lake, established by C.N.A. The proposed effluent will have lower concentrations of BOD and TSS at these points.

In the EA, measures for dust abatement are presented, as well as traffic control measures during the construction stages. It is also important to mention that Mexico's Comisión Federal de Electricidad, downstream, will reuse the effluent of the WWTP at a downstream location. This translates into less water being drawn from the Rio Grande aquifer.

Compliance with Ecology and Cultural Laws and Regulations

As part of the environmental review process by SEMARNAP and other agencies, the National Institute of Anthropology and History issued a memorandum (number 310/96) and dated August 26, 1996, indicating that there was no objection relative to the proposed WWTP site.

III. Technical Feasibility

Appropriate Technology. As part of the master plan supplemental report for improvements to the water, sewer, and wastewater treatment of Ciudad Acuña, various alternatives were evaluated. The alternatives were developed and evaluated using a 20-year planning horizon.

Wastewater Treatment

In accordance with chemical analysis conducted on the influent, it was determined that the BOD5 concentration (103 mg/l) and the TSS (96 mg/l) are below the typical domestic values, primarily due to water infiltration. This premise was taken into consideration in the WWTP design and sizing. It is important to mention that the WWTP will be financed under the Build-Operate-Transfer (BOT) scheme. For the WWTP four alternatives were evaluated, including the no-project alternative.

Alternative 1 - WWT System with Activated Sludge. The process units are as follows:

Water Train

Pretreatment, inlet sump, primary settling tank, aeration tank, secondary settling tank, and chlorination tank.

Sludge Train

Aerobic digester, sludge thickening, and drying bed or press filters.

Alternative 2 - Oxidation Ditch. This alternative is a modification of the activated sludge process. The oxidation ditch features important advantages over the oxidation/stabilization lagoon system, due to its high performance and provides good removal levels of nutrients. The more notorious disadvantages are the need for qualified personnel and a higher energy consumption level. Its train process consists of the following components:

Pretreatment, oxidation ditch, clarifier or secondary clarification tank, chlorination tank, sludge recirculating tank, sludge thickening, and drying beds or press filters.

Alternative 3 - Oxidation Lagoons. The main process train of this alternative comprises pretreatment, anaerobic lagoon, facultative lagoon, and stabilization lagoon. This method depends heavily on the water and ambient temperatures. The lagoons, after extended periods of time, become clogged and saturated.

Alternative 4 - No-project. This alternative was not considered feasible given the current discharge conditions and the deficient operation of the existing lagoons.

Excluding alternative no. 4, the alternatives were evaluated using a matrix with the following parameters: cost effectiveness, environmental considerations, effluent quality, expansion features, compliance with C.N.A. regulations, operation requirements, and public acceptance. Based on the analysis, alternative No. 1 (activated sludge) was selected.

Sewage Collection System

The current sewage collection system covers about 49.4% of the urban area. The network is composed by 1,600 manholes and 140,000 meters of pipeline. The pipe diameters vary from 15 cm to 107 cm.

A study conducted under the direction of the IBWC (Minute 294) diagnosed the conditions of the environmental infrastructure of Ciudad Acuña. This study developed alternatives for the sewage system, using as the baseline the Master Plan prepared under the direction of the C.N.A. The Minute 294 study incorporated the recommendations submitted by the Binational Technical Committee (BTC) of Ciudad Acuña. The BTC is comprised by representatives of IBWC (both sections), C.N.A. (Border Affairs and Regional), EPA, Sistema Municipal de Aguas y Saneamiento (SIMAS) of Ciudad Acuña, Comisión Estatal de Aguas y Saneamiento (CEAS) del Estado de Coahuila, NADB, and BECC.

The evaluated alternatives include the BOT sewer improvement projects.

Alternative 1 This alternative utilizes the BOT as the baseline. Some collectors (Las Vacas and Infonavit/Granjas del Valle) will be constructed using larger diameters. The sewer system will operate by gravity to the existing WWTP site. As part of the project, a lift station will be constructed at the existing WWTP site. This lift station will pump the sewage to the new WWTP facility.

Alternative 2 This alternative follows the same starting point as Alternative 1, with the exception of an additional pump station and collector.

Alternative 3 This alternative is similar to Alternative 2, with the exception that the collectors Las Vacas and Infonavit/Granjas del Valle keep their BOT diameters.

Based on coverage, technical aspects, and cost-effectiveness, the BTC recommended Alternative 1.

O&M Plan. This plan identifies the requirements of O&M of all unit processes, including human resources, the frequency of maintenance and yearly cost estimates. Before start-up of the WWTP and pump/lift stations, there should be a final O&M plan in place. A similar O&M plan will also be required for the sewage collection system.

Compliance with applicable design norms and regulations. The requirements for construction of the sewer system have been validated by C.N.A. and corroborated by the BTC.

IV. Financial Feasibility and Project Management

Financial Feasibility.

The NADB conducted an analysis of the project information presented by the consultant to determine its financial feasibility. Based on this analysis, the

amounts for loan and grant components were determined, as well as the impact the project would on the user rates. The results of the analysis were presented in a public meeting held on August 13.

The table below summarizes the project construction costs, as the BTC identified the components in June, 1999.

| | |
|--|------------|
| Estimated cost: | |
| Concept Dollars | |
| Phase I Concession (BOT) | 28,624,973 |
| WWTP | 13,858,296 |
| Lift stations | 1,024,617 |
| Force main, collectors & subcollectors | 13,742,060 |
| Phase II Mid term | 7,624,541 |
| Construction of subcollectors | 5,368,975 |
| Expansion of subcollectors | 2,255,566 |
| Phase III Long Term | 42,555,275 |
| Construction of laterals | 33,850,246 |
| Construction of collectors | 8,705,029 |
| Institutional Development | 1,546,543 |
| Total | 80,351,332 |

The required investment for funding of Phase I (the WWTP and associated collectors, sub-collectors, and pump stations) has been obligated by the BOT concessionaire.

Amounts represent March 1997 prices, at a \$7.89 pesos to 1 dollar exchange rate. Estimated costs include project design, management, taxes, and contingencies.

Estimated Operation and Maintenance Costs

(Annual)

| | |
|----------------------|-----------|
| Concept Dollars | |
| WWTP Included in BOT | |
| Personnel | 1,072,682 |
| Maintenance | 302,931 |
| Materials | 145,659 |
| Chemical compounds | 110,480 |
| Electricity | 748,593 |
| Total | 2,380,345 |

Based on the analysis developed by the project consultant, the NADB determined the amount of grant funds and loan components. It will be

necessary to follow the requirements imposed by each one of the agencies participating in the development of this project.

Financial Structure Recommended by the NADB

Source Amount %

(DIIIs)

| | | |
|------------------------------------|------------|--------|
| Concession (BOT) | 28,624,973 | 35.62% |
| CNA, State & Local Governments | 16,726,605 | 20.81% |
| NADB-BEIF | 16,726,605 | 20.81% |
| NADB-Credit | 16,726,606 | 20.83% |
| NADB-IDP | 238,898 | 0.30% |
| Institutional Development (Others) | 1,307,645 | 1.63% |
| Total | 80,351,332 | 100% |

Rate model: The rate model developed by the project consultant was utilized for determining the impact the project would on the user rates. The rate model developed by the consultant was reviewed by the NADB. With the proposed financial structure it is necessary to increase the rates by a total of 23% over the next three years. Thereafter, the rates need to keep up with inflation, cost of living increases, and for future expansion and replacement. The rate increases will enable the utility to cover its debts, liabilities, O&M expenses, reserves, and capital improvements. The average rate will increase from \$1.43 pesos to \$1.76 pesos per cubic meter, which represents an increase from 1.9% to 2.3% of the income of low-income families. According to the financial analysis, the average family can afford to pay up to \$60 pesos per month for water service. The average monthly charge would be about \$43.10 pesos per month.

Project Management. The project will be managed by the SIMAS - Ciudad Acuña, that has operated the public utility for several years. The SIMAS is the agency that will adopt the rate adjustments. The public utility would operate in a self-sufficient manner, supporting itself through charges imposed on the users.

V. Community Participation

Comprehensive Public Participation Plan. The objectives of the Comprehensive Community Participation Plan (Plan) are to ensure that the community understands and supports the environmental, health, social, and financial benefits and costs of the project, as well as any changes in user fees. Ciudad Acuña, with important contributions of the steering committee submitted a plan, which comprises the following activities: develop a steering committee to lead the implementation of the plan, identify and meet with local groups and organizations, two public meetings (one has already taken place)

and develop and final report documenting public support for the project. The activities carried out thus far in fulfillment of this Plan are detailed below.

Steering Committee: A steering committee was formed in 1996 as part of the BECC certification process to guide the public participation component. The committee has been responsible for disseminating project information and scheduling the public meetings. Committee members also met as necessary to guide the public information campaign about the project and related activities.

Local Organizations: The City and the steering committee have met and will continue to meet with business, civic, community and neighborhood representatives to present the project and request support for the project.

Public Information: Information about the project has been provided to the public in the utility bills and at the public and neighborhood meetings. Information about the financial aspects of the project were provided to the residents during the second public meeting held on August 13. The information presented incorporated the NADB preliminary financial analysis. Ciudad Acuña has made available to the public the Comprehensive Sanitation Master Plan and BOT Designs, and environmental information documents 30 days before the public meeting. This information has been available at the offices of the SIMAS. A public meeting was held on June 19, 1999. There were over 50 people in attendance.

Public Meetings: Two public meetings have been scheduled. The first public meeting was held on June 19, 1999, and was properly advertised 30 days in advance. The meeting covered the technical aspects of the project. The second public meeting was held on August 13, 1999.

VI. Sustainable Development

Definition and Principles. The project complies with BECC's definition of Sustainable Development: "An economic and social development based on the conservation and protection of the environment and the rational use of natural resources, but considering current and future needs, as well as present and future impacts of human activities".

All the environmental parameters have been met and the culture of reuse of treated water has been realized through the sale of the effluent to Comisión Federal de Electricidad (Mexico's Power Company). This action will help extend the life of the Rio Grande aquifer. The improvements will help preserve life in the Rio Grande, considering that the effluent will have lower BOD and TSS concentrations than those required by C.N.A.

The principles of sustainable development are satisfied, which include: Human beings are the central point of all concerns for sustainable development; they have the right to a healthy and productive life in harmony with nature. This project complies with the principle's objectives, which are to solve human

health problems by improving the potable water system, and decrease pollution of the environment and health risks to the population, through sewerage improvements and sanitation of wastewater.

Institutional and Human Capacity Building. For the optimum operation of the Utility it will be required an investment of about \$1.5 million dollars will be required to increase the institutional capacity of the Utility (SIMAS). Further, the transition from a lagoon system to a mechanical technology (activated sludge) will require the training of personnel. The increase in treatment capacity will prevent potential sanctions that could otherwise occur.

Conformance with Applicable Local/Regional Conservation and Development Plans. The project will not modify any land use patterns or zones, since most of the sewer lines will be constructed on already impacted and improved areas. The site of the WWTP will be re-landscaped to provide for a buffer zone to mitigate the impacts resulting from its construction.

Border XX1, a regional environmental plan established by the United States and Mexico, utilizes as project sustainability indicators the percentage of collected and treated wastewater, and the population percentage with water sewer service. For 1998, these figures were 90% and 49.4%, respectively, and it is anticipated that the area served will increase to 100%.

Natural Resource Conservation. With the water leak detection program, water losses are anticipated to drop from 54.4 % to 30.4%. Furthermore, with the installation of water meters and water conservation campaigns there will be better results associated with the conservation of natural resources.

Additionally, there is a contract with C.F.E. for the sale of treated wastewater, adjusted for evaporation, to be used in the cooling process of the power plant. The reused treated volume will reduce the water drawn from surface or underground sources allocated in the Rio Grande basin.

Given that the WWTP site is natural reserve zone, it will be necessary to implement a reforestation program.

Energy Conservation The selected sewer system alternative will require less energy since it only adds one pump station. Although the WWTP will require a power generation substation, energy conservation measures will be implemented whenever feasible.

Community Development. The new project, with an investment of \$78 million dollars, will ensure compliance with federal regulations for water quality. The project will also improve the quality of life in the community. Presently, the existing lagoons pose a health hazard to the neighbors, considering that the growth of the city has exceeded the treatment capacity of the plant. The project will help reduce and eliminate the health biological hazards for the residents and will eliminate bad odors, biological hazards, and infectious diseases.

Furthermore, with the construction of the new WWTP, the quality of the effluent discharged into the Rio Grande will be improved.