Border Environment Cooperation Commission

Comprehensive Water and Wastewater Project for the City of Matamoros, Tamaulipas

General Criteria

1. Type of Project

The Comprehensive Water and Wastewater Project for the City of Matamoros, Tamaulipas, (Matamoros Project), as described in this document, proposes improvements needed for the city's water, wastewater collection and treatment infrastructure to enable the City to meet present and future water quality needs for a 23-year project planning period. The project is divided into two phases. The first phase comprises three years, from 2003 to 2005, while the second phase covers the years 2006 to 2020 or later, depending on urban development rates and financial resources available at the time. In order to provide technical oversight for the project a Binational Technical Committee (BTC) was established, made up of representatives from the corresponding U.S. and Mexico agencies: United States Environment Protection Agency (USEPA), International Boundary and Water Commission, U.S. and Mexican sections (IBWC and CILA), National Water Commission of Mexico (CNA), Tamaulipas State Water Commission (CEAPA), North American Development Bank (NADB), Matamoros Water Utilities (JAD) and Border Environment Cooperation Commission (BECC). The project will improve the quality of life and environment of the residents of Matamoros, in addition to bringing about beneficial environmental impacts to the border city of Brownsville, Texas and other small communities in both countries.

2. Project Location

The City of Matamoros is the head of the municipality of Matamoros, located in the northeastern part of the state of Tamaulipas, Mexico. The city of Matamoros borders Brownsville, Texas, to its north, as the two cities are only separated by the

Rio Grande. The City of Matamoros is bounded on the east by the Gulf of Mexico, south by the city of San Fernando, and west by the municipalities of Valle Hermoso and Rio Bravo, all of the cities also in the State of Tamaulipas.

Matamoros is located along the Rio Grande River approximately 37 kilometers upstream from the river's outfall to the Gulf of Mexico. The location's geographic coordinates are 25°52' N and 97°30' W, 10 meters above sea level.

Description of the Community

This section presents a description of the site's demography and the water and wastewater services provided by Matamoros Committee for Water and Drainage (Junta de Agua y Drenaje -JAD). The information describes the population that will benefit from the project, which in this case includes all of Matamoros' current and future residents, as well as the problems to be addressed under the project. The source of information provided is the "Land Use and Population Update for the Master Plan to Improve Water and Wastewater Services in Matamoros," developed by consultant HG Construcciones y Supervisión (HG Update). It should be noted that after the development of this study, the results of the 12th Population and Housing Census administered by the Mexican Statistics, Geography and Information Institute (INEGI) in 2000 were published. This information was compared with the population projections estimated by the HG Update, and it was concluded that population growth assessments will need to be developed every three years to correlate them to the funding scheme.

Demographic Data

Matamoros' current population, recent growth rates and population projections were reviewed by the BTC to determine water, wastewater collection and treatment requirements for the next 20 years. This was confirmed via Official Communication N0B00.03.0153 dated May 26, 2002. For the duration of the project, JAD proposes to review the population projection every three years to adjust the infrastructure development program as appropriate.

The 1999 HG Update contains population projections based on information from the 1995 poll and the 1990 and older censuses. The information reflects a 4.01% average annual growth rate. This results in a baseline population of 427,611 residents by the year 2000. The projected population for the year 2020 would be 938,751. These results were used as part of the baseline information to develop the project. However, once the results of the 2000 Census were published, it was noticed that the population projections turned out to be higher than the Census number (427,611 projected vs. 393,767 from census data). Thus, a two-phase funding scheme was developed; a first three-year phase with a follow-on second phase based on a population growth assessment at the end of the first period and making corresponding adjustments. The projected population assumed by year 2020 will be 616,529.

Municipal Environmental Services

According to the most recent information from INEGI's 12th Population and Housing Census (2000), the city of Matamoros has water and wastewater collection coverage rates of 89.5% and 77.3%, respectively.

But Matamoros problems are not limited to a significant backlog in water and wastewater collection services coverage. Existing infrastructure has not been upgraded or adequately maintained due to a considerable lack of resources. This has forced JAD to resort to practices that do not benefit the environment. The entire amount of wastewater generated in Matamoros currently remains untreated and is dumped into open-air canals and drains. Due to corrosion, wastewater collection lines have collapsed in different parts of the city's primary system, resulting with the need to rehabilitate 11 kilometers of wastewater collection lines. At times the cost of rehabilitating collapsed lines exceeds the amount of funds immediately available to JAD, which trigger the use of "quick fixes" like cross-connections between wastewater and rainwater runoff collection lines to somehow alleviate the problem. However, these actions ultimately result in contamination of the Rio Grande River and agricultural drain waters. Additionally, the use of rainwater collection lines to relieve wastewater lines reduces the rainwater runoff conveyance capacity. In addition, the dumping of untreated wastewater into canals and drains is a major health risk factor in the proliferation of waterborne diseases.

With regard to the water system, the existing treatment systems do not have the equipment or backup treatment units available for JAD to respond to emergencies or schedule preventive maintenance. This also causes equipment and facilities to wear out prematurely, thus increasing the inefficiency in the use of available resources.

A very serious problem is the amount of water losses, currently estimated at 37%. A city such as Matamoros, with a water supply shortage, needs to establish and maintain operating policies and efficient use programs to reduce losses. It is clear that water, wastewater collection and treatment services in Matamoros need to be expanded and upgraded in view of the deficient conditions of some of the existing infrastructure. It is therefore necessary to implement an Infrastructure Improvement Program for Matamoros to address major environmental issues and to improve the quality of life of the city's residents.

3. Project Description and Tasks

The project activities proposed under the Comprehensive Water and Wastewater Collection and Treatment Project for Matamoros are divided into two phases: a first phase that includes the 2003-2005 period during which time JAD will develop projects that are immediately needed, and a second phase to develop the tasks proposed to meet future needs, from year 2006 to 2020 or later. Actions for this second phase will be assessed and scheduled as determined by the city's urban development rate.

To meet the objectives of the project, tasks have been programmed based on the priority needs in the city of Matamoros. This was the basis used to schedule the tasks described below, which are grouped by type of infrastructure. The needs and priorities were determined by JAD based on the overall condition of the infrastructure' and the demands of the residents.

Water

Raw Water Supply for Treatment

The National Water Commission (CNA) of Mexico has granted JAD a water allowance of 48.1 Mm³/year, which amounts to an average flow of 1,525 l/s. This meets the water demands for the first phase of the project according to a technical analysis developed by CNA's Rio Grande Regional Management Office - confirmed via Official Communication (letter No.) BOO.00R07.07.02-029 (03) of January 16, 2003.

Considering the harsh water shortages in the Lower Rio Grande River watershed, JAD anticipates that water scarcity in the Rio Grande basin may affect in the future Matamoros' development. Thus, JAD proposes to address the enormous challenge of supplying water to city residents in the future by minimizing demand increases, directing actions consistent with the 2001-2006 National Water Program [Programa Nacional Hidráulico or PNH]. This program considers Mexico's northern border with the United States of America as a priority area, inasmuch as its location and economic activity make it one of the most important areas in the country, albeit with an excessive strain on the scarce water resources. Among the most important objectives of the PNH are to drastically reduce unaccounted water losses and adjust water rates to reflect the true value of water. To address the above, JAD is proposing the following actions:

- *Waterproofing storage ponds.*
- *Installing 100,000 household water meters.*
- *Adjusting water rates and assessing the potential reduction in per capita water use as a result of the proposed adjustment.*
- *Reclaiming water from water treatment plant backwash units.*
- *Reviewing water demands at the end of the first three-year period of the project based on population growth.*
- *In the mid-term, the project anticipates the need to conduct feasibility studies to explore the possibility of groundwater withdrawal and treatment. Groundwater has high salinity levels, thus the viability of using this resource must first be assessed.*

The capacity of presettling basins will be increased to 110,000 m³ for the first phase. It is anticipated that after the year 2020, storage will need to be increased to 1,300,000 m³. The area where these basins are currently located is not large enough for expansion in the year 2020, so a different site will have to be located for new basins, or to build additional storage.

Water demand projections presented in the planning study show an average daily demand of 3,509 l/s by the year 2020, including a 10% loss rate in presettling basins. These projections will be evaluated at the end of the first phase (2005) and every three years afterwards to make the appropriate adjustments in the funding program.

Water Treatment

Improvements to the water treatment infrastructure consists of rehabilitating and expanding Water Treatment Plant #2 to reach a 1,000 l/s treatment capacity, which is the required volume for the year 2005. Expansion would continue gradually to arrive at the capacity required by the year 2020 after evaluating water demands after the completion of the first phase. As for the rest of the existing facilities, they

will be decommissioned and demolished once Water Treatment Plant #2 reaches the capacity needed to treat the total amount of water required by the end of the project planning period. Simultaneously with the expansion of Water Treatment Plant #2 during the first phase, chlorination facilities will be rehabilitated and permanent staff training programs will be established. It is important to mention that no additional water rights will be required for this first phase of the project.

The implementation of the above tasks will improve the quality of the water treatment plant effluent to meet Official Mexican Norms related to water turbidity and total coliform criteria. Improvements to the chlorination systems will eliminate excessive residual chlorine, and trihalomethane problems will be addressed by upgrading the water treatment and disinfection processes.

Water Distribution

Expansion and improvements need to be implemented at the WTP #2 high-service pump station to convey the plant's design flow to elevated tanks or directly to the distribution system during the years 2005 and 2020. The tasks that need to be implemented include the demolition of the two existing elevated tanks due to their faulty structural condition. Also two new elevated tanks need to be constructed during the first phase, and four more in the following phase, all located throughout the city and each with a capacity of 3,600 m³. This will assure sufficient water reserves and maintain the minimum pressure required by the distribution system during the hours of peak demand. For the subsequent phase, storage tanks within the Water Treatment Plant # 2 site are proposed to be constructed for use as clear water storage tanks and for additional storage for emergency response. These storage tanks will require a capacity of 35,000 m³ during the first few years of the 2nd phase, and may require an additional capacity of 30,000 m³ by the year 2020, depending on the city's population growth.

Four types of distribution system line improvements will be required to enhance water system operations. These were determined through water modeling.

Improvements include:

- *Interconnecting 17 km of water lines during the first phase. This will enhance both water flow and pressure for distribution purposes and will allow assessment of the priority of the rest of the tasks for the following phase.*
- *Constructing 9.3 km of water conveyance lines exclusively for recharging elevated tanks #3 and #4 during the first phase, as well as lines for the other four tanks during the second phase.*
- *Conveyance capacity will be enhanced during the second phase by replacing existing lines with larger diameter lines to increase conveyance capacity and to reduce water losses caused by friction.*
- *Additional lines will be rehabilitated during the second phase when they need to be replaced by similar lines due to incrustation or corrosion.*

Wastewater Collection

Water modeling was used for the wastewater system and the results were used to determine the following actions that need to be carried out:

- *During the first phase, constructing 14 km of interception lines on the city's east side, and 21 km on the west side.*
- *Wastewater lines need to be replaced with larger diameter pipes, in addition to increasing the slope in some of the cases. This includes 6.8 km of collectors during first phase projects and 87.2 km for future projects. Replacements amount to approximately 94 km of lines (20 to 152 cm. diameter) during the project's two phases.*
- *Future projects to be developed after 2005 include the installation of wastewater collection lines in areas that currently do not require the service. Approximately 50 km of lines are estimated to be needed for this task. The proposed material for the 45 cm diameter and smaller pipes is PVC, while 61 cm and larger lines will be of reinforced concrete with anti-corrosion protection.*
- *Replacing lines identified as having structural problems (collapsed lines) resulting from corrosion. The project has estimated 7 km of pipes (20 to 152 cm diameter) that need to be replaced during the first phase.*
- *Some sections of the wastewater collection system are old and will need to be replaced during future phases. JAD estimates that 10 km of lines (20 to 152 cm diameter) will need to be replaced.*
- *Based on the water model, the first phase includes the replacement of 16 existing pump stations (PS) with new stations with sufficient capacity to handle design flow rates. Ten of these stations will be located on the city's east side, while six will be on the west side. An additional 19 stations will be built in future phases. The Matamoros project also includes the equipment needed to automatically operate pump stations, including level controls, back up power generators, and telemetry. Additionally, as part of the design criteria, the necessary tasks for conveying excess rainwater flows will be implemented.*

Rainwater Collection

Based on a cost-benefit analysis of the tasks required to improve the rainwater collection system, the BTC determined that the San Francisco, Chula Vista and Ciudad Industrial coverage areas should be included as part of the project. Results obtained from the water modeling reflected the following capacity requirements for rainwater pump stations for the project's second phase:

- *San Francisco* *13,800 l/s.*
- *Chula Vista* *16,600 l/s.*
- *Ciudad Industrial [Industrial City]* *14,000 l/s.*

Wastewater Treatment

To prevent Matamoros from being a source of contamination for the Rio Grande and agricultural drains, the construction of wastewater treatment plants is proposed to address the issue of untreated wastewater discharges.

In order to provide adequate treatment to existing and future wastewater flows in the planning area, the project proposes the construction of three Wastewater Treatment Plants (WWTP). Based on wastewater flow projection rates for the service area, these three facilities must be built in phases, with gradual expansions until they have enough capacity to treat the flows and loads projected by the year 2020. A first phase will start with the construction of a 400 l/s wastewater treatment facility in the eastern part of the city, which is to be completed by the year 2005. West and South WWTP's would be during the second phase.

The system considered as most appropriate for the treatment of wastewater generated by Matamoros consists of a lagoon system. This type of arrangement performs adequately for biological removal, provided proper design and maintenance are ensured. The city's weather conditions, with a high temperature, mild winter conditions and abundant sun, are optimal for this type of treatment system. Table 1 presents the projected treatment capacity and completion timeframes.

TABLE 1
WASTEWATER TREATMENT PLANTS
FLOW

YEAR	TOTAL TREATMENT CAPACITY AVERAGE FLOW (LPS)		
	WEST WWTP	EAST WWTP	SOUTH WWTP
2003	-----	*400*	-----
2006	*705*	-----	-----
2008	-----	-----	*450*
2020	*940*	*500*	*900*

Source: Master Plan

In addition to the above, the use of a lagoon system makes it possible that a portion of the effluent may be improved to meet higher water quality standards for industrial reuse. Furthermore, operation and maintenance costs for a lagoon treatment system are low compared to those of other treatment methods.

Task Schedule

Tasks considered for the Comprehensive Water and Wastewater Collection and Treatment Project for Matamoros, as mentioned above, will be grouped into two major phases: a first phase that includes priority tasks to be completed by the year 2005 and a group of future works needed to meet infrastructure demands projected through the year 2020. On this basis, the task schedule for the first phase of the project is summarized in Table 2 . This schedule could be modified due to the costs defined in the final design, which is under development.

TABLE 2
SUMMARY OF TASKS FOR THE FIRST PHASE - 2003-2005 PERIOD

DESCRIPTION OF ITEM	BUDGET (MILLION PESOS)	NOTES
WASTEWATER COLLECTION AND TREATMENT		
Vactor equipment	*$ 5*	
Decommissioning of the Ocampo Collector	*$ 15*	
Pump stations, mains, and increased capacity in collectors, West area	*$ 150*	
*Repairs to collapsed lines in Primary System**	*$ 38*	*Downtown and various city areas*
Pump stations and construction of 14 km of interception lines , East area	*$ 84*	*Various diameters; city's East*
Construction of the East Wastewater Treatment Plant	*$ 58*	*400 l/s. Located on the city's east area,*
WATER AND INSTITUTIONAL CAPACITY BUILDING		
Replacement of service vehicles	*$ 10*	*63 units*
Construction of Elevated Tank #3 and conveyance line	*$ 37*	*3600 m3 tank*
Construction of Elevated Tank #4 and conveyance line	*$ 36*	*3600 m3 tank*
Rehabilitation of Water Treatment Plant #2	*$ 14*	*Up to 1,000 l/s with water reclamation from filter backwash*
Expansion and improvements to the high service pump station	*$ 23*	
Disinfection system in Plants #1 and #2 (chlorination system)	*$ 2*	
Installation of 100,000 household meters	*$ 120*	*Throughout the city*
Sectorization of main lines	*$ 15*	
Capacity building actions		
Update user registry	*$ 4*	
By-Pass	*$ 3*	
Water storage lagoon 110,000 m3	*$ 19*	
Transmission lines	*$ 47*	*36" line*
Total	**$ 680**	

A summary of the project costs by phase for each of the water and wastewater systems is shown in Table 3.

TABLE 3
SUMMARY OF COMPREHENSIVE PROJECT COSTS
INVESTMENT BY TYPE OF INFRASTRUCTURE

LINE ITEM	ESTIMATED INVESTMENT IN MILLION PESOS	
	FIRST PHASE	FUTURE PHASE
Water infrastructure and institutional capacity building	*330*	*1,700*
Wastewater treatment and collection infrastructure	*350*	*1,818*
Works funded by CNA	*80*	
INVESTMENT BY PHASE	*760*	*3,518*
TOTAL FUNDS		*4,278*

As shown above, the first phase requires 680 million pesos to complete the projects described in the above tables. Section 4 provides a more detailed description of the funding scheme and the proposed contributions by each of the participating agencies.

4. Conformance to International Treaties and Agreements

The Mexican and U.S. sections of the International Boundary and Water Commission share responsibility for jointly addressing environmental and boundary issues that affect the region, particularly those pursuant to the 1983 La Paz Agreement. Under the Agreement, both countries pledged to implement joint actions to protect, enhance and conserve the environment along the common border. The joint cooperation efforts were enhanced as a result of the North American Free Trade Agreement, with the goal of improving the region's environment and public health.

In accordance with the above, the project is based on guidelines established by IBWC for the development of projects. Specifically, the project is described in the "Joint Report by Principal Engineers and Technical Advisors to the Work Plan for the Comprehensive Project for Matamoros, Tamaulipas." The joint report was signed on February 6, 1998 by engineers in charge and technical consultants to IBWC's Mexican and U.S. sections, the United States Environmental Protection Agency (USEPA) and the [Mexican] National Water Commission (CNA). The aforesaid document is an addendum to IBWC's Minute 294, "Infrastructure Planning for addressing Border Wastewater Collection and Treatment Issues" of November 24, 1995.

Minute 307 of the International Boundary and Water Commission, signed on March 16, 2001, provides some water use policies intended to establish a contingency plan to address Mexico's water debt to the United States that resulted from the 1944 International Boundary and Water Treaty.

The Matamoros project, in addition to conforming to these international treaties and agreements, will result in great binational benefits. Some of the most important goals are:

1. *The elimination of wastewater discharges to the Rio Grande to obtain environmental benefits for both countries.*

2. *A more efficient and rational use of water as proposed by this project evidences the willingness of Mexican authorities to abide by water distribution agreements between Mexico and the United States.*

3. *Investments will be made in water projects to increase water use efficiency in Matamoros by reducing per capita consumption and making a more rational use of the scarce volume of water obtained from the Rio Grande.*

4. *Institutional capacity building actions will provide for improved efficiency during JAD's administration, thus creating a comprehensive water culture to achieve the city's sustainable development.*

This project complies with agreements executed by Mexico and the United States such as the La Paz Agreement, the Comprehensive Environmental Plan for the Border; the Border 2012 Program, and the North American Free Trade Agreement.

Human Health and Environment

1. Human Health and Environmental Need. *The "La Palangana" lagoon, which receives flows from agricultural drains, and the Rio Grande, are the two bodies of water receiving most of the wastewater discharges from the city. The remaining wastewater is discharged into agricultural drains located south of the city. Based on these facts, it is easy to understand the serious nature of water pollution and degradation problems that impact on these bodies of water and their surrounding environment. Accordingly, wastewater collection and treatment actions are urgently needed in Matamoros.*

These environmental problems impact on human health, inasmuch as they expose residents, especially those who live near these sources of pollution, to gastrointestinal type diseases. The undeniable importance of water for human life and its susceptibility to become contaminated make water the main vehicle for the transmission of pathogens like bacteria, intestinal parasites, and other organisms. Diseases that are spread in this manner are called waterborne diseases, while those transmitted by ingesting contaminated foods are called digestive diseases.

Table 4 is presented with the purpose of showing waterborne disease trends. It is clear that there is a trend towards higher incidence rates in these types of diseases, which are expected to be indirectly reduced by minimizing potential sources of disease proliferation.

TABLE 4
HISTORY OF WATERBORNE DISEASE RATES IN THE MUNICIPALITY OF MATAMOROS

DISEASE	1997	1998	1999	2000	2001	2002*
Typhoid fever	*15*	*18*	*45*	*50*	*48*	*25*
Paratyphoid fever and other salmonellosis	*1,361*	*2,104*	*816*	*760*	*22*	*16*
Shigellosis	*30*	*35*	*9*	*51*	*83*	*30*
Intestinal infections caused by other organisms and misdiagnosis	*35,094*	*73,651*	*32,053*	*43,558*	*47,645*	*28,576*
Intestinal amoebiasis	*1,672*	*3,668*	*4,087*	*2,773*	*3,485*	*2,006*
Liver abscess	*21*	*20*	*16*	*15*	*16*	*7*
Taeniasis	*3*	*4*	*3*	*2*	---	---
Ascariasis	*522*	*555*	*378*	*311*	*578*	*141*
Oxyuriasis	*370*	*754*	*699*	*409*	*601*	*321*

** Partial Year Statistics*
Source: Tamaulipas Department of Health, Direct communication, 2002

The proposed project has been developed to address the above environmental issues. The project intends to develop a series of tasks and programs in Matamoros with the following general objectives:

- *Providing water and wastewater collection services to 100% of the Matamoros population, addressing primarily those areas that lack these services by constructing the necessary water and wastewater infrastructure.*
- *Improving the city's image with efficient water, wastewater and rainwater collection and treatment systems, developing new projects and refurbishing or replacing existing facilities.*
- *Treating wastewater generated by the city to comply with Mexican Official Norm NOM-001-ECOL-1996.*
- *Complying with NOM-001-ECOL-1996 by submitting to CNA a schedule of actions and projects to be developed for water discharge quality control.*
- *Complying with environment-related standards and international agreements between Mexico and the United States.*

2. Environmental Assessment. *The environment in the area where the Matamoros Project will be implemented has been completely altered from its natural state, which originally consisted of pastureland and the area known as the* "*low deciduous thorn forest*" *that is home to leguminous plants such as mesquite and huizache. These alterations include the conditions described below.*

The city's urban area, where the project is to be developed, has grown and thus, land use has been modified primarily for residential and industrial purposes in addition to public services and facilities in the city area. Likewise, the surrounding areas have suffered alterations that, although not similar in type or magnitude to those in the urban area, have indeed resulted in land use changes in areas that were basically used for agricultural and cattle-raising purposes in the past.

This transformation of the natural environment system has developed in such a disorderly fashion that it has resulted in other problems in addition to those directly related to ecosystem changes. The most significant problems, given its impact on the area, is the environmental contamination and degradation that has resulted from untreated wastewater discharges into open-air canals or drains.

As for air quality, even though the government owns air quality monitoring equipment, the equipment has not been installed due to the lack of trained personnel for its operation, according to statements made by the municipal government. For that reason, records are not available to assess air quality conditions. However, it is believed that no serious air pollution problems exist.

The region's natural flora has virtually disappeared from the city, as well as from the surrounding areas, due to urban growth and land use changes for agricultural and cattle-raising purposes. The existing flora in these areas consists of shrubs and herbaceous plants that appear in abandoned tracts of land, especially those designated for agricultural use.

With regards to the fauna, reports indicate a large variety of species are native to the area where the city of Matamoros is located; however, due to alterations to the natural environment caused by the reasons described above, these species are hardly found in the area, inasmuch as they have been displaced by urban developments and have migrated to areas where they have a better possibility of preserving their natural habitat.

Additionally, hazardous waste generation in Matamoros is caused by solid waste from various human activities. Although a sanitary landfill exists in the area, waste has been mismanaged, especially in areas adjacent to the urban areas. In addition, the municipal government has stated that the landfill capacity has been exceeded and as such, the mismanagement of waste also causes contamination problems underground and the surrounding environment.

A Regional Environmental Impact Statement was developed using the Federal Format for the Water Sector.

Furthermore, a Transboundary Environmental Impact Assessment was developed using the Terms of Reference for Compliance with Border Environment Infrastructure Fund (BEIF) Program Requirements.

3. Compliance with Applicable Environmental and Cultural Resource Laws and Regulations. *Numerous federal, state and local laws and regulations have been issued with the purpose of protecting the country's environment.*

These laws and regulations are the framework for the different requirements that must be met to obtain the required authorizations to implement the proposed tasks. The project has been developed so as to have the appropriate technical elements to obtain these authorizations. In the case of wastewater treatment, the facility designs were developed to meet the limits contained in NOM-001-ECOL-1996.

Pursuant to the provisions of the General Law on Ecological Balance and Environmental Protection as to Environmental Impact Assessments, JAD developed a Regional Environmental Impact Statement (EIS) as directed by the Delegate of the Secretariat of the Environment and Natural Resources

(SEMARNAT), Jorge Cardenas-Gutierrez in Official Communication No. SGPA/03-403/02 of May 8, 2002.

The EIS has been reviewed and approved by SEMARNAT as of May 2, 2003.

Since some wastewater collection and treatment tasks will be funded by the BEIF program, and a Transboundary Environmental Impact Assessment is required. This study was reviewed by the United States Environmental Protection Agency (USEPA), which issued the Finding of No Significant Impact (FONSI) on April 18, 2003.

In addition to the above laws and regulations, and with the purpose of protecting the country's historical heritage, a Finding of No Objection was requested from the [Mexican] National Institute of Anthropology and History (INAH) for the development of the project, as evidenced by Official Communication No. 322/02 issued on September 5, 2002 by INAH's Directorate and signed by Nora Ahumada-Sánchez.

Technical Feasibility

1.- Appropriate Technology

Solutions proposed for the Matamoros Project consider applications and operations similar to those currently in place, with a difference in that the use of more recent materials and procedures are being proposed. The project is not considering the use of sophisticated processes that could create dependency upon specialized suppliers or service providers.

Water

As mentioned in the demographic analysis, a vigorous population growth is expected in Matamoros during the next 20 years. This growth directly impacts on the demand for water services. Water demands for the different project phases can be projected based on water consumption by type of user. However, the population projections used as the basis for estimating the demand level established by Montgomery Watson must be assessed every three years to determine whether it matches the original projection established by the HG Update, or a technical analysis of population growth and related water demands needs to be developed. Thus, in January 2003, CNA completed a technical analysis that determined water demands for first three-year cycle of the project.

Once water demands for each period and sources of water demand were established, JAD proceeded to develop a water model for the system, which determined potential solutions to address the city's water issues. To review the works that comprise the first phase of the project, see Tables 2 and 3 located in the first section of this document.

Raw Water

The evaluation of the first phase identified the need for construction of an emergency water storage facility with capacity of 110,000 m^3. During the

subsequent phase, the project includes the construction of a new storage facility to reach 1,300,000 m^3 storage capacity by the year 2020.

Future tasks for raw water conveyance include the construction of a 4,500 m. line similar to the existing one, to convey raw water to the treatment plant.

Water Treatment Plants

To provide the amount of potable water required by the population, and to assure the quality required by standard NOM-127-SSA1-1994, the Matamoros Project proposes to expand and improve Water Treatment Plant No. 2 to reach a capacity of 1,000 l/s to meet water demands up to the year 2005. In the second phase, the capacity of the facility will be expanded according to the city's growth and available infrastructure. The rest of the water plants are planned to be decommissioned once Water Treatment Plant #2 is fully operational and able to provide services to the entire community.

Distribution Lines

As a result of the studies, JAD decided to implement four types of improvements to the water system.

1. *Addition of lines to provide the system with versatility and allow for better interconnection, improving thus the system's pressure level.*
2. *Transmission lines to supply water to projected elevated storage tanks.*
3. *Expansion of lines that require greater conveyance capacity to meet water demands.*
4. *Rehabilitation of lines with low pressures due to incrustation, and those that have water leaks resulting from corrosion or other reasons.*

Materials recommended for these tasks include PVC for pipes smaller than 40 cm. in diameter, high density polyethylene (HDP), or iron for 46-51 cm. pipes, and for diameters over 61 cm, lined iron pipes.

Pump Stations

Water Plant #2 will require one or more high service pump stations to convey treated water to elevated tanks and to distribution system lines. A high service pump station, along with elevated tanks, will supply water to most of the city of Matamoros to meet water demand during peak hours. Areas immediately adjacent to WTP #2 will be supplied water directly from the facility's high service pump station.

Water Storage

To meet water needs two elevated tanks will be built during the first phase and four others will be built during the subsequent phase. Each tank will have 3,600 m3 storage capacity. The six elevated tanks have the same dimensions: 31 meter diameter, 33.5 meters height above ground level, and a 10 meter operating head.

Efficient Water Use

To reduce current water losses of 37% to 22%, the project proposes the implementation of the actions described below to meet the objective within the timeframe of the project.

Household Meter Installation.- In order to create public awareness about rational water use, the project proposes the installation of 100,000 meters, preferably during the first phase of the project.

Improvements to water treatment plant efficiency - during the first phase, filter backwash water reclamation systems will be constructed and internal water leaks will be controlled.

Waterproofing in raw water storage lagoons.- This action will reduce water losses due to water infiltration to the ground in the storage lagoons site.

Rehabilitation of water intakes.- This activity is targeted entirely on controlling losses in water intakes.

Wastewater Collection and Treatment

As a result of the wastewater collection system modeling, the Matamoros Project incorporated the rehabilitation of collapsed lines and system improvements and expansion. JAD estimated wastewater flows in Matamoros during the various phases of the project using a similar criterion to what was used for the water system, including the analysis of treatment alternatives included in the Master Plan. It must be highlighted that the size of wastewater collection lines and pump stations was maintained pursuant to planning study, since the principal design factor used in that document is rainwater flow into the wastewater collection system, and the adjustment for sanitary wastewater does not reflect a significant reduction in pumping capacity and pipe diameters.

Collector Systems

The water model used for the system showed that most of the pipes are insufficient to convey the flow required during rainy seasons. Pipes must be replaced with larger diameter lines and with more inclined slopes. This requires approximately 94 km of pipes between 20 and 152 cm in diameter, 6.9 km. of which will be installed during the first phase.

In addition, wastewater interception lines must be constructed to convey flows to wastewater treatment plants proposed to be built during the first phase. Lines to supply the West and East Wastewater Treatment Plants represent an additional 14 km of lines for the east area and 21 km for the west area.

Additionally, plans include wastewater collection lines to provide service to new areas during the future phase. For this, the primary systems needs to be re-sized to accommodate the flows resulting from these new developments, which represent increases due to the additional population to be served. Approximately 50 km. of lines are required to provide new wastewater collection infrastructure to new developments.

A very serious problem in the city is the collapse of wastewater lines as a result of corrosion. Therefore, the Matamoros Project proposes replacement of pipes that are in critical structural condition. This includes replacing faulty lines with new lines similar in diameter, unless greater capacity is required based on the water analysis. The approximate amount of pipes to be replaced during the first phase is 7 km with diameters that range from 20 to 91 cm. An estimation of potential collapses was prepared based on a historical analysis of these events, with the conclusion that 10 km of collectors need to be rehabilitated.

It must be noted that to reduce the effects of corrosion on pipes, the project proposes using plastic material for pipes up to 45 cm in diameter and anti-corrosion lining in concrete pipes.

Pump Stations

The 21 existing pump stations will be replaced with new stations with greater capacity. Sixteen stations will be built during the first phase, ten of which are for the East side of the City and six for the West side. During the second phase, the remaining five pump stations will be replaced and twelve new pump stations will be built in new development areas.

Wastewater Treatment Plants

In order to use power efficiently and implement a simple wastewater treatment system, the project proposes construction of wastewater treatment lagoon systems to adequately manage the wastewater flows of the City. Appropriate technology and efficient power use criteria established by BECC will be applied.

From the evaluation of alternatives proposed by the Master Plan and the comparative analysis of population growth rates, JAD was able to establish design flows for each of the wastewater treatment plants. Table 1 shows the treatment capacity for each of the three facilities and the estimated year of construction. The facilities will have 400 l/s treatment capacity during the first phase. It must be noted that the construction of the West and South Treatment Plants will be undertaken during the second phase, and their actual completion time will largely depend on population growth and the availability of financial resources.

Rainwater Collection

Design flows for the rainwater collection system were based on a storm episode of one-year and four months. The Matamoros Project determined that the three areas with the highest flooding rates should be evaluated to develop a proposed solution for the rainwater collection problem in such areas. These areas are Buena Vista, San Francisco and Ciudad Industrial.

The Matamoros Project considers as a future project the construction of pump stations in these areas to mitigate frequent flooding problems.

2. Operation and Maintenance

Once the water, wastewater collection and treatment systems of Matamoros are improved and expanded, they will add to the existing JAD operational requirements. However, facilities currently operated by JAD are similar to those proposed under the project. Only in the case of wastewater treatment plants, does JAD not have appropriately trained staff to operate the facilities. For this particular case, the project proposes to include training and joint operation with the contractor during the construction period to enable operators to become familiar with O&M requirements through hands-on training programs. For the rest of the facilities, best operation and maintenance practices will be implemented and the staff will be trained to implement new facility operation practices and preventive maintenance programs. These programs are currently limited due to financial and structural constraints.

3. Compliance with Applicable Design Norms and Regulations

The project technical engineering designs conform to design criteria and recommendations issued by CNA and, in the case of projects not yet developed, will comply with these same guidelines in addition to conforming to all applicable standards related to water, wastewater collection and treatment infrastructure design. It must be mentioned that the ultimate objective of the proposed works is to meet the water quality standards specified in the Official Norms listed below (to mention only some of the most important ones):

Official Mexican Norm NOM-001-ECOL-1996, which establishes maximum permissible levels for contaminants in wastewaters discharged into national waters and properties.

Official Mexican Norm NOM-002-ECOL-1996, which establishes maximum permissible levels for contaminants in wastewaters discharged into urban or municipal wastewater collection systems

Official Mexican Norm NOM-003-ECOL-1997, which establishes maximum permissible levels for contaminants in treated wastewater used in public services.

Official Mexican Norm NOM-127-SSA1-1994, "Environmental health, water for human use and consumption – permissible quality limits and treatments required for water treatment."

Financial Feasibility and Project Management

1. **Financial Feasibility.** *The financial feasibility analysis was concluded to determine the estimated cost and financial structure of the project, as summarized below:*

TABLE 5
COST ESTIMATION

ITEM	AMOUNT (THOUSAND PESOS)
Wastewater Pump stations and collectors	*234,000*
Decommissioning the Ocampo Collector	*15,000*
Repairing "collapses"	*38,000*
Wastewater treatment plant	*58,000*
Vactor equipment	*5,000*
Elevated storage tanks	*73,000*
Rehabilitating Water Treatment Plant #2	*14,000*
Expanding water pump stations	*23,000*
Disinfection systems	*2,000*
Household metering	*120,000*
Establishment of sectors	*15,000*
By-pass	*3,000*
Water storage lagoon (110,000m3)	*19,000*
Transmission lines	*47,000*
Institutional capacity building	*14,000*
Total	*$680,000*

2. Financial structure. *A summary of the financial structure proposed by the project is illustrated in the following table***.**

TABLE 6

FINANCIAL STRUCTURE

FUNDING SOURCE	AMOUNT (THOUSAND PESOS)	%
CNA (Grant)	*125,000*	*18.4*
State of Tamaulipas (Grant)	*62,500*	*9.2*
City of Matamoros (Grant)	*31,250*	*4.6*
JAD [W and WW Utility] (operating funds)	*31,250*	*4.6*
NADB - LIRF (loan)	*100,000*	*14.7*
NADB - BEIF(Construction Grant)	*330,000*	*48.5*
Subtotal	*$680,000*	*100%*
Works funded by Mexico (CNA)	*80,000*	
BECC - PDAP (Grant)	*600*	
Total	*$ 760,600*	

Rate Model: *The municipality of Matamoros, Tamps, will authorize a rate to construct the infrastructure, operate and maintain it. The rates were estimated based on the population's income. The rates are presented in the following table. The rate/fee model was developed by North American Development Bank.*

TABLE 7
RATE MODEL

YEAR	RATE $MX/CUBIC METER	AVERAGE BILL $MX/MONTH	INCREASE
2002	*4.21*	*102.3*	
2003	*6.32*	*153.5*	*50%*
2004	*9.10*	*221.1*	*44%*
2005	*9.10*	*221.1*	*0%*
2006	*9.10*	*221.1*	*0%*
2007	*9.10*	*221.1*	*0%*

The project will have a grant component from the Border Environment Infrastructure Fund (BEIF). If no BEIF Assistance is provided to the project and assuming 100% loan component, the rates would be the double.

3. **Project Management.** *The project will be management by "Junta de Agua y Drenaje de Matamoros (JAD)", who has adequate staff to manage the proposed infrastructure and address any potential emergency related to the operation and maintenance of the project.*

Public Participation

Public Process Startup

This public process was formally initiated on February 6, 2002, when Mr. Salvador Treviño, General Manager of the Junta de Agua y Drenaje de Matamoros [Matamoros' Water and Wastewater Collection Utility, the project applicant] was provided with BECC's Community Participation Guide and other reference documents to start the public participation process.

Steering Committee

The Steering Committee was established on September 4, 2002 at a meeting held in the Vitrales Room at the Gran Hotel Residencial in Matamoros, attended by 75 people representing local organizations, professional associations, academic institutions, neighborhood organizations, community service clubs, businesses, etc. This helped ensure an ample, plural and inclusive Steering Committee with a clear idea of the community's most significant views. Steering Committee officials were elected as follows: Chairman: Wenceslao Cantú-Cantú; Alternate: Francisco Martínez-Carvajal; Alternate: Priest Ruben Becerra-Ruiz.

Comprehensive Community Participation Plan

Based on previous work meetings held with community members and representatives who later joined the Steering Committee membership, JAD submitted a Comprehensive Community Participation Plan to BECC for review. The plan was received by BECC on March 7, 2002 and approved on March 14, 2002.

Public Information

The Steering Committee and JAD held more than 120 meetings with local organizations, distributed over 5,000 flyers and brochures, and attended numerous project presentations at radio and television stations. The project documents were available to the community for review at the office of the Junta de Agua y Drenaje de Matamoros. Efforts by the Steering Committee and JAD have been constant and fruitful for community outreach purposes.

Public Meetings:

First Public Meeting: *This meeting was held on October 7, 20002 at the "Mundo Nuevo" Convention Center in Matamoros, Tamaulipas, and was attended by more than 400 people, 57% of which were women. This showed the high degree of female participation in the community's planning efforts. At this meeting, JAD reported the project's technical scope, its location, the issues it intends to address, and the approximate cost. The audience, by the intensity and commitment of their participation, confirmed the community's concern to address environmental issues. An exit poll was administered to 305 attendees, and 98% of the interviewees expressed their support for the project.*

Second Public Meeting: *The second public meeting was held on April 10, 2003. This meeting was also held at the "Mundo Nuevo" Convention Center in Matamoros, Tamaulipas, and 313 citizens registered in the sign up sheets. It is pertinent to mention that the Convention Center's capacity is for more than 500 people. The Convention Center was filled with very enthusiastic citizens, many of them standing meaning that more than 500 people attended this second public meeting.*
The presence of Matamoros women in the 1rst public meeting was 57% of the total, for this 2nd public meeting this percentage increased to 71%, this confirmed what the 1rst meeting showed, the high degree of female participation in the community's planning efforts. JAD presented as a key issue for this meeting the project rates, additionally its location and technical information and the approximate cost of the project,.
After a very intensive question and answer session with the audience, an exit poll was applied to 210 attendees, 75% of them expressed their support for the project and the rates.

Sustainable Development

1. Definition and Principles. *The basic principle for sustainable development considered by BECC is: Conservation oriented social and economic development that emphasizes the protection and sustainable use of resources, while addressing*

both current and future needs, and present and future impacts of human actions. The Matamoros Project includes among its objectives providing water, wastewater and wastewater treatment. The project plans to provide these services to the entire population during a 20-year project horizon, inasmuch as these services are currently deficient and, in the case of wastewater collection, not all residents are served. The city does not have wastewater treatment and this situation negatively impacts on the environment and seriously limits the possibility of reusing water that is so scarce in the Lower Rio Grande River watershed. This project has goals for reducing water losses, encouraging rational water use, and providing a certainty as to the availability of water for future growth.

Overall, the proposed project will promote significant environment and natural resource conservation benefits, inasmuch as the following feasible objectives have been established:

- *Improve Rio Grande water collection and withdrawal efficiencies.*
- *Optimize distribution lines and reduce water losses.*
- *Increase household metering coverage to be able to bill and collect the actual amount of water used up by residents and thus promote the rational use of water.*
- *Increase wastewater collection infrastructure to adequately convey raw water to the treatment facility and treated water to the final discharge point.*
- *Treat wastewater generated by city residents. These will make additional volumes of treated water available for industrial reuse and/or other uses.*
- *Gradually but significantly reduce raw water infiltration into the ground.*

This project intends to provide 100% water, wastewater collection and treatment coverage by the end of the planning period, substantially improving the overall living conditions for residents who currently lack these services, and opening up the possibility of developing economic activities that may provide better opportunities for the community.

In view of the above considerations, the project conforms to BECC's sustainability principles.

2. Institutional and Human Capacity Building

As part of the Matamoros Project development, JAD identified activities and actions in addition to the construction of infrastructure to enhance JAD's institutional capacity.

- *Update and upgrade the user registry and the commercial information system (computer system) to improve billing and collection practices and reduce payment delinquency.*
- *Improve the information control and follow-up process by designing and implementing organization and procedure manuals in all the areas.*
- *Improving the processing of information generated by JAD through the purchase and installation of adequate computer equipment, as well as*

developing and implementing a comprehensive information system (computer system).

- *For the household metering program the project proposes to set up an appropriate maintenance shop. This action will promote rational water use.*
- *Along with the household meter installation program, billing and water use information from different city areas will be correlated with water flows entering the distribution system. This will enable the utility to identify and implement actions to reduce water losses and unaccounted water volumes.*
- *JAD's service requires the use of machinery, equipment and vehicles that will be purchased as part of this program, including automobiles, trucks and Vactor equipment.*
- *The implementation of several of the above actions, such as updating the user registry, enhancing the billing system and installing household meters, will facilitate the task of identifying and eliminating illegal connections.*
- *JAD has developed a water culture campaign that will be reinforced during the following years to create public awareness as to the importance of saving and making rational use of water.*
- *Infrastructure growth will clearly demand greater technical capabilities in JAD to efficiently operate the system. Hence, the project has considered a staff training program to operate the system in a more efficient manner. An option that has been considered for training is one offered by NADB through the Utility Management Institute (UMI). The above will be incorporated into a comprehensive human resource development program.*
- *JAD plans development of safety procedures and practices to minimize the risk of environmental contingencies related to chlorine gas leaks.*
- *A quality assurance and control program will be establish with the purpose of creating quality criteria to operate the system under applicable quality procedures and policies, as well as to establish criteria and standards for the design and construction of new infrastructure.*
- *Analyses of the legal framework have been made to determine the actions to carry out the necessary legal adjustments JAD's institutional capability.*
- *A water quality program has been proposed to enable JAD to establish operating procedures oriented towards continuous improvement, increasing thus the utility's technical capacity and providing more efficient and high quality services.*
- *To carry out these actions, JAD decided to update user fees, which are estimated to have a 100% increase by the year 2003. For subsequent years, user fees will be reviewed every three-year period.*
- *NADB has assisted JAD through its Institutional Development Program (IDP) and will continue providing support to the Matamoros Project with the development of tasks related to updating the user registry, the rate/fee study, enhancing the information system, developing the management and organization system, among other issues.*

- *NADB developed a study to evaluate the user fee structure and create a tool with which JAD may implement service charges appropriate to the financial conditions to operate, maintain and increase the infrastructure, avoiding the risk of facing an infrastructure backlog in the future.*

An important point that must be highlighted is the infrastructure's maintenance and preservation. The project proposes the development of two types of maintenance programs for the facility: preventive and corrective maintenance.

Additionally, the training will include a contingency program for the system's construction, start-up and operation phases, which will be provided in writing to all the staff directly or indirectly involved in these activities. A safety program will also be implemented and reinforced by the provision of an appropriate number of quality equipment. The safety program will include enforcement of construction specifications, in addition to general procedures for operating the equipment and facilities, including electrical installations.

3. Conformance to Local and Regional Conservation and Development Plans

The Matamoros Project conforms to BECC requirements and is based on the strategic guidelines provided in the Municipal Urban Development Plan and on regional conservation regulations and criteria. The main objective is to improve the quality of life of Matamoros' residents within a framework of harmonious and balanced integration of urban development and land management planning. Policies and guidelines would relate to three fundamental issues: growth, conservation, and improvement.

The Matamoros Project conforms entirely to the city's urban development planning strategies, both for its current needs as well as for future projected needs, and largely contributes to achieving the objectives of improving the quality of life of city residents. The project proposes urgent tasks to reduce the current backlog and improve the conditions for people who already reside in the urban areas. In addition, projects will be built that will enable the city to provide improved living conditions for future generations. This is a significant contribution to the sustainable development of Matamoros' urban area.

In the area of regional planning, the project incorporates actions and tasks included in the PNH, such as the implementation of projects and actions intended to reduce unaccounted water losses and increase JAD's overall efficiency. The project is also oriented towards reducing water contamination in the watershed considered by the PNH to be a priority area by virtue of its being a binational watershed with significant economic activity. The project meets the basic tenets of policy guidelines proposed by the PNH. The project focuses its efforts on development of the city of Matamoros within a sustainability framework that considers water as a national security resource and incorporates user participation in decision making processes, as the users are the ones ultimately affected by the implementation of water related policies.

4. Natural Resource Conservation

Proposals to improve water infrastructure are oriented towards beneficial use of water through water collection, storage and distribution improvements. One of the main objectives of the project is to promote the rational use of water due to the scarcity of this vital liquid in the Lower Rio Grande Valley region.

Additionally, improvements in household metering and adjustments in user fees, as well as public education campaigns to promote a better use of water, are intended to reduce the daily per capita water consumption rate.

With the improvements proposed for the wastewater collection and treatment system, effluent discharges will have a higher quality before reaching their final destination into natural water bodies, thus creating safer sanitary conditions for the community. These same treated waters may be reused, primarily to irrigate crops, including cotton, wheat, safflower, sorghum, corn, alfalfa, date palms, and citric fruits. Reuse of water that replaces use of fresh water for other activities also improves availability of fresh water for human consumption in Matamoros.

The construction of the collector system and the East Wastewater Treatment Plant will substantially improve the quality of water that currently flows into the "La Palangana" lagoon, thus contributing to improve the condition of a major habitat for migratory birds.

5. Community Development

Expected results from the implementation of the Matamoros Project, in addition to improving the quality of water and the environment, will create favorable conditions for the city's development, starting with the creation of new jobs for the construction, operation and maintenance of the proposed projects. In addition, the project will continue promoting the establishment of industries as has happened in recent years, particularly maquiladoras [twin plants], creating a source of economic and social development for the area.

Once the new facilities begin operation, the need for specialized personnel will be greater, since it will be important to have qualified operators. This will encourage the utility to improve training the staff, including management, to build an adequate internal capacity to address most, if not all, of the problems that may arise in relation to operation and maintenance of the facilities.

Furthermore, by improving the quality of the region's bodies of water, such as the Rio Grande River and nearby lagoons, these water bodies will become major recreational sites for residents and will also advance the urban development planned for Matamoros.

Available Documents

- *Infrastructure Planning for Water and Wastewater Improvements for the city of Matamoros, Tamps.(under Minute 294)*

- *Environmental Assessment of Transboundary Impacts*
- *Mexican Environmental Assessment*
- *Financial Analysis and Viability for the Comprehensive Water and Wastewater Project for the city of Matamoros, Tamps.*
- *Certification Document*