

STATE PUBLIC SERVICE COMMISSION OF TIJUANA

Tijuana, B.C.

PARALLEL CONVEYANCE SYSTEM FOR THE CITY OF TIJUANA

* Lift Station and Wastewater Conveyance System

* Rehabilitation and Expansion of the San Antonio de los Buenos

Wastewater Treatment Plant

STEP II FORMAT FOR PROJECT CERTIFICATION PROCESS

Presented to the

BORDER ENVIRONMENT COOPERATION COMMISSION

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EXECUTIVE SUMMARY

INTRODUCTION

In a joint effort, the United States and Mexico have started a program to control wastewater discharges to the coastal waters of the border zone between Tijuana and San Diego. Part of these efforts include a 25 MGD international wastewater treatment plant located in San Diego County, California, which shall be used to control an important part of the municipal sewage generated by the city of Tijuana. In addition to this plant, the State Public Service Commission of Tijuana (CESPT) has developed two important new projects that will allow it to manage, treat and discharge to the ocean for final disposal the balance of the wastewater that is generated today within the urban area of the city. These projects are:

- the construction of a new parallel system for the conveyance of wastewater from its concentration point at the border with the United States for treatment at the San Antonio de los Buenos Wastewater Treatment Plant, and
- the expansion and rehabilitation of the San Antonio de los Buenos wastewater treatment plant.

CONVEYANCE SYSTEM

The existing wastewater conveyance system consists of a lift station, named PBI, with a nominal capacity of 35 MGD, and an open channel; however, due to the increase registered in the wastewater collected by the sewer system of the city, the lift station and the conveyance channel have been operated to their maximum capacity in a continuous way, which has necessitated the postponement of maintenance of the facility. As a result of these circumstances, the system has suffered frequent failures.

When the conveyance system fails, raw wastewater is discharged through the Tijuana river into the estuary and tidelands of the river, followed by transboundary problems of environment pollution and health risks to the nearby communities. The construction of a new conveyance facility will provide a backup for the existing infrastructure and prevent a recurrence of these problems. The new conveyance system will have a capacity of 50 MGD.

TREATMENT PLANT

The treatment plant of San Antonio de los Buenos has a nominal treatment capacity of 17 MGD, and the wastewater flow that is conveyed by the existing system has been greater than 27.4 MGD in the last few years. Therefore, only part of the wastewater is treated at the plant and the rest is combined with the treated effluent and discharged directly to the sea. The pollution problems caused by this combined effluent are serious and diverse, ranging from the visual effect of the discharge that affects the sea water properties, up to ecological and sanitary effects on the population and environment. On the other hand the plant performance is less than the design and the effluent quality that is produced does not comply with the Discharge Standards (CPD) which have been set by the National Water Commission (CNA). In order to attend these problems, CESPT has initiated the surveys and studies necessary to rehabilitate and increase the treatment plant capacity.

TECHNICAL CHARACTERISTICS

Lift Station

The new lift station will utilize five pumping systems composed of two pumps in series each with 700 HP motors on each pump. The head loss that needs to be overcome is of 400 ft, and the average flow of each system will be 13 MGD. The pumps are special wastewater centrifugal type with a solids particle size of 4". The new lift station will be located next to the PBI and will be interconnected to the existing conveyance system.

Conveyance System

The new conveyance system will run parallel to the existing channel. In the first 3 miles the piping will be pressurized and will have a 48" diameter. Beginning at mile 3.0, the piping will have gravity flow (except at nine siphons that will be used to cross several streams and topographical accidents) up to the discharge point into the sea 11.4 miles downstream. The gravity flow piping will be of reinforced concrete, with a 54" diameter. The new conveyance system will also be connected to the San Antonio de los Buenos treatment plant.

Treatment Plant

The San Antonio de los Buenos Plant consists of three ponds in series and with a chlorination system for the outflow. The first two ponds have a diffused aeration system. The rehabilitation and enlargement of the plant will consist mainly of four tasks:

- rehabilitation of the pre-treatment system (screening and grit chamber),
- substitution of existing coarse bubble aeration equipment for modern fine bubble aerators,
- installation of plastic baffles in the ponds to prevent hydraulic short circuits,
- installation of a system to recirculate sludge from the last to the first two ponds, and
- construction of a system to handle the excess sludge wasted from the plant.

COSTS AND FINANCING

The estimated capital investment required for the new lift station and conveyance system is of 16 million dollars, and for the rehabilitation and enlargement of the treatment plant another investment of 2 million dollars is estimated as necessary. To cover this capital investment, the United States Environmental Protection Agency (EPA) and the American Section of the International Boundary and Water Commission (IBWC) have announced a contribution of 16 million dollars, with the balance being provided by CESPT, through a credit from the North American Development Bank (NADBank). The present document summarizes the STEP II of the project certification process of the Border Environment Cooperation Commission (BECC).

PUBLIC HEALTH AND ENVIRONMENT

The estuary of the Tijuana river and the coastal region along the border constitute invaluable natural resources because of the biological diversity they keep, because of their natural beauty and the benefits that this represents for recreation of the bordering communities and the large number of people that visit the zone. A wastewater discharge without control has put in serious risk these resources. The environmental authorities from both countries have conducted many scientific studies on these ecosystems and the factors which threaten them, the conclusions have been unanimous; the control of these sewage discharges is an essential task for environmental conservation.

It is also important that the public health risks represented by these raw sewage discharges be prevented. These risks arise for those who use the coastal waters for recreational purposes, as well as for the population that resides near the zones where the discharges take place.

COMMUNITY PARTICIPATION

The active participation of the communities in the analysis and solution of the environmental problems is a policy established by CESPT, and shared with the BECC. For the development of the projects described above, the CESPT, with advise from the BECC, created two citizen's steering committees which include representation of the main sectors of each community (San Diego and Tijuana.) In Tijuana the committee includes representation from the regions of Tijuana that will receive direct benefits from the project and that will be responsible for covering project costs.

I.- General

A.- TYPE OF PROJECT

The parallel conveyance system of the City of Tijuana has as an objective the improvement of the management, treatment and final disposal of the city's wastewater. Among the principal benefits of the project are:

- *a stronger reliability on the wastewater conveyance system of the city,*
- *a better quality of the wastewater which is treated at the existing treatment plant and that is discharged into the coastal waters south of the city, and*
- *the possibility of reusing within Mexico the treated effluent from the binational plant, which has recently been put in operation inside of United States territory, on the left bank of the Tijuana river close to the international border.*

These facilities will be built by the State Public Service Commission of Tijuana (CESPT). The Environmental Protection Agency (EPA) has committed a \$16 million contribution to cover part of the costs; the remaining part will be covered by CESPT with a loan from the North American Development Bank (NADBank). According to the procedures established by the NADBank, and by request of EPA, CESPT needs BECC certification that complies with the criteria established for these type of projects. In this document the main environmental, technical and economical characteristics of the projects are presented.

B.- LOCATION

The project is located in the City of Tijuana. The three main components of the proposed works and their location include:

- *a new wastewater lift station located in the vicinity of the existing facility at Independencia avenue and Venustiano Carranza street,*
- *a new wastewater conveyance system of 10.8 miles length that runs parallel to the existing channel, and*
- *the rehabilitation and expansion of the San Antonio de los Buenos treatment plant, including the disposal of sludge.*

C.- PROJECT AND TASK DESCRIPTION

1.- Project Description

The Mexican and United States Governments have started an ambitious sanitation program at the border zone of Tijuana and San Diego. As part of this program a treatment plant has been built to handle Tijuana's wastewater at the northern side of the border and a submarine outfall for disposal of the treated effluent; these binational projects are named in the treaties signed by Mexico and the United States as of July 2nd of 1990 in Minute No. 283 of the International Boundary and Water Commission (IBWC).

The new plant, officially named "International Wastewater Treatment Plant" (IWWTP), shall consist in a first stage of pretreatment units for the removal of coarse material, sand, floating material, oil and grease, followed by an advanced primary system that includes coagulation and disinfection. The first stage of the IWWTP has entered into service as of April of 1997. The second stage of the IWWTP shall consist of the biological removal of organic material. The effluent of the plant shall be discharged into the Pacific Ocean at 0.93 miles from shore through a submarine outfall. The submarine outfall shall enter into service sometime in 1998. In the interim period between the termination of the first phase of the IWWTP and the termination of the submarine outfall, the effluent of the IWWTP may be discharged through an emergency connection to the sanitary system of the city of San Diego and conducted to a treatment plant at Point Loma; the hydraulic capacity of this emergency connection is, notwithstanding, lower than the capacity of the IWWTP treatment.

As a complement to these facilities two large projects are under development:

- *a lift station and a conveyance of 10.8 miles of length that begins at the wastewater treatment binational plant and ends at the lift station of the current Tijuana treatment plant,*
- *the rehabilitation and expansion of the existing wastewater treatment system.*

The lift station and pipeline will serve to convey an important wastewater flow from the city, at the current point of concentration at a place nearby to the crossing of the Tijuana river with the international border, to the discharge of the San Antonio de los Buenos stream at a place known as Punta Banderas, 5.6 miles south of the border.

Since the main objective of these facilities is to serve as a backup for the existing wastewater conveyance facility, they may be also used for two important future tasks:

- *to return to Mexico, if deemed convenient, the treated effluent from the international plant for possible reuse, and*
- *to help handle the effluent from the binational plant when, for any reason, the facilities destined for discharge into the Pacific ocean are not in service.*

Lift Station and Conveyance Line

The current conveyance system consists of a lift station (known as PBI) and a pressurized transfer line, another gravity flow line and an open channel. The lift station has 4 pumps with 1,500 HP motors and a capacity of 11 MGD each. As part of the annexed works of the new lift station, the enlargement and fitting of unbridled structures in the grit removal units is being considered in order to enable cleaning of the facilities. Thus, two large grit chambers were sized, with access to heavy machinery, at the site where the existing channels are currently. Also, an equalization tank has been proposed in order to guarantee the proper operation of the pumping equipment.

In the past few years, the operation of the PBI has frequently been affected due to overloads that the system has had to work with, with the resulting spill of raw wastewater into the United States. With the new pumping and conveyance system, the risk that these problems may be repeated is eliminated.

In 1995, CESPT had a Mexican engineering company examine alternatives of the route that the transfer line should follow. As a result of this study, CESPT concluded that the best alternative consists of a route parallel to the existing conveyance system. The new conveyance system will consist of a 3.2 miles pipeline of 54" diameter and 9.5 miles of gravity flow pipeline of 48" diameter. The lift station will have a design capacity of 25 MGD at average flow, and 50 MGD at maximum flow.

San Antonio de los Buenos Plant Rehabilitation

At the area known as San Antonio de los Buenos, CESPT operates a treatment system consisting of two aeration ponds, one sedimentation pond and a disinfection system with chlorine gas. The plant was designed to treat up to 17 MGD of wastewater. The current flow of wastewater arrives at the plant through the existing conveyance channel. This channel receives flows from the main collectors in the city are conducted, as well as the raw wastewater which is picked up by a pump station built by the International Boundary and Water Commission (PB-IBWC) and sent to the PBI.

Along the way, the conduction line receives also flows collected by the wastewater pump stations from Playas de Tijuana and from the Matadero area. The total flow received by this collection system exceeds, by much, the capacity of the treatment plant. This situation has resulted in only part of the wastewater receiving treatment in the ponds and the treated effluent is mixed afterwards with the remaining raw wastewater before discharge to the ocean. Thus, the effluent discharged at San Antonio de los Buenos does not comply with the applicable water quality standards, in particular regarding

pathogenic organisms. In addition to the above, the San Antonio plant has experienced operational problems due, mainly, to three reasons:

- a deficient pretreatment system,
- a deficient aeration and biomass conservation system in the reactors, and
- hydraulic short circuits that cause the actual hydraulic retention times in the reactors to be lower than design.

Main characteristic of the ponds are those named as follows:

Pond	Area Ha	Depth m	Theoretical Retention Time, days	No. of Diffusers
1	4	4.5	3	950
2	4	4.5	3	622
3	2	4.5	1	28

It should be pointed out that, after operating from 1984 to 1994 with no major maintenance works, CESPT carried out a program to dredge the ponds, which yielded an increase in removal efficiency, regarding biochemical oxygen demand (BOD), from the ponds at levels close to 65%, and that is how they currently operate. With the proposed rehabilitation, the efficiency should increase up to 90%. The operational efficiency of the plant in 1996, with an average wastewater flow of 16.7 MGD, was the following:

Parameter	Units	Influent	Effluent	Efficiency (%)
DBO total	mg/l	263	115	56
DBO soluble	mg/l	119	75	37
DQO total	mg/l	508	266	48
SST	mg/l	211	62	71
Grease and oils	mg/l	131	67	49
Choliform total	MPN/100 ml	2.4 E+10	2.4 E+3	---

Because the SAB treatment plant capacity is lower than the flow of the conveyance channel, a part of the flow, approximately 11 MGD, does not receive any treatment and is mixed with the plant effluent. The quality of the water mixture does not comply with the applicable effluent standards and causes the pollution of the coastal areas around Punta Bandera.

The discharge standards (CPD) that the National Water Commission has set for Punta Bandera are as follows

Parameter	Daily Average Concentration	Instantaneous Maximum Concentration
Total BOD	30	45
Soluble BOD	20	25
Total COD	100	140
TSS	30	40
Oil and Grease	10	15
Total Coliform	---	10,000
Fecal Coliform	---	1,000

Units in mg/L, except coliform in MPN/100 mL

In January 1996, CESPT, with support from an Mexican environmental consulting firm, carried out a study on rehabilitation and possibilities of expansion of the San Antonio de los Buenos plant. From the results of the study it was concluded that it is possible to rehabilitate the plant and to increase its average treatment capacity up to 25 MGD without the need of making substantial modifications to the existing structures. Should it be necessary to increase the treatment capacity of the plant beyond 25 MGD, the construction of complementary treatment works would be required.

An aspect of the rehabilitation and expansion problem that is being currently studied by CESPT is related to management, treatment and disposal of the sludge generated in the plant. The projects that are proposed as a result from these studies, will be incorporated in the CESPT current building program. It should be mentioned that the extended aeration system that will be used in the rehabilitated plant produces an almost total oxidation of the biomass, which results in a very small production of sludge, that, would also be predominantly non organic. The estimated cost of rehabilitation and expansion of the plant, with the additions mentioned in regard to the sludge, is of 2 million dollars.

2.- Project Tasks Program

The project tasks consist of the conclusion of the engineering design, the bidding process, and, finally, construction and equipment installation.

3.- Description of the Community

The city of Tijuana has become one of the most important economically blooming cities in Mexico. Growth of the commercial, tourist and industrial sectors, in particular, the manufacturing industry, has overcome all expectations. This growth has brought with it rising environmental problems. One of the most severe environmental problems faced by the community is the contamination of its shores and coastal waters because of discharge of raw wastewater. The authorities at the three government levels (municipal, state and federal) have been seeking the solution of these problems. The most relevant environmental actions to be considered are those related to drinking water supply, sewage and sanitary systems, including the operation and maintenance of the treatment plant at San Antonio de los Buenos. New works are required in order to prevent discharge of raw wastewater into the Tijuana river and/or the coastal waters.

The current population of the city of Tijuana is approximately 1.1 million people, and the coverage of the sewage system service is of 65%. The evolution of these statistics, and other related, is shown in the following table:

year	Population	Household Connections	Sewer Coverage	Average Wastewater Flow
	No. of People	N°	%	MGD
1995	995,116	151,407	57	30
1996	1,048,535	171,407	61	33
1997	1,106,489	191,407	65	37
1998	1,169,575	211,407	68	41
1999	1,238,538	231,407	70	45
2000	1,314,535	251,407	72	49
2001	1,398,227	271,407	73	53
2002	1,491,965	291,407	73	56
2003	1,598,028	311,407	73	61
2004	1,720,087	331,407	72	64
2005	1,863,729	351,407	71	68

CESPT looks forward to increase rapidly the coverage of the water and sewage services through a new sanitary program proposed for the years of 1997 -1999. The sanitary program proposed by CESPT includes the following:

- construction of 340 miles of sewer pipes,
- construction of 15 miles of collectors, and
- construction of three new wastewater treatment plants with a total capacity of 13 MGD to provide service to 69,964 houses in 31 residential areas.

The increase in the collection of wastewater by the new sewage works does not affect the generation / treatment balances, since the flow of wastewater gathered by new sewage works will be treated in treatment plants built as a part of the same sanitary programs.

4.- Project Alternatives

The project alternatives are: not doing anything and to develop other projects that try to reach the same goals. The alternative of not doing anything is not acceptable because of environmental and public health issues mentioned earlier. Other ways of achieving the same goals were studied by CESPT and other government organizations, in particular by CNA, concluding that the most recommendable, from a technical and financial point of view, is the proposal described herein.

The alternative of building a new lift station based on rehabilitating the existing facilities at the current PB1 is considered imprudent because of the following reasons:

- The wet well needs remodeling of a considerable magnitude.
- The access line from the IWWTP to the PB1 will cross over with multiple lines inside the site.
- The PB1 abuts with lots with access to the back street (Carranza street) which makes it easier to build the pressure line from the lift station.

In regard to the conveyance line, the possibility was considered of constructing it over the right of way of the existing line or over other road ways. The option of constructing this over other road ways would involve keeping the lines under the shoulders of the road of the Tijuana-Ensenada highway, an option which is not recommended according to criteria of the National Water Commission.

5.- Project Justification

The city of Tijuana has grown at an accelerated rate in the last few years, which will probably continue in the immediate future. The parallel works are justified in order to provide treatment to the growing wastewater flows. The scenarios of management and treatment of wastewater are those named in this section.

The treatment options of the wastewater flows expected to be generated in the city are the following:

1995	At the end of 1995, beginning of 1996, the average wastewater flow was 32 MGD. With a treatment capacity at San Antonio de los Buenos of 17 MGD, 45% of the flow did not receive any kind of treatment. In addition, the wastewater that passed through the plant was treated in a deficient manner.
1998	The average flow is estimated to be 41 MGD, from which 25 MGD would receive treatment at the binational plant and 16 MGD in San Antonio de los Buenos. Under these conditions, the capacity of the two plants shall be practically saturated and the pollution problems would occur again. For such reason, if the capacity is not increased at San Antonio de los Buenos at this date, new pollution problems will arise in the coastal waters.
2000	The average flow is estimated to be 50 MGD, same as the combined capacity of San Antonio de los Buenos enlarged to 25 MGD and the binational plant. At this point it will be necessary to include new treatment plants or apply expansions at the existing facilities. The design capacity of the IWWTP is 25 MGD, notwithstanding, in the first stage it shall begin working at approximately 50% of its nominal capacity. The SAB plant has a nominal capacity of 17 MGD. Under this conditions, the total treatment capacity will be 30 MGD being gradually increased up to 42 MGD. By 1998, the capacity of the plants will be expanded because of the generation of wastewater. If the capacity of the SAB plant is enlarged up to 25 MGD, the total capacity would be able to cover the needs until the year 2,000, and if SAB was to be enlarged up to 32 MGD the needs of the year 2002 would be satisfied.

Because of the reasons above mentioned, it is considered that the rehabilitation and expansion of San Antonio de los Buenos is justified and necessary. The works that are constructed shall include the necessary facilities for a proper management, treatment and final disposal of the sludge according the environmental law in effect and with sustainable development and environment protection criteria established by BECC.

D.- CONFORMANCE WITH INTERNATIONAL TREATIES AND AGREEMENTS

The proposed project has been analyzed and discussed in many diverse public and private forums, particularly before national and international organizations that the governments of Mexico and the United States have created to address border environmental problems. The projects are contained in the agreements that in terms of environmental matters have been established by the International Boundary and Water Commission, as well as the regional plans from the State Government of Baja California and the National Water Commission. Other organizations that have become aware of these

proposals are the Environmental Protection Agency of the United States (EPA), as well as CWQCB-SDR (California Regional Water Quality Control Board, San Diego Region) and SDMWD (San Diego Metropolitan Wastewater Department). It is a consensus of all the consulted organizations that the construction of a parallel system for the management of Tijuana wastewater, as well as the rehabilitation of the San Antonio de los Buenos plant are priority projects for control of environmental pollution in the Tijuana-San Diego region. It should also be mentioned that EPA has reserved a special fund for funding these works, an action that makes the support given to this project evident.

II.- Human Health and Environment

A.- HUMAN HEALTH AND ENVIRONMENT NEEDS

The effects on the environment and public health caused by discharges of raw wastewater at Punta Banderas and in the estuary of the Tijuana river have been widely documented and analyzed in the environmental impact study carried out in 1996 by the International Boundary and Water Commission (IBWC) and the Environmental Protection Agency (EPA). Some of the most important conclusions from the results of these studies are presented as follows.

Considering that IWTP does not have authorization to discharge the effluent to the coastal zone, as long as the ocean outfall is not finished, the plant can only treat a flow no greater than that allowed by the emergency connection to the city of San Diego sewage system. The excess flow shall be sent through the PB1 to San Antonio de los Buenos, but given the limited capacity of the SAB plant, only part of the wastewater will receive treatment and the rest will be discharged raw at Punta Bandera.

On the other hand, the construction of the new pipeline will allow the required maintenance to the existing channel and PB1 which, due to an increase in wastewater flow has not been accompanied by a correspondent increase in pumping capacity, and has had to work at maximum capacity on a continuous basis. If the new lift station and wastewater pipeline are not available, the pumping of raw sewage to Punta Bandera could be interrupted and the resulting spillage would pollute the Tijuana river and its estuary.

B.- ENVIRONMENTAL ASSESSMENT

The effects of discharging contaminated wastewater at Punta Banderas were studied by the company responsible for the design of the ocean outfall for the IWTP (Parsons Engineering Science, Inc., 1996) and the results made evident that the effects of the pollution would extend beyond the international boundary line. Just to mention a single example, it is estimated that in the months of June to December the coliform concentration in the coastal waters at the border line would be between 100 and 10,000 organisms/100 mL 80% of the time. To recall that the California state regulation for waters with recreational use is of 1,000 coliform/100 mL. Obviously, between the border line and Punta Banderas the concentration of pathogenic organisms will be even greater.

By 2001, assuming that the proposed works will not be carried out, the dilution of pollutants in the coastal zone at Punta Banderas was estimated; along the shore line the dilution varies from 1 to 10; with these dilution factors, the concentration of pathogens at the coastal zone will always be greater than that permitted in waters for recreational use, even without direct contact.

Other environmental problems are those seen in the past and that will persist in the future if the proposed works are not carried out, like the formation of puddles of contaminated waters along the courses that the sewage overflows take, that yield the proliferation of mosquitoes and other insects, which would represent a health risk for the people living in the neighboring zones.

In the estuary, the discharge of highly available nutrients which are contribute by the raw wastewater could be a cause of eutrofication that would affect the local fauna. Likewise, the accumulation of settleable solids will create banks of septic material which could kill or affect benthal organisms.

C.- COMPLIANCE WITH APPLICABLE ENVIRONMENTAL AND CULTURAL RESOURCE LAWS AND REGULATIONS

CESPT has hired a consulting firm to carry out studies on the environmental impacts expected from the proposed works. The study is nearly concluded and the results include the analysis of the applicable regulations that concern this project, as well as the relationship with the local development plans and programs. The laws and regulations in terms of environmental and cultural resources to which the projects would be liable, include, but are not limited to, the following:

- water quality standards of the effluent from the SAB plant established by the National Water Commission,
- permits and authorizations required by the National Institute of Anthropology and History,
- actions to mitigate the adverse environmental effects identified in the EA study and approved by the National Institute of Ecology and/or the ecological authority of the State of Baja California,
- municipal regulations on land use,
- other recommendations derived from the meetings of the Citizen Steering Committee for the project, and
- all the other construction standards applicable to projects with state or federal financing.

III.- Technical Feasibility

A.- APPROPRIATE TECHNOLOGY

1.- Specifications of the Project

The technical specifications of the project, as of the lift station as well as the conduction line are currently in the development process by the engineering companies engaged by CESPT. In the study of alternatives and in the Facilities Plan, the technical tentative specifications were established subject to revision as a function of the results of the final design. It should be mentioned that the final design will be developed according to the standards of the Engineering Management and the Basic Standards of the National Water Commission and with the Official Mexican Standards.

2.- Technical Process

Lift Station

For the construction of the lift station, CESPT has under consideration a land near to the current PB1. Once it is assured that the land is available, the next step will be to carry out technical feasibility studies of alternatives and evaluation of tentative budgets, including connection works of IWTP to the new lift station. To make clear that the two lift stations (PB1 and the new plant) will be interconnected, which will allow to use them indistinctively for pumping raw wastewater coming from the Tijuana collectors, as well as treated effluent from the IWTP.

The rebuilding of the old lift station shall be made suitable to keep the equipment and necessary facilities that will conform the new lift station. The enlargement of the electrical substation will be developed within the same area on which the operations are carried out. The selected pumping equipment have the following characteristics:

- the arrangement consists of a 4 group system in operation and 1 as standby. Each group shall be formed by two pumps in series, working in a booster way. For such reason there will be 10 pumps in the plant
- The total dynamic load of the pumping is of 400 ft.
- The load available in the suction varies from 10 to 15 ft.
- The operation flows go from 13 MGD, when only one group operates, up to 50 MGD when simultaneously all four groups are operating.
- The pumps selected are specially made to handle wastewater
- Pumps are centrifugal type, obstruction proof, with a solids passage of up to 4" diam.
- Pumps will be installed directly to a vertical motor squirrel cage type 700 HP each, with 1160 rpm and to work with a voltage of 4160 volts and 3 phases. The efficiency of the motor-pump team is of 85%.
 - The installed capacity at the electrical substation is of 6000 Kva, that includes four groups operating and accessory installations.

Interconnection of the pumping plants: A new pump plant will be available placed in the old building of the PB1, that would be able to transfer treated wastewater through the binational plant or the raw wastewater that come to the pumping plant which is currently in operation.

Interconnections in the outfall: In order to have versatility in the operation and to make easier the maintenance of the sewer mains, both existing and new from the project, three interconnections are contemplated.

- at the residential area of Lázaro Cárdenas, at the place where the conduction pipeline begins working as an open surface, sewage collector type,
- at the pumping plant of ponds. At this place will have the option to feed the ponds with the new or the existing sewer main,
- at the discharge of the treatment plant of Punta Bandera. At this place the option will be to direct the effluent from the plant to Punta Bandera, either by the new sewer main or the existing one.

Transfer Line

In the year of 1995, CESPT directed a Mexican engineering company to conduct a study of the alternatives for a route for the conduction line. As a result of said study, CESPT came to the conclusion that the best alternative consists of a parallel route to the current channel. In October of 1996, CESPT directed another engineering firm to develop the final design of the transfer line. The results of this projects will be ready in April of 1997, the main characteristics of the new system are those shown in the following table:

From Km	To Km	Description	Type of Conduction
0+000		Lift station and air chamber	Structure.
0+000	1+900	Discharge or Pumping Line.	Concrete or Ductile Iron 48" Diam.
1+900		Transition Flow Tower, Concrete Structure	Structure.
1+900	2+205	Pressure Line	Prestressed Concrete or Ductile Iron 48" Diam.
2+205		Energy Release Tower, Reinforced Concrete	Structure
2+205	2+915	Pressure Line	Prestressed Concrete or Ductile Iron 48" Diam.
2+915		Energy Release Tower, Reinforced Concrete	Structure
2+915	4+505	Pressure Line	Prestressed Concrete or Ductile Iron 48" Diam.
4+505		Energy Release Tower, Reinforced Concrete	Structure.
4+505	4+660	Transition to Open Surface Flow	Reinforced Concrete Box
4+660		Transition box and sewer main interconnections	Reinforced Concrete.
4+660	14+000	Gravity flow, in pipe working as an open surface such as a sewer collector line, and under pressure at 5 siphons	The 54" diam collector line will use high density polystyrene. The siphons will use prestressed concrete or ductile iron.
14+000		Interconnection between the sewer main with the Lagunas pump station, that pumps the sewage to the Punta Banderas treatment plant	Ducts and structures of reinforced concrete.
14+000	14+750	Open surface conveyance in a collector type pipeline	High Density Polyesterene 54" diameter.
14+750		Interconnection between outflow lines to guide the treated effluent from the Punta Banderas plant	Ducts and structures of reinforced concrete.
14+750	16+750	Gravity conveyance in a pipeline working as an open surface collector, and under pressure at 4 siphons	The 54" diam collector will use high density polystyrene. The siphons will use prestressed concrete or ductile iron.
16+750		Transition pipeline to a reinforced concrete box.	Reinforced Concrete
16+750	18+220	Hydraulic jump through a concrete box and 2 buffer tanks working as energy dissipation structures	Reinforced Concrete

Before discharging to the ocean, the outfall has a section with a steep grade, where the kinetic energy will be expended. This section will be sent through a reinforced concrete duct and 2 intermediate buffer tanks will be used, where the energy will be dissipated in hydraulic jumps. The discharge to the ocean will be accomplished by releasing the effluent to the stream bed very near its point of contact with the shore line.

Rehabilitation and Expansion of the SAB Treatment Plant

Preliminary engineering studies proved that the technical feasibility to rehabilitate the present facilities of the SAB treatment plant and the possibility to increase the capacity of treatment of the plant to 25 MGD without the need of making major changes (construction of new concrete tanks, modification of the process equipment or the addition of new treatment processes). A technical feature that CESPT has currently under study is that referred to the management, treatment and final disposal of the sludge generated in the rehabilitated plant.

B.- OPERATION AND MAINTENANCE PLAN

1.- Operations Start Up Plan

Conditions of operation of the management system of wastewater of the city will be in benefit for the same with the construction of parallel works. While counting on the new conduction works, IWWTP will be able to work at full capacity and be able to send the treated effluent to be discharged at Punta Banderas. The following table shows a comparison of the destiny of the wastewater with and without the proposed works.

	Year				
	1997	1998	1999	2000	2001
Wastewater Flow (MGD)	37	40	44	50	52
<i>Origin and destiny of waste waters without the proposed works</i>					
Flow treated at IWWTP	6	19	25	25	25
Flow sent to an emergency connection	6	6	-	-	-
Flow sent to the marine outfall	-	13	25	25	25
Flow sent to SAB	31	22	20	24	28
Flow treated by the plant	17	16	17	17	17
Wastewater discharged into the sea	14	7	3	7	11

Origin and destiny of the wastewater with the proposed works					
Flow treated at IWWTP:	6	25	25	25	25
Flow sent to an emergency connection	6	-	-	-	-
Flow sent to the marine outfall	-	13	13	25	25
Flow sent through a new conduction	-	13	13	-	-
Flow sent to SAB	31	16	20	24	28
Flow treated by the plant	17	16	20	24	25
Wastewater discharged into the sea	14	-	-	-	25

As can be seen in the previous table, if the parallel works are not available, the volume of raw wastewater discharged into the sea would be between 7 and 11 MGD; with the parallel system the potential discharge of raw wastewater will be eliminated until 2001, when it would be necessary for a new expansion at San Antonio de los Buenos.

IV.- Financial Feasibility and Administration of the Project

A.- FINANCIAL FEASIBILITY

Tijuana is located at the far northeast corner of Mexico; this corner, which includes the international border, allows its population a higher quality of life than the national average. Tijuana has an accelerated and dynamic population growth curve. In 1985, the total population was 989,287 in the urban and rural zone, with an annual growth rate of 5% during the last two decades, more than twice the national average rate of 2.1%. If it remains with such a tendency, the population of Tijuana will be doubled in less than twenty years.

The pace of Tijuana's economic growth is subjected to external factors that tend to increase it, such as: a readily available international market for industrial products subject to the economical cycles of the United States. The economy of Tijuana has been showing a sustainable growth rate during the last few years, its Internal Gross Product has been maintained with an average rate of growth near 4%, notwithstanding the recessive period of the past decades in Baja California (1970-1990).

In 1995, it was estimated that an economically active population of 322,359 lived within the municipality of Tijuana, from which 10% is dedicated to primary activities, such as farming, and the secondary sector, factory workers, generates 31% of the employment in the city, supported mainly by the maquiladora manufacturing industry, which generates 77% of the industrial employment. About 52% of the total employment is attributable to tertiary activities and others not specified amount to 7%.

The Tijuana-San Diego region is considered to have one of the highest levels of income along the border, since 65% of its population is found at the high and medium income status. The State Public Service Commission, CESPT, is an organization that has as its mission to provide the community with an adequate drinking water supply, sewage collection and the construction and operation of the necessary hydraulic infrastructure for the municipality. From a financial point of view, the historical financial statements of the CESPT reflect a healthy structure.

For example: CESPT has characteristically maintained during the last five years a high level of liquidity, according to the liquidity index, which has been kept between 2.54 and 7.09 times. On the other hand its working capital has also been kept at high levels, for example, at the end of 1996 the working capital was US 23.2 million dollars.

In addition, CESPT's financial leverage has decreased since 1991 to the present, from 42.78% to 11.86%. If CESPT's financial leverage is compared with other organizations that have levels near 40%, it could be said that this is a low level of indebtedness. This figure gives an idea of the solid financial position of the organization.

If CESPT's liability terms structure is reviewed, it can be noted that the short term liabilities have maintained, in the last four years, a relationship with the long term liabilities which fluctuates between 20% and 30%. During the last few years CESPT has increased the participation of capital in the financing of its fixed assets, as it can be seen in the relationship of "accountable capital / fixed assets" which has increased from 86.33% to 105% during 1991 to 1996.

The current ratio (current assets/current liabilities) allows one to note that CESPT keeps under finance basis the greatest part of its assets with capital. For example, in 1996 the liabilities only are equivalent to 10% of the accountable capital. From BECC's point of view and for the kind of company that is CESPT, characterized by the intensive use of capital for the acquisition of fixed assets, this indicator talks good about the financial position kept by CESPT.

As for the debt coverage ratio, one can comment that CESPT kept from 1991 to 1993 a relation which fluctuated between 1.6 and 2.0 times. Due to the gradual support from the long term liabilities, CESPT has reached major levels of coverage to 2.0 times. Including this ratio came up in 1996 to 6.54 times.

During the last five years, the gross income of CESPT has presented a continuous behavior in regard to the sales, this income has been close to 30% of the sales. In the years of 1993 and 1994, the gross income decreased because CESPT acknowledged non payable accounts for the amount of US \$5.2 million.

The financial cost has kept a continuous behavior in regard to the sales, these have generally kept a relation that fluctuates between 5.0% and 8.0%, except in 1994, year in which the high finance products gave place to that the integral finance cost resulted in favor of CESPT.

The total amount of investments required by the project named "Parallel System for the Reception/Emission of Wastewater Outflow" is of: \$18,154,608 U.S.

The Environmental Protection Agency (EPA) is going to contribute 88.13% of the investment of the project and has been requested with the NADBank to grant a credit to CESPT for the remaining part.

Financial Structure of the Project

Finance Source	Amount	Financed	Share
	USCy.	Pesos	
Contribution of EPA	16,000,000	128,000,000	88.13%
NADBank Credit	2,154,608	17,236,864	11.87%
Total	18,154,608	145,236,864	100.00%

The amount requested in credit with NADBank includes the capitalization of interests generated during the construction. It is feasible to mention that the amounts herein are the result of the preliminary estimates since there is no final design available.

From BECC's own point of view, CESPT has the capability of indebtedness required in order to obtain credit from NADBank, and recommends that this credit be granted for a term of five years.

The impact of such a loan on CESPT's financial structure is small, basically because the present financial leverage is very low, 11.85%, and this yields to count on a very healthy financial position.

In order to come up with this conclusion it was necessary to analyze and to project CESPT's operation and maintenance costs, investment and capital improvement program. It is important to mention that according to the utility's estimates, in the year 2001, the demand for drinking water is going to overcome the capacity of the current supply sources, for such reason it is necessary for CESPT to construct new collection works estimated at 126 million dollars. According to information given by CESPT, in this financial study it was considered that these collection works are going to be financed by the Federal Government.

B.- TARIFF AND FEE MODELS

The sale of drinking water services are the main source of income of the utility. The sale of drinking water services have historically represented between 80% and 90% of the income of the utility. In December of 1996, the sale of domestic drinking water services were 49.69% of the drinking water sales, the commercial and industrial drinking water sales represented 20.23% and 21.27% respectively, and for the government use 8.81%.

As for the efficiency of accounts payable of the drinking water sales, it can be said that during the last year, the level of accounts payable of the operating organization have been improved, from 72.16% in 1995 to 80.71% in 1996. Another indicator that makes this evident is the fact that the term of the accounts payable for drinking water sales, has been decreased from 153.94 days of sales in 1994, to 143.27 days in 1996. The technical efficiency of the supply system has been kept between 73% and 77% in the last few years. This indicator allows the analysis that the percentage of produced water in the year is sold and payable in that same year, in the specific case of CESPT this indicator is at about 60%.

Historically the drinking water sales for domestic use amount to 50% of the sales, and also this means that a similar percentage in the accounts payable for the year of 1996, on the other hand, government drinking water sales represent less than 10% of the total and its debt represents 29% of the accounts payable for drinking water of the utility in 1996.

The fee charged by the utility historically has been sufficient to cover operation costs, to comply with its financial engagements and to keep building more infrastructure.

The fee for drinking water for domestic usage remained with no changes in nominal terms during 1994 and 1995. But if the inflationary effect is taken into account, the fee has not only increased but it also decreased in actual terms down to 52%. And in 1996 it only was increased up to 1.3% in actual terms.

The drinking water fees for commercial usage, industrial and government use have been increased in 1996 in nominal terms 26% in average, but in real terms the accrued increase is negative.

The debt coverage ratio shows that the finances of the utility have not been affected because of lack of an actual raise in fees during the last few years, in 1995 and 1996 the coverage was 2.25 and 6.54 times, respectively. From the BECC's point of view the fees that are being collected by CESPT have been appropriate and have allowed it to work and keep a healthy financial structure.

From the analysis of the projected cash flow it was determined that the utility can maintain continuously in actual terms its future fees for drinking water, with the purpose to have the financial capability in order to comply with its operational liabilities, investment and payment of financing, including those derived by the implementation of the project in question. Notwithstanding, it is recommended that any proposed increase in the fees in the future shall be analyzed at the moment and under the conditions that are important at that time, in the same manner as is recommended the analysis at the right time of any proposal of omission of inflationary adjustment of the drinking water fees.

C.- ADMINISTRATION OF THE PROJECT

CESPT is an organization whose mission is to provide drinking water, collection of wastewater and the construction and operation of hydraulic infrastructure of the municipality to the citizens of Tijuana.

CESPT began operating on December 20, 1966, the date on which by Act No. 44 it was duly organized as a decentralized public organization from the State Government, with its own juridical and proprietorship.

1.-Divisions

CESPT is supported by five Divisions, with the purpose of coordinating all the plans, programs and particular work from each of the different areas to be oriented towards the acquisition of the institutional goals of CESPT. These divisions provide assistance to all the areas of CESPT with the purpose of having a more efficient development of its internal work, and in addition different ways interfere in the abroad relations of CESPT.

- *Information Division*
- *Legal Division*
- *Public Relations Division*
- *Internal Controller's Office*
- *Division of processes and technical projects*

Following the main activities of these divisions are:

Information Division

The function of this unit is to provide the computer and communication tools for the personnel of CESPT, as well as the infrastructure of an Automated Information System, which allows them to administer with better efficiency, from service to the public and development of specific projects. Also it provides advice to personnel of the organization in the processes related to computer equipment, software packages, data systems and communications.

Legal Division

The functions of this unit consist in duly addressing those matters in which their intervention is necessary, either by request from any authority or from a particular. In addition it provides legal advice to the Board of Directors as well as for the Departments of the Organization. Likewise, it provides assistance and advice in committees and meetings, in the revision of legal projects and regulations and other internal administrative bylaws, and also legal advice related to public works, regularization of real estate and other activities

Public Relations Division

The main function of this division is to create and strengthen a positive image of CESPT on behalf of its employees and the user public. In order to reach this goal the public relations area complies with the program named: "Integral Public Relations", whose objective is to make known to the community what CESPT does and how it does it, as well as to understand the image of CESPT held by the public.

Internal Controller's Office

The controller's office is in charge of audits of the purchasing process as well as bids, etc., with the purpose of controlling and inspecting the finances of the organization. It also helps to improve and innovate the administrative processes pursuant to state by-laws. Its function is basically to regulate and report to the state controller's office.

Processes and Projects Division

The main objective of this unit is to propose and seek technical solutions that are implemented to be the more feasible and efficient for the organization, and to ensure that the projects and works are congruent with the plans and programs of growth of the institution.

V.- COMMUNITY PARTICIPATION

A.- COMPREHENSIVE COMMUNITY PARTICIPATION PROGRAM

1.- Local Steering Committee

According to the community participation requirements, BECC assisted CESPT with the formation of a Citizen's Steering Committee to learn about the nature, impact, costs and benefits of the new projects and to state their opinion on the same. This Committee has 28 prominent members of the community and has assembled 18 times since its creation in November 25, 1996.

The BECC certification criteria includes as a fundamental condition the participation, as wide as possible, of the community that will receive the benefits from the projects and that will cover the costs of the same. In order for a project to be certified by BECC it is necessary that such project is known and that it receive support and approval from the community.

Based on a public opinion survey, the committee designed an information campaign, which has been implemented over the past two months.

The Citizen's Steering Committee independently has and will continue to receive support from CESPT, IBWC and BECC.

The main duties of the Committee are the following:

- *to participate in the definition of an integral program of citizen participation*
- *to provide a follow-up process to the above mentioned program*

- to inform and establish a dialogue with the community throughout the different meetings of the community
- to define and approve the strategies of information and communication
- to select an advertising company for the information and communication program
- to supervise and provide a follow up process to the media campaign, content analysis and opinion surveys
- to participate in the invitation of private and general public meetings
- in general terms, to participate actively in the process of community participation

A citizens' steering committee has also been created to assist CESPT with outreach on the U.S. side of the border. Nine citizens have volunteered their time to serve on this committee and to develop and implement a community participation plan for the City of San Diego. A coordination mechanism between both committees was created to ensure communication and cooperation.

2.- Meetings with Local Organizations

The Tijuana Citizens' Committee has held 21 meetings with different sectors, professional groups, NGO's and colonias and has participated in press tribunes in radio and T.V. to inform the public.

The Citizens' Committee in San Diego also has participated in several information meetings with different sectors of the community. They have scheduled at least 10 meetings with local organizations on the San Diego side of the border.

3.- Access of the Public to Information on the Project

The Tijuana community has received information about the project through particular meetings, media campaign and information with pamphlets and in the water utility bills of 250,000 users. The application will also be made available to the public at the U.S. EPA's office in San Diego.

4.- Public Meetings

There has been a 30-day public notice for the public meeting. This meeting will be held on May 14. There will be a second public meeting some five days after this meeting.

B.- REPORT THAT MAKES EVIDENT THE SUPPORT FROM THE PUBLIC

Pending.

VI.- SUSTAINABLE DEVELOPMENT

A.- DEFINITION AND PRINCIPLES

The nature and magnitude of the environmental problems in the border zone of Tijuana - San Diego have been analyzed and studied in a joint manner by both the United States and Mexico. The main principles of the problem have been suitably expressed in a joint manner in the Border XXI program.

The governments of Mexico and the United States grant the highest priority to the solution of water pollution problems and their effects on human and natural resources in the border zone. Even though the temporary actions performed up to this date by the governments of Mexico and the United States have mitigated the adverse effects of the raw wastewater discharge into the estuary, shores and ocean, the problem requires a final, long-term solution for the whole bay. The facilities proposed in this document are within the framework of a definitive solution and will contribute in an immediate manner to diminish such problems.

B.- COMPLIANCE WITH LOCAL/MUNICIPAL AND REGIONAL CONSERVATION AND DEVELOPMENT PLANS

The region of California - Baja California approximately extends to 222 km along the international limits, from the Pacific Ocean up to the Colorado River and includes four population centers. The main sister cities along this line are San Diego - Tijuana and Caléxico - Mexicali. Ensenada, located to the south of Tijuana and Tecate, is also part of this border region.

In terms of agricultural production the most important nucleus is located in Imperial County, in the U.S.A., and the Valley of Mexicali, in Mexico. At the urban centers the industrial and commercial activities, including tourism, form an important source of work and income for the population.

From merely an environmental point of view, it is important to mention the rich biodiversity and important natural beauties located in the area. The main protected ecological areas found in this region are:

- the Tijuana river estuary (that includes the Wild Life Park of Tijuana and estuarine reservation, the National Forest of Cleveland,
- the State Park of the Anza Sheep Desert in the United States,
- reservation of the biosphere of the High Gulf of California - Colorado River delta,
- mountain ranges of Hansen - Mesa del Pinal,
- national forest reservation of the San Pedro mountain ranges, and
- the National Park Constitution de 1857, in Baja California.

D.- CONSERVATION OF NATURAL RESOURCES

The coastal region of Baja California in its vicinity with the United States, where the new wastewater conveyance facilities will be located, as well as the San Antonio de los Buenos plant, typically has coastal bushes and chaparral ecosystems that occupy the south part of the inside mountain ranges that extend along California and Baja California. At higher altitudes and near the ocean, the chaparral is mixed with conifer forests and vegetation along the valley and intermittent streams. Flora and fauna are diverse and provide a habitat for nesting and resting of neo-tropical migrating birds. These ecosystems are the home of many species considered to be endangered, according to the state listings of Mexico, and federal listings of the United States.

Considering the historical lack of water in the Tijuana area, in particular the dry seasons that periodically occur throughout the region, the new facilities will include a component for reuse of the treated wastewater in industry, municipal public services, soils regeneration, aquifer recharge or in any other option that might contribute to a balanced regional development and the rational utilization of the water.

In the recent past, the closure of San Diego County beaches has been frequent due to the high levels of fecal coliform, resulting from an inadequate level of treatment for the wastewater from both the sanitary and storm sewer systems. Another concern of the communities of the area is the discharge of industrial wastewater into the sewer system. In the Tijuana river estuary, the zone of influence of the tides has been reduced in 80 %, with the corresponding impact on the local ecosystems.