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**Private Sector Department**



**ARGENTINA**

**ROSARIO-VICTORIA BRIDGE PROJECT**  
**AR-0237**

**ENVIRONMENTAL AND SOCIAL IMPACT REPORT**

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## **I. INTRODUCTION**

- 1.1 The Government of Argentina (GOA), through its Ministry of Economics and Public Works, and the Provincial Governments of Santa Fe and Entre Ríos, developed a concession for the new roadway link, known as the Rosario-Victoria Bridge. The purpose of this link is to improve the connections between the northeastern or “Mesopotamia” provinces (Entre Ríos, Corrientes, and Misiones) and the rest of the Nation. The link will also serve to facilitate the interaction between the Mercosur countries, since it will provide the fourth land link to cross the Paraná river in its 1,583 Km length between the cities of Buenos Aires and Posadas (Province of Misiones). The areas of Entre Ríos and southern Santa Fe, separated by the Paraná river delta, will be the principal focus for commercial and industrial growth in the country. The city of Rosario (with over one million habitants) is expected to become a major transportation and distribution center for the Mercosur region. The limited infrastructure and road access across the Paraná river has hampered both passenger and freight transport through the Mesopotamia region.
- 1.2 On September 29, 1997, following a competitive bid, the GOA awarded a 25-year concession to the Consortium “Puentes del Litoral” formed by Impregilo S.P.A./Iglys S.A./Hochtief A.E.G./Techint S.A./ Benito Roggio e Hijos S.A. All of these companies have participated in Argentina’s concession program. The project entails the construction, maintenance, and administration of the technical and commercial exploitation of the roadway network, which will connect the cities of Rosario (Province of Santa Fe) and Victoria (Province of Entre Ríos). The project, to be carried out on the Paraná River valley, consists of a two-lane roadway system supported by bridges and embankments for a total extension of 59.3km. This will link the north end of Rosario, the National Route No.11, and the city’s beltway (Av. de Circunvalación), with the north of Victoria and the Provincial Route No.11.
- 1.3 The total investment of the proposed project amounts to US\$ 339.4 million, of this US\$ 207.1 million will be finance by the government, and the remaining US\$ 132.3 million are to be financed by the Consortium, which is to be the total estimated cost of the project eligible for IDB financing.

## **II. PROJECT DESCRIPTION**

### **2.1 Site Location**

- 2.1 The Paraná Delta region comprises one of the largest river basin and associated wetlands of Argentina. The lower delta (where the project is located) extends approximately 400 Km northeast-southeast from the City of Buenos Aires to the city of Paraná (Entre Rios), and it encompass an area of approximately 17,000 square kilometers. The region has very unique characteristics due to the seasonal flooding that forms many rivers, creeks, and islands that are continuously changing courses. This naturally changing environment has been use for seasonal cattle ranching. Today it is of marginal agricultural use, with the exception of fishing and hunting; but it has great ecological diversity and recreational values. The delta acts as a 50 to 60 Km wide barrier between the provinces of Entre Rios, Santa Fe and Buenos Aires (where 50% of the country's population and 70% of the industrial employment resides). The region is part of the larger Paraná Paraguay River system, which historically has been an important navigable corridor.
- 2.2 At the proposed crossing point, the Paraná River valley is formed by the main river channel and an area of marshlands, and small islands with both permanent and temporary watercourses. The river basin is approximately 56 km wide at this point, requiring the construction of a complex combination of bridges and embankments.
- 2.3 There are only two existing Paraná river crossings into the province of Entre Rios. The proposed location is 180 km downstream (south) of the Tunnel SubFluvial Hernandarias crossing connecting the Cities of Santa Fé and Paraná, and 176 km upstream (north) of the Zárate Brazo Largo Bridge connecting the cities of Zárate and Ceibas.
- 2.4 The city of Rosario on the western side of the Paraná River, and at the edge of the Argentinean Pampas, is a very important agricultural and industrial center. With over one million habitants, it has well-developed port facilities. Today its ports (including San Lorenzo and San Martín) ship 29% of the grain production of the country, and 49% of the general cargo. On the eastern side of the crossing, the town of Victoria, with approximately 35,000 habitants, is a quiet rural town serving the cattle ranching establishments of Entre Rios.

### **2.2 Project Components**

- 2.5 The construction of this roadway network is to include the formation of embankments for a length of approximately 47 km, with viaducts (bridges) for a length of 12 Km. The roadway will carry three lanes of traffic through the main bridge (a fourth lane is under evaluation by the GOA), and two lanes for the rest of the alignment.
- 2.6 The minimum length of the viaducts was one of the design requirements in the bidding process. Based on previous hydrologic and hydraulic studies, it required a minimum of 18% of hydraulic transparency (equivalent to 11 Km of bridges) over the river valley. The approximately 12 km of viaducts will be distributed in the following manner:

- A single 1 Km concrete viaduct inland at the Rosario terminus;
- A single 3.3 Km main cable stayed bridge structure to be built over the Paraná River's largest navigable channel with access viaducts at both ends; and
- Twelve bridges to be built over navigable and temporary watercourses through the island area with an approximate total length of 8.1 km, with each of these twelve bridges varies in length from 512 to 1,112 meters.

- 2.7 The main bridge over the Paraná River will have a 50-meter vertical, and 300-meter horizontal clearance for shipping traffic. This is the same clearance of the Zárate Brazo Largo bridge located 176 Km downstream. The viaducts over the islands will have approximately 10-meter vertical and 45 meter horizontal clearance (at a water level of 7.00 meters IGM representing normal flood water levels) over the six navigable watercourses. In Argentina, all elevations are determined relative to a datum point in Plaza de Mayo, Buenos Aires (IGM). The Rosario datum is at 3.04 m IGM.
- 2.8 The 47-Km embankment is to be build at an elevation of approximately 12,50 meters IGM with slopes 1 to 4. It will be approximately 15 meters wide at the top, and 80 meters wide at the base, requiring 18 million cubic meters of filling material. The fill will consist of sand that will be dredged from nine deep borrow pits along the alignment (sizes 1000 m x 150 m x 30-40 m deep) and pumped into place by dredging barges. The construction of the embankment will require the dredging of a 28 km long - 25 m wide channel, from the Victoria side, due to the lack of deep water access to the area. This channel will be parallel to the alignment on the downstream side, and it will be used for the movement of barges, and to provide access to the construction areas. Access to the rest of the alignment will be via the existing watercourses.
- 2.9 Construction activities will proceed from two fronts, one from Rosario, and one from Victoria, with construction offices, storage, and operating facilities on each side. The construction of the bridge pilings and the full embankment will be done via water access; once the embankment is finished, the precast superstructure of the viaducts will be carried into place by trucks running on the embankment.
- 2.10 The toll plaza for both directions will be located on the eastern side of the main cable stayed bridge, with a length of approximately 240 meters. There is a provision to widen the embankment on the Victoria side for the possible construction of a future second toll plaza and also provisions in the concession contract to negotiate for the addition of two more lanes in the future, if the annual average daily traffic reaches a level of 8,000 vehicles equivalent.

## **2.3 Project Cost and Schedule**

- 2.11 The total investment of the proposed project amounts to US\$ 339.4 million. Due to the characteristics of the project, and the significant amount of investment needed, the GOA proposed that the public sector should participate in the project investment with a financial contribution to complement the efforts of the private sector. Therefore, the

GOA in its bidding documents, established the financial contribution to be the determining variable to award the concession (based on a basic toll rate of \$ 7.40 + value added tax "IVA"). The winning bid resulted in a governmental contribution of US\$ 207.1 million. The remaining US\$ 132.3 million is to be financed by the concessionaire, which is to be the total estimated cost of the project eligible for IDB financing.

- 2.12 The construction period of the project is estimated to be four years, starting in late 1998 and concluding in 2002. The sponsor has stated that it expects to finish construction in less time (i.e. 3 ½ years).

## **2.4 Project alternative analysis**

- 2.13 The conception of this project is not new, it dates back almost 50 years, and it has been the subject of many studies. The first plans and studies prepared for this crossing date from the mid 1950's as an alternative to the existing Tunnel SubFluvial (180 Km upstream) built in the 1960's and opened in December 1969. The location is also equidistant to the Zárate Brazo Largo Bridge, 176 Km downstream from Rosario.

- 2.14 The specific location of the project (as currently conceived) was stipulated by the GOA in the bidding process, as a consequence, the project environmental studies do not analyze any alternative locations. The following summarize the principal rationale for the site location:

- From the transportation aspect, it connects to the northern end of the Rosario Beltway (Av de Circumvalación), providing a direct connection to the highway system going north, south and west of the city without loading additional traffic directly into the city streets.
- On the Victoria side, the connection to Route 11 bypass the town, and will connect directly to Route 26 going east, thus eliminating direct in-town impacts.
- From an expropriation and human resettlement aspect, the land to the Rosario's water edge belongs to the Dirección Nacional de Vialidad (DNV), as a consequence no private properties have to be resettled or expropriated in Rosario.
- From the effects to the natural ecosystem in the river valley, the ecosystem is very similar for almost 100 miles north-south, as a consequence the impacts for any other crossing would be very similar.

### **III. LEGAL AND INSTITUTIONAL FRAMEWORK**

#### **3.1 Institutional Framework**

3.1 A Control Body (Organo de Control) was created by Decree 517/98 under the sphere of the MEyOSP, with competence to perform all the actions required by the supervision, inspection, auditing and follow-up of the Concession Contract. It has sole responsibility for review and approval of all environmental documents produced by the concessionaire. The members must be appointed by the MEyOSP before the Concession Contract comes into force. This control body has also the mandate to perform the coordination with all government institutions. The national and provincial organisms with environmental competence, include:

- The Dirección Nacional de Vialidad (DNV) or the Highway System National Board will be the recipient of the facility at the end of the concession contract.
- The Secretaría de Recursos Naturales y Desarrollo Sustentable (SRNDS), acting as the national environmental agency.
- The Province of Santa Fe, through the Secretaría de Medio Ambiente y Ecología (Environment and Ecology Subsecretariat).
- The province of Entre Rios, through the Unidad Especial y Comité the Seguimiento de Ecología y Medio Ambiente (Environment Committee).

3.2 The daily operations and technical aspects of the project are to be overseen by a Transitory Committee. This committee is to be created to act as the operating arm of the control body. The committee will perform the supervision, review, evaluation and approval of all activities related to the construction phase. It will perform the functions of the Control Body during the full length of the construction period, and until one year after initiation of the toll collection. The committee members include a president (named by MEyOSP), a general coordinator, two managers for the technical area (one in charge of design, and the second in charge of construction), one manager for all economic aspects, a legal advisor, and administrative personnel. The experts for each specific technical area (i.e. geotechnical, civil, hydrology, hydraulic, and environmental) will be hired as consulting teams. The functions of this committee related to environmental aspects include:

- Establish the procedures for the evaluation and approval of all the environmental documentation;
- Approval of the Environmental Impact Assessment, Resource Inventories, quarterly reports, and annual reports submitted by the Concessionaire;
- Approval of the Mitigation and Monitoring Plan;
- Determine any actions related to the environmental impacts in accordance with the information received from the Environmental Reports;
- Design the content, and require Extraordinary Reports from the Concessionaire if unusual events should occur (floods, fires, etc.);
- Carry out environmental audits and inspection of activities;
- Receive any claims related to environmental aspects.

- 3.3 The Transitory Committee has national jurisdiction, since its members are appointed by MEyOSP, and serves as the link to the national and provincial organisms with environmental competence listed above.
- 3.4 The Control Body will retain all the responsibilities of the Transitory Committee until the committed becomes fully operational. Once the Transitory Committee has been dissolved, the control of the Concession will be by the Control Body which becomes the link between the Conceder and the Concessionaire.

## **3.2 Legal Aspects**

### ***3.2.1 Environmental***

- 3.5 Despite the fact that environmental norms were included in the Constitution (Article 41), a “General Environment Law” has not yet been enacted; neither has a set of laws that prescribe the minimum requirements in environmental quality for each specific environmental media or natural resource (i.e. flora, fauna, soil, water quality, air quality, etc.). More importantly, there is no national law that regulates the Environmental Impact Assessment (EIA) process, since Annex II of the Law of Public Investment 24.354 that established the EIA standards and procedures and made it mandatory, was vetoed by the executive branch by Decree 1427/94.
- 3.6 Given the existing regulatory framework, the most significant environmental requirements are covered by the Concession Contract, and those stipulated by the DNV in the Environmental Manual for Roadway Projects (Manual de Evaluación y Gestión Ambiental para Obras Viales de la Dirección Nacional de Vialidad, July 1993). A summary of the applicable laws listed in the Concession Contract is provided in Tables 3.1 to 3.4. Most of these regulations concern specific environmental aspects for which portions may be directly or indirectly applicable and that most of this legislation is predominantly declaratory and the funding mechanisms in many cases for enforcement and compliance have not been assigned. The most significant or relevant legislation listed in the tables include: Prevention of Water Pollution; Soil Conservation; Forest Protection; Protection of Flora and Fauna; Air Pollution; Archeological, Anthropological and Paleontological findings; Hunting and Fishing; and Architecture and Urban Planning.

### ***3.2.2 Health and Safety***

- 3.7 National laws 19.587 and 24.028 and their regulatory and complementary standards establish the conditions pertaining to hygiene, safety and medicine at work as well as the requirements related to accidents at the workplace.



### **3.2.3 Public Information and Participation**

- 3.8 The Argentine Constitution establishes the right of consumers and users of goods and services to adequate and truthful information. The regulatory framework for the Concession establishes that users possess the right to receive information on the services that the Concessionaire provides and on traffic problems; requisitions can be made upon both the Concessionaire and the Control Body. The Control Body is obliged to make publicly available the Quality Control Program presented by the Concessionaire. The regulatory framework does not expressly establish that the Control Body must make publicly available the EIA.
- 3.9 There is no applicable Argentine rule that stipulates public hearings or any other system for public consultation on proposed projects. The SRNDS (as the national environmental authority), does not stipulate any legal or administrative requirements for the implementation of citizen participation or consultation mechanisms. The only provision in this area, is the DNV Environmental Manual for Roadway Projects, which establishes that when a project is carried out in areas where indigenous communities live, that these communities must be consulted.

### **3.2.4 Expropriation Procedures**

- 3.10 If an expropriation in the public interest is to proceed, the following requirements must concur:
- a law or decree that declares the property as of public interest,
  - a law or decree that clearly identifies the property to be expropriated (location, size measurements),
  - an agreement between the parties or a judicial declaration that establishes the price of the property,
  - previous and effective compensation, and
  - in case of disagreement over the price offered by the Government, the property owner has the judicial recourse regarding the price in question, but he can not stop the expropriation process.

### **3.2.5 Concession Contract**

- 3.11 The concession contract requires that prior to taking possession of the land the Concessionaire must prepare a Quality Plan that includes a Quality Control Manual (QCM or Manual de Calidad), and an Environment Management Manual (EMM or Manual de Gestión Ambiental). Both documents must be submitted to the Control Body within 30 days from the approval of the Concession Contract and be approved or objected by the Control Body within 30 days. The EMM must include: a commitment from the concessionaire to propose and develop mitigation measures; the procedures for preparing reports on environmental impacts and resource inventories; environment verification and control procedures; and procedures, terms, and methods to perform environmental audits.

- 3.12 The Concession Contract states that guidance for addressing the project environmental aspects is to be based on the DNV Environmental Manual for Roadway Projects (Manual de Evaluación y Gestión Ambiental para Obras Viales de la Dirección Nacional de Vialidad, July 1993). In addition, for those aspects not covered in the DNV manual, the World Bank Environmental Assessment Sourcebook (Volume I, Policies, Procedures and Cross-Sectoral Issues 1991; considering the project as “Category A”) should be used.
- 3.13 The Concessionaire’s environmental obligations, prior initiation of construction activities include the preparation of an Environmental Impact Assessment (EIA), the initiation of a First Inventory of Resources, and to provide a list of documents and procedures to be executed during the first 30 days of construction activities.
- 3.14 The Concessionaire's environmental obligations once construction activities are under way include: a Monitoring Plan, a Mitigation Plan, preparation of Environmental reports every three months during the construction activities, preparation of Environmental reports every four months during the operation, preparation of yearly annual synthesis at the end of each year, and the execution of three additional resource inventories: 1) when construction is completed; 2) the first year after the operation begins; and 3) prior to finalization of the concession.
- 3.15 Under Concession Contract, the Concessionaire responsibilities are limited to those impacts related to the construction activities and the GOA assumes responsibility for the impacts related to the location and design and the project operation. This provision limits the environmental risks and liabilities of the concessionaire during construction to construction related accidents and natural forces such as floods during construction period.
- 3.16 The concession contract establishes that the GOA will declare public domain all the land required for the project, and will take possession of these lands through the legal acquisition process. The concessionaire will receive the land as needed to proceed with construction.

### **3.3 Compliance Status**

- 3.17 The decree, which awarded the Concession Contract between the MEyOSP and the Concessionaire, was signed on May 19, 1998. The possession of the land by the Concessionaire occurred on September 14, 1998. The Concessionaire has submitted the necessary documents to fulfill the requirements of the Concession Contract prior to beginning construction activities (see below).
- 3.18 The EMM (Manual de Gestión Ambiental) and QCM (Manual de Calidad) were both submitted to the Control Body prior to July 1998. These documents provide the basic concepts and objectives related to environmental and social protection and control for the project. The EMM identifies the organization, legal, operational, and procedural requirements to execute the project and includes a commitment from the concessionaire

to propose and develop mitigation measures, the procedures for preparing reports on environmental impacts and resource inventories, environment verification and control procedures, and the procedures, terms, and methods to perform environmental audits.

- 3.19 The project's Environmental Impact Assessment (EIA) was prepared by the Concessionaire and submitted to the Control Body on July 8, 1998. The objectives of the EIA were to: identify and characterize the impacts during the construction and operational phases of the project; recommend mitigation measures that will compensate the project's effects in the natural environment, and the well being of the affected population; and provide a management tool for decision making based on a simplified presentation that would give priority to the most critical aspects. In addition to this project EIA, two other environmental assessments were performed associated with the project: a Pre-feasibility Environmental Impact Assessment was prepared in 1994 by the Fundación CEPA under contract from the provincial government of Entre Ríos; and a Preliminary Environmental Impact Assessment was prepared by Serman Associates S.A. and Taylor Engineering and submitted as part of the concession bidding proposal.
- 3.20 The project EIA was made available to the public on July 10, 1998 in various locations (e.g., cities of Rosario, Victoria, Santa Fe and Buenos Aires at the Ministry of Public Works in Rosario, Ministry of the Environment and Ecology in Santa Fe, Municipality of Victoria, and MEPW in Buenos Aires). The 1994 Pre-feasibility EIA included consultations with governmental and non-governmental institutions, two public meetings, and a home survey of 200 Rosario residents. The findings of this study concluded that the general perception of the bridge is positive. Recent efforts by the Fundación CEPA and the concessionaire have also been performed to provide information on the project. (see section 7 for details on public consultation).
- 3.21 The project Environmental Management Plan (EMP) was submitted to the GOA in September, 1998. The EMP includes objectives, various procedures, identification of impacts, mitigation and monitoring programs, responsibilities, a list of required permits, public communication plan and a list of required additional documents. The EMP includes procedures for document control, audits, training, inspections, inventories, contingencies/emergencies, and health and safety. In addition, various other documents have been prepared and will be prepared. (See section 6 for details on EMP).
- 3.22 The acquisition of the right of way requires the expropriation of approximately 50 square Km (5,000 hectares). The right of way was defined by the GOA as 1000 meters wide across the Paraná river valley, and narrows to approximately 100 meters on the approaches to Rosario and Victoria. Basically all of the expropriation occurs in Entre Rios (56 Km), since Santa Fe only accounts for 2 Km and the land belongs to the DNV. The Province of Entre Rios promulgated the required lands to be declared of public domain under Law 9012 on July 2, 1996 and the law was approved under Law 9060 on December 23, 1996. As of July 1998, 29 out of the 30 owners have agreed to the value offered by the GOA, and one is proceeding through the judicial process. The final amount paid to the property owners is approximately US\$ two million. The Control Body has indicated that the process of acquisition will be completed shortly.

## IV. ENVIRONMENTAL AND SOCIAL CONDITIONS

- 4.1 The environmental impact analysis considers the area of influence to be the provinces of Santa Fe and Entre Rios; however, the areas of potential effect are considered to be different for the human and natural environments. The affected human environments include the cities of Victoria and Rosario and the effect on the natural environment focuses on the river valley and floodplain. At the proposed crossing point, the Paraná River valley is 56 Km wide, formed by the main river channel and an area of marshlands and small islands with both permanent and temporary watercourses (the landscape units are identified in Figure 3). The area directly affected by construction activities in the valley is in the range of 700 hectares (7 Km<sup>2</sup>), while the expropriation includes 5,000 hectares (50 Km<sup>2</sup>). The indirect effects are evaluated several Km upstream and downstream.

### 4.1 Environment

- 4.2 The Paraná River Basin covers part of Brazil and Argentina, the country of Paraguay and part of Bolivia. The river basin's area above the cities of Rosario and Victoria is 2,275,000 square kilometers, or 88 percent of the basin. There are three hydrologic zones within the basin. A high zone above the confluence of the Paraguay and Paraná rivers, a middle zone and a low zone. The project area is within the low zone. This zone extends approximately 400 Km northeast southeast from the City of Buenos Aires to the city of Paraná (Entre Rios), and it encompass an area of approximately 17,000 square kilometers. The river serves to transport floral species from the Chaqueño and Amazon ecosystems. Moreover, the river system is intermediate between the subtropical forest, xeric forest and the pastoral ecosystem of the Pampas, enhancing the biodiversity of the area. Therefore the characterization of the climate, geology, geomorphology, soils and ecosystems are regional.
- 4.3 The climate of the area is classified as subhumid humid, mesothermal. The Annual average temperature is approximately 17 degrees centigrade, although frosts occur from May to September the temperature is moderated by the Paraná River. Winds are predominantly from the northeast and south, and are usually below 40 Km/h. however; they may exceed 130 Km/h in thunderstorms. Victoria averages 1,137 mm of precipitation per year while Rosario averages 1,023 mm per year.
- 4.4 Below its confluence with the Paraguay, the Parana's main river channel is from 1 to 3 km wide with a river valley ranging from 50 to 70 km wide. The average depth is 7.1 meters. Normal flow is approximately 18,000 cubic meters per second (m<sup>3</sup>/s) while a record flood in 1983 recorded over 30,000 m<sup>3</sup>/s in the river channel at Rosario plus 26,000 m<sup>3</sup>/s across the flood plain for a total discharge of over 56,000 m<sup>3</sup>/s in the Rosario area. Historically, flooding occurs two out of three years and may occur any time of the year with a tendency toward February and March and a return to normal by June; notable floods have occurred in 1905, 1966, 1982-1983, 1992 and 1998. Table 4.1 indicates the level of flooding at Rosario in each of the record years, frequency and intensity of flooding. The medium level of the Paraná in Rosario from 1884 to 1998 is

- 2.85 m. The maximum, recorded in May 1998, is 6.43 m and the average annual minimum is 1.39 m. Calculation of the mean flow before 1970 and after 1970 indicates that the volume of the river is increasing, as the median level after 1970 is 3.5 m. Table 4.2 shows a statistical analysis of river levels at Rosario relative to the Zero IGM by adding 3.04 m to the Rosario elevation. The Paraná receives most of its suspended load from the Paraguay River. Material along the bed of the Paraná is fine to medium sand up to about 0.35 mm in diameter. This sediment creates parabolic dune-like sand piles from 2 to 3 m's high, which oscillate between 1 and 5 meters per day.
- 4.5 Several geological formations make up or underlie the Paraná River basin. Pure white fine to medium-grained sands of the Ituzaingo formation occur between 25 and 50 meters deep and the formations that make up the bridgeheads on both sides of the river are silts, sandy silts and silty clays. The project is in the lower zone of the Paraná River, on an alluvial plain where the river is braided with an extensive delta. The river channel occupies approximately 14 percent of the flood plain; however, 32 percent of the floodplain is generally covered in water. Measurements of the left bank of the Paraná have indicated that bank is receding at an average annual rate of 10 to 15 meters.
- 4.6 Along both sides of the river in both Santa Fe and Entre Rios are spiny xeric climax forests. Between the river terraces is the food plain with distinct types of vegetation typical of the Chaqueño and Amazon biotic provinces. Stable and mature communities do not exist in the river valley, owing to the dynamic geomorphology of the floodplain. Periodic destruction of the islands limits vegetation. All vegetation communities within the valley belong to a succession sequence whose climax state is a white forest. The river and islands also support communities of submerged or floating plants. The landscape units for the crossing area include open water, beaches, marshes, islands and sandbanks, beaches, canopy forests, other forests, brush, natural pastures and anthropic.
- 4.7 The zone of islands and the Paraná Delta, as a whole contain important faunal assemblages including both fish and tetrapods. This zone is transitional between the middle and lower portions of the delta. The area is estimated to support 243 faunal species including 36 mammals, 157 birds, 29 reptiles and 21 amphibians. Many of these are important resources for the local people known as "Islanders". The "normal" state of the river is one of constant fluctuation which is responsible for the existence, abundance and interactions of the components faunal assemblage. Species on the island habitats are anatomically, morphologically, physiologically adapted to survival in a constantly changing environment. The International Union for the Conservation of Nature (IUCN) and the Convention on International Commerce of Threatened Fauna (CITE) present lists of species vulnerable to extinction or where hunting is prohibited. These lists include the river seal, swamp deer, and the yacaré overo (river crocodile) were stated to be present.
- 4.8 Regarding aquatic fauna in the study area, there are 320 listed species belonging to 30 families. Many of these are migratory because of thermal conditions, diet or reproduction, and are not related to annual cycles. In the main course of the river seven main ecological types of fish can be found: bottom fish, predators of the open river; fish of quiet water and vegetation; parasitic fish, flying fish, amphibious fish and, fruit and

seed eating fish. although the river system is very rich in benthic species, including over 100 species, the main riverbed is characterized by mobile sands and dunes offering little favorable habitat for the development of species.

4.9 There are several reserves or parks in the vicinity of the project. These are listed as follows:

- North of Victoria there is La Azotea or Diamante National Park. This park is south of Diamante and north of Victoria in Entre Rios province. It was created in 1991 and consists of 2,548 ha. In the park elements of the White and xeric forest are recognized. This also includes a population of the endangered river seal.
- In Santa Fe Province El Rico reservation is a complex of Islands including 3,750 ha, with expansion plans for another 2,250 ha.
- In Entre Rios the “Carpincho Natural Area” of 375 ha was created in 1989.
- Granadero Biagorria is located about 100 meters upstream of the bridgehead at Rosario. It is part of the national system of recreational areas, even though over 100 families dedicated to fishing for many years have occupied it.
- Two reservations in the area are proposed within the Department of Victoria: Victoria Reserve, 138,000 ha of Municipal land in the Paraná River Valley, and Rosario Reserve on islands facing the city of Rosario.

## **4.2 Social And Economic**

4.10 The analysis of the social environment includes the demographics, economic and urban areas that will be connected by the bridge. In the department of Victoria there are two sections: the alluvial valley and the Peniplain where the stable human population resides. On the other end of the Bridge is the department of Rosario, in southeastern Santa Fe province. The cities of Rosario and Victoria are very different. Rosario is one of the largest metropolitan areas on Argentina, while Victoria is a small city with a population 3 percent the size of Rosario's. Presented below are some the inherent differences in the two communities.

4.11 The population of Santa Fe reached 2,798,422 in 1991, and Entre Rios had over 1 million persons, while the provinces are roughly similar in size. Santa Fe has a higher birth rate and a greater percentage of population below 14 years of age than Entre Rios does. Both provinces show a decline in the 20 to 29 year-old population segment, indicating migration. Since 1970 the nation has experienced an inter-provincial redistribution of the population, and resultant urban growth (i.e., movement from rural to urban). The population of Entre Rios is expected to increase from the 1991 figure by 200,000 inhabitants by 2010. The youngest segment of the population is expected to decrease from 3.14 percent in 1990 to 2.87 percent in 2010, however, for the same period all other segments are expected to increase. The population of Santa Fe will increase over the same period approximately 600,000 persons. Rosario's 1991 population was 1,079,359, with an annual growth rate of 1.34 percent. Victoria's 1990 population was 30,126, which is expected to increase by 1,700 inhabitants by the year 2005. The annual growth rate of Victoria is 0.62 percent.

- 4.12 Both provinces have experienced a decline in employment; however, Rosario's problem is much more severe than Victoria's. Rosario has an unemployment rate of 18.1 percent. There is also an under-employed population involuntarily working less than 35 hours per week, which is 12.5 percent. The unemployment rate in Victoria is 4.7 percent.
- 4.13 Rosario is highly urbanized and its rate of delinquency is high. The frequency of crimes against property in Rosario is 66 times greater than in Victoria. Victoria is a community with a strong sense of purpose and a valued sense of security.
- 4.14 Traffic accidents with police intervention increased by almost 50 percent in Rosario between 1989 and 1993 from 30,700 to 45,000 per year. Accidents are not provided for Victoria.
- 4.15 Historically, Rosario has been a location where there has been a high incidence of illness. In relation to the nation, sickness in both Santa Fe and Entre Rios have increased in recent years. Mortality rates have decreased in Rosario (8.41 per thousand) while they have increased in Victoria (8.0 per thousand). Rosario has seven municipal hospitals, five provincial hospitals, 44 municipal health centers and 29 provincial health centers. Victoria has 2 hospitals and 6 municipal health centers.
- 4.16 The level of poverty becomes evident as one looks at such indicators as high unemployment part-time employment and concentration in the distribution of income. These indicators point to a significant decline in the quality of life in Argentina over the last three decades. The lowering of incomes had created a new class of working poor whose basic needs are not satisfied.
- 4.17 A study by The Municipal Foundation Bank (1996) found 22,000 families made up of 110,000 persons living in irregular settlements in Rosario. The study found that Rosario is an important place for resettlement of people expelled from their original homes. There is an irregular settlement of fishermen or "islanderas" adjacent to the proposed bridgehead in Rosario. The population is estimated at several hundred persons, although a precise count has not been made.
- 4.18 In 1991 2.8 percent of Rosario's population was illiterate; primary education reached 96.2 percent of the population; 57 percent had reached middle school and 22.4 percent had attended college. In Victoria, in the same year, the illiteracy rate was 7.0 percent. 95.5 percent of the population over 10 years old had attended primary school, 52.5 percent middle school, and 6.7 percent had attended college or university. There are 10 primary schools in the islands dependent on Victoria's school council. One is a floating school that follows the hunters and fishers.
- 4.19 Water and wastewater service in Victoria is inadequate. Only sewers serve half of the population and the sewage is released untreated into the river. Water is available to only 44 percent of the residents. Rosario has both water treatment and wastewater treatment plants.

- 4.20 The project fluvial area has been exploited for its natural resources for centuries, although it has intensified since the increase in populations of nearby cities in the 19<sup>th</sup> century. The island habitats have been used for lumber, farming, fruit orchards, and livestock production, fishing and hunting. The extraction of wood is an important activity in the islands which, when combined with clearing for pasture, has resulted in the deforestation of the islands.
- 4.21 The Province of Entre Rios has a greater emphasis on livestock (48.2 percent), followed by agriculture (32.9 percent) and fishing (4.3 percent); while in Santa Fe agriculture is 53 percent and livestock is 23 percent of the economy. Regionally important commercial fish species are the Sábalo, Surubi, Dorado, Pati, Parapita, Pacu, Manguruyu, Pejerrey, Anchovy, Bagarito, Boga, Bagre, Amarillo, Mandubi, Moncholo and Tarrarira. Fishing is an extremely mobile activity, requiring setting up and moving base camps about every 10 days. Hunting includes hunting for commerce or subsistence, and hunting for sport.
- 4.22 Santa Fe ranks third among the provinces for manufacturing, commerce and services, with industry (e.g., beverages, tobacco, paper, petrochemicals and metal products) providing 25 percent of the gross productivity. Entre Rios ranks in eighth place for manufacturing and industry and sixth place for services.
- 4.23 Tourism is of a much greater relative importance in Entre Rios than in Santa Fe. In Entre Rios revenues from restaurants and hotels represents approximately 0.8 percent of the economy. Two of the main tourist attractions are the Uruguay and Paraná rivers. These are important for their natural, cultural and historic attractions. Victoria offers Eco-tours on an incipient level and religious retreats to the Abby of Niño Dios where Benedictine monks lived as they have since the 19<sup>th</sup> century. Tourism related to hunting and fishing ranges from weekend camping trips of nearby city residents, to international trips from Europeans and Americans. Hotels, however, are concentrated in the city of Paraná. Although tourism is less important in Santa Fe there are several attractions in Rosario including the islands, an historic train station, a zoo, battlefields and monuments.
- 4.24 Transportation in the area effected by the project is by land, water and air. There are three surface transportation routes that connect the Municipality of Victoria. Provincial Route No 11 (RP 11) Provincial Route 26 (RP 26) and Provincial Route 9 (R.P.9). RP 11 and RP 26 are paved in asphalt while RP 9 is unpaved. RP 11 enters Victoria from the Paraná to the northwest. R.P 26 extends from Nogoya, Southwest toward Victoria. RP 9 enters Victoria from the south. Table 4.3 provides traffic counts for the two paved routes.
- 4.25 Since Rosario is a developed port city, it is a hub of transportation. It is served by rail, and connected to Buenos Aires via National Route 9. This route is divided with limited access over much of its course. National Route 11 follows the Paraná River and passes through Rosario, several other Provincial and National Highways connect Rosario to the rest of Argentina. There are also two beltways around Rosario. Table 4.4 provides traffic counts for four of the city's primary roads.



- 4.26 Existing Crossings of the Paraná into Entre Rios are the Tunnel Subfluvial and Zarate-Brazo Largo Bridge. Operations of the Zarate-Brazo Largo have been restricted for two years due to cable problems with the main bridge. This bridge complex crosses the Paraná as R.N 12 and National Route 14. The cities of Rosario and Victoria are near the midpoint between these crossings.
- 4.27 There are 25 known archaeological sites in the river delta, and one of them is in the north side within the project right of way. The project EIA provides a map and coordinates for each site. Sites are generally on high hills, typically away from the main riverbed, and exhibit a high density of ceramics, human and animal bone, and little or no stone.

## V. ENVIRONMENTAL AND SOCIAL IMPACTS

- 5.1 The environmental and social impacts from the project have been identified in the final project Environmental Impact Assessment (EIA) prepared in 1998, which is based in part upon the pre-feasibility EIA (Fundación CEPA, 1994), the preliminary EIA (prepared as part of bidding process), the DNV Environmental Manual for Roadway Projects, and the World Bank environmental assessment guidance. The analysis involved characterizing the project on four spatial scales: regional, inter-provincial, fluvial valley, and urban. The EIA focused on how the principal project activities (see Table 5.1) may impact the environmental and social conditions in the local area fluvial valley, inter-provincial, urban, and regional. Regional impacts were evaluated and considered to be relatively insignificant since the project design does not include intrusive activities other than the bridge embankments at Rosario and Victoria, the full roadway complex is to be built across the fluvial valley, and the traffic would be routed through existing transportation corridors

### 5.1 Construction Phase

#### 5.1.1 *Environmental Impacts*

- 5.2 A listing of the potential environmental impacts related to project construction is presented in Table 5.1. The most significant impacts to the environment due to construction are changes in the hydraulic and sedimentological regime, gradual effect of habitat alteration and physical barriers to the fauna, potential environmental contamination, and construction risks. A summary of these impacts is presented below.
- 5.3 Hydraulic and Sedimentological Regime. The project requires dredging and disposal of dredge material, soil movement, and excavation for construction of the bridge foundations, embankments, and auxiliary structures along the 59-km length of the bridge complex. The 47-Km embankment is to be built at an elevation of approximately 12,50 meters IGM with slopes 1 to 4. This elevation is approximately 5 m above the average terrain over the islands (elevations vary from 2 to 6 m on the islands). The size of this embankment will be approximately 15 meters wide at the top, and 80 meters wide at the base, requiring 18 million cubic meters of filling material. The construction of the embankment will require the dredging of a 28 km long - 25 m wide channel, from the Victoria side, due to the lack of deep water access to the area. This channel will require the excavation of approximately 4 million cubic meters of material to be disposed on the downstream side.
- 5.4 These activities contribute to the temporary and localized alteration of the hydraulic and sedimentological regime. The dredging activities result in suspension of surface silts, clays, and sands causing increased turbidity parallel to and in the immediate vicinity of the proposed embankments. The construction of the embankments and auxiliary bridge structures gradually increase the restriction of water currents and circulation causing an increase in stagnant waters mainly upstream, as well as, increase in water elevations

upstream of the bridge complex along the embankments. The hydraulic impacts are magnified as the bridge project reaches completion, while the turbidity ceases upon completion of the construction phase.

- 5.5 Similarly although the characteristics of the Paraná River basin include a highly turbid state, the intrusive activities magnify this condition during the construction phase. The suspension of sediments thus contributes to a reduced water quality, as well as, potential spills, releases or runoff of hydrocarbon-based fuels associated with the operation of the construction equipment.
- 5.6 Physical Barriers and Habitat Alteration. The construction of the embankments and the dredging results in the direct removal of floating aquatic vegetation, shrubs, and trees from the islands and shallow river bottom. The area directly affected by the embankment and channel is approximately 450 hectares. The process of removal additionally results in either the direct mortality of fauna residing in the vegetation or depending on the intrinsic abilities, the direct fleeing of fauna to other suitable habitat in the vicinity.
- 5.7 Environmental Contamination. It is estimated that a total of 60 trucks a day might be needed to carry the cement, steel and other construction materials and equipment. The equipment due to its quantify and length of operation generates gaseous emissions and fugitive dust contributing to a temporary and localized reduction in air quality, as well as, increased noise levels.
- 5.8 Construction Risks. There are several areas of risk in the project during the period of actual construction. The project is vulnerable to natural forces such as floods and other impediments. The construction of the foundation work for the viaducts and the main bridge are susceptible to overtopping if there is an exceptional rise in the river level. Normal construction precautions include allowing for prevention of flooding of the work area by raising the protective barriers around the site. Another construction-duration risk is to the hydraulic embankment construction. High water levels and the corresponding increased rate of the current pose a hazard to the construction of the embankment placing until it reaches the design height and closed out at the structures. Should failure occur during the placement due to these factors, recovery would necessitate waiting for a reduction of both the water level and the velocity of the flow. Or possible temporarily diversion of the flow to allow replacement of the material. Either method will add to the construction time and cost, and will create increased siltation problems. Site reconnaissance activities, discussion with the Concessionaire managers, and review of the relevant documents do not reveal concerns for existing contamination in the right of way area.

### **5.1.2 Social Impacts**

- 5.9 The potential social impacts due to construction are summarized in Table 5.3. The most significant, although limited in relative terms, impacts are related to land use and expropriation, effect on local residents who work or live near the construction areas, and archeological impacts.

- 5.10 The construction of the bridge complex is physically in five distinct land areas: Rosario, Granadero Baigorria, Islas (Islands), Victoria, and un-permitted/Irregular Housing (i.e. squatters). The land used during the construction activity is in relatively less densely populated areas in the northern district of Rosario along the embankments of the river near a municipal river walkway (green space) and a small residential area (Granadero Baigorria) of un-permitted (illegal) persons. In Victoria the proposed main bridge ramp is mainly open space. The expropriation of property is limited to 30 private properties, consisting of basically undeveloped natural areas.
- 5.11 There are no permanent occupants located within the right-of way. However, there are four illegal structures located on the islands of Invernada, Libertad, and Deseada. These structures are used on a temporary basis by approximately 10 persons (i.e., squatters). These structures will be left since they do not effect construction activities. As a consequence, no resettlement is expected to be required for the entire construction of the project.
- 5.12 Granadero Baigorria is the local community of illegal residents who live near the base of the bridge in Rosario and whom depend on fishing for subsistence and income. The construction will disrupt the consumption and commercial exploitation by fisherman and there will be a potential increase cost to this population to access the areas given the need for additional fuel costs to transverse longer distances to catch fish.
- 5.13 The construction will impact any existing archeological sites along the course of the bridge complex.
- 5.14 The bridge construction laborers will incur potential health and safety risks. Given the majority of the labor force is expected to be local, the typical health problems of single men working remotely such as sexually transmitted diseases, alcoholism, and others is not anticipated. Impacts and risks to the local population during construction involve increased noise, risk of diseases transmitted by the non-local work force, and risks due to the intensity and quantity of construction vehicular movement.

## **5.2 Operation Phase**

### **5.2.1 *Environmental Impacts***

- 5.15 The potential environmental impacts associated with project operation are listed in Table 5.4. The most significant impacts anticipated from the bridge structure are attributed to the permanent alternation of the hydraulic and sedimentological regime and habitat alteration due to the permanent barriers formed by the bridge embankments. Environmental contamination and impacts to the wildlife caused by increased hunting and fishing in the area are also potentially significant.
- 5.16 Hydraulic and Sedimentological Regime: The most significant operation phase impacts are attributed to the physical placement of the bridge complex, particularly the

embankments and pillars, resulting in the permanent alteration of the hydraulic and sedimentological regime of the Paraná River basin.

- 5.17 Adequate statistical data exists to establish the hydrologic characteristics of the Paraná River basin. This data has been used to identify the 100- and 1,000-year floods. Numerous computer-aided hydraulic modeling studies were performed before the bidding process and additional computer and physical models were conducted to analyze the hydraulic behavior of the river resulting from the construction of the roadway embankment across the floodplain.
- 5.18 The erosion and new flow regime are being studied using both mathematical and hydraulic models. The Instituto Nacional de las Aguas built the physical hydraulic model. To mitigate risks, calibration procedures were performed on both the computer simulations and the physical models to verify and validate the hydraulic analysis.
- 5.19 The 100- and 1,000-year design flows were determined by referencing previous studies on the Paraná River and performing additional statistical analysis. The 100-year flood is established as 57,100 m<sup>3</sup>/s and the 1000-year flood as 75,000 m<sup>3</sup>/s. For more efficient computer modeling of the floodplain, the width of the Paraná River floodplain was divided into nine separate flow zones. The total flow was divided among the nine zones with the largest flow within the main channel of the Paraná River. The one-dimensional computer modeling of the Paraná River floodplain was developed using MIKE11, a computer program developed in Denmark. The two-dimensional computer modeling of the Paraná River floodplain was developed using FESWMS-2DH developed for the U.S. Federal Highway Administration. Several references were cited for the determination of estimated scour depths including *HEC-18, Evaluating Scour at Bridges*, prepared for the U.S. Federal Highway Administration, 1990.
- 5.20 The effects of the Rosario-Victoria Bridge crossing on the river velocities and backwater elevations within the river have been estimated to be minimal. The design parameters required a minimum of 18% of hydraulic transparency (as measured in lineal bridge distance), with the remaining 82% of the length as embankment. However, the real hydraulic transparency (in terms of water-flow) is in the order of 50% (i.e. a considerable portion of the delta is dry land under normal floods) and most watercourses are not interrupted by the crossing. When compared to the bridges and culverts of the existing Zarate Brazo Largo complex (located 176 Km downstream of this project), the length of the proposed 12 bridges across the river valley, is more than two times larger in this project. In the main channel the average flow velocity for the 1000-year flood is approximately 1.7 m/s (with the peak velocity approximately 2.5 m/s). In the eight additional flow areas modeled across the extended floodplain, the maximum velocities vary from 1.5 to 1.9 m/s through the smaller waterway openings.
- 5.21 The changes in water levels over the Paraná River Delta due to the project under normal flood conditions are minimal. In the cases of extreme flood conditions (i.e. 100 and 1,000 years floods) the project results in an increase on the flow over the main Paraná river channel in the range of 1 to 2%, and a slight decrease over the smaller rivers and creeks.

Figures 5.7 to 5.10 provide a comparison of the expected flow distribution with and without the project for the 1,000 and 100 years floods. The main channel accounts for approximately 30% of the flow over the river delta under these conditions. The upstream changes on water levels due to the project are very different for the main Paraná river channel, than for the flood plain (islands and smaller watercourses). The effects on water levels downstream of the project are less pronounced, and dissipated a few km downstream from the structures.

- 5.22 During a 100-year flood (water levels at Rosario at 9.60 meters IGM, and a water flow established at 57,100 m<sup>3</sup>/s) the water levels on the main channel increase from 3 centimeters (cm) at the crossing to 0 cm at 40 km upstream. During a 1,000-year flood (water levels at Rosario at 10.80 meters IGM, and a water flow established at 75,000 m<sup>3</sup>/s) the water levels on the main channel increase from 5 cm at the crossing to 1 cm at 40 km upstream.
- 5.23 The estimated changes over the flood plain during a 100-year flood (as estimated for Arroyo Barrancoso located in the middle of the delta) are: from 20 to 25 cm increases upstream of the embankment, approximately 16 cm increases up to 20 km upstream, approximately 4 cm increases up to 40 km upstream, and insignificant at the town of Diamante (70 km upstream) since at that point the delta narrows and converges into the main channel. The changes during a 1,000-year flood are expected to be of similar elevation but with higher water velocities.
- 5.24 The project alterations are estimated to lead to increase sedimentation downstream during annual flood events due to the increased erosive capacity associated with the increase water flows, which will be aggravated under periodic extreme flood conditions. Furthermore, the upstream areas will also gradually be increased sediment deposition over time. The effects on sedimentation, lateral erosion, and the creation of stagnant pools of water will depend on two main factors: (a) the hydraulic interaction of the downstream dredge channel (that runs parallel to the embankment) connecting all the watercourses between Victoria and the middle of the delta; and (b) how the sediment carried by the floods is deposited downstream of the bridges. It is expected that the channel should avoid the creation of stagnant pools of water. It is also expected that the erosion protection of the bridge footings, with 40 to 50 meters of geotextiles blankets, will control lateral erosion of the embankment.
- 5.25 The monitoring programs described in section 6.3 are designed to measure and evaluate the effectiveness of these erosion control measures, and provide the basis for corrective mitigation measures when needed.
- 5.26 Potential Flooding: The potential flooding under normal or average flow conditions is insignificant since the changes in water levels over the Paraná River Delta due to the project are minimal. Under these conditions (water level 6.50 meters IGM) only 32% of the floodplain is covered by water, and the crossing does not interrupt most watercourses.

- 5.27 In the case of extreme flood conditions (i.e. 100 and 1,000-year floods) the upstream changes on water levels due to the project are anticipated to be approximately 5 cm in the main channel, and 25 cm at the center of the floodplain at the crossing, extending approximately 40 km upstream and becoming insignificant at the town of Diamante.
- 5.28 Given the topography of the coastline no additional flooding due to the project is expected on the Rosario side, since the Santa Fe coastline is high with natural cliffs in the order of several meters almost all the way north to Diamante.
- 5.29 On the Victoria side, the Entre Rios coastline slopes gently into the floodplain with large areas subject to seasonal flooding. The evaluation performed by the concessionaire's hydraulic specialist indicates that the average width of the additional flooded area is in the order of 35 meters for the first 10-km upstream and up to 20 meters for the remaining sector up to the town of Diamante. The size of the additional flooding under these extreme flood conditions is in the order of 140 hectares (Ha).
- 5.30 In order to provide a sense of magnitude, the Paraná River delta between Rosario-Victoria and Diamante covers an area of approximately 213,000 Ha. Of this area, approximately 145,000 Ha were flooded during the flood of 1998 that reached an elevation of 9.48-m IGM at Rosario (almost a 100-year flood event). Based on these current estimates, the flooding due to the project would have increase this area by less than 0.1 percent.
- 5.31 In terms of the duration of these extreme floods, it took over 40 days for the flood of 1998 to recede 1 meter from the peak water level. The results of the hydraulic analysis performed in the EIA indicated that on average, the water levels for extreme floods would remain between one to three days more with the project in place when compared to the existing hydrologic regime.
- 5.32 This additional flooding will not affect the town of Victoria, since all of its buildings are at elevations between 30 and 63 meters IGM, neither the upstream settlements of Rincon del Doll and Las Cuevas located at elevations higher than 12 meters IGM. The land uses of this portion of the floodplain include fishing, hunting and seasonal cattle ranching, since the salinity of the soils does not support agricultural uses.
- 5.33 Habitat Alteration: The construction of the embankments at a height of 4 to 10 meters above the natural terrain and width of 80 m, represents a loss of vegetation, which simultaneously represents a loss of habitat for the local fauna. The area is a complex ecosystem, which supports a rich biologically diverse flora and fauna. It also is known to support or potentially support a number of potentially endangered wildlife species including: Rana criolla, Iguana overa, yacaré, Lobito del Rio, Gato montes, guazuncho, ñandu, Zorro del monte, Zorrino, Vizcacha, Mulita.
- 5.34 The change in current flows and velocities creates a barrier effect that may impact fish and other wildlife sensitive to current velocities, resulting in avoidance of certain normally transited areas, and thus potential restriction of movements either up or

downstream of the bridge complex. The magnitude of these impacts is limited given the magnitude of hydrological changes and the degree of hydraulic transparency maintained.

- 5.35 Environmental Contamination: The traffic projected to cross the bridge complex will contribute to an overall deterioration in noise, air, and water quality due to the continuous flow of vehicular traffic across the bridge. The total estimated average annual daily traffic is reported as 2,440 vehicles for the opening year, and 4,560 vehicles for the year 2010. This traffic will contribute on a permanent basis: 1) vehicular gaseous emissions and fugitive dusts, 2) intrinsic noise and (3) surface runoff water contamination from grease and oil vehicular leaks. The noises will adversely affect wildlife particularly birds, mammals, and fish given that it will induce avoidance of more sensitive species and thus their eventual permanent displacement. Air pollution will similarly affect species more sensitive to toxins and dusts resulting in acute or chronic toxicity or injury over time. Surface runoff pollutants will also contribute to degradation of the water quality. The noise impacts were analyzed using US Department of Transportation models, which concluded that the noise decibels though significant to induce migration of sensitive bird and fish species, were also highly localized. Additionally, there is an increased propensity for generation and disposal of solid wastes due to the increase in human access to the area, which further contribute to contamination of the water and terrestrial habitats.
- 5.36 Uncontrolled Hunting and Fishing: Fish and wildlife are adversely impacted due to increase fishing and hunting pressures as a direct consequence of the facilitated physical access from the bridge complex including off-ramps to the islands on the eastern-end of the river basin. The access would serve the community already living, fishing, and hunting on the islands, local visitors, and tourists.

### 5.2.2 Social Impacts

- 5.37 The operational impacts to the social-economic environment are listed in Table 5.5. The most significant impact is potential modification in the way of life in Victoria since the bridge will establish direct contact with the larger city of Rosario and serve as a conduit for “big-city” problems of Rosario. Other potentially significant impacts are:
- Potential adverse impacts to public health and loss of lifestyle/cultural values associated with the improved access amongst the communities;
  - Increased burden of additional traffic in the vicinity of Victoria and to a lesser extent in Rosario;
  - Impacts on road system due to increased traffic;
  - Modification of fishing conditions upon which fisherman in the area make their living or rely on for sustenance; and
  - Accelerate the rate of irregular/illegal human settlements due to the facilitated access to the islands, riverbanks, and other areas of the river system.
  - Transformation in Victoria in the suburban and perimeter areas of the old town, related primarily to the increase in services to the commercial transportation sector;



- Cumulative impact due to accelerated economic development, if not properly planned or managed;
- Additional pressures on urban development and also on recreation and tourism use of the river embankment areas, which may result in land use conflicts;

### **5.3 Beneficial Impacts**

5.38 The project has been highly desired by the local population for some time. The following are the principal potential beneficial or positive direct impacts associated with the project:

- Improve the transportation system, both at local, regional and national level;
- Enhance social communication between residents in Rosario and Victoria and improve quality of life;
- Hire local skilled and unskilled construction workers (total construction workers is estimated at 760);
- Directly increase local revenues through purchase of local goods, materials and equipment and increased tax revenue for local and provincial governments;
- Accelerate economic development and social modification to the existing regional and local population of Rosario and Victoria.

## **VI. ENVIRONMENTAL AND SOCIAL MANAGEMENT**

- 6.1 An Environmental Management System has been implemented for the project in order to ensure sound protection of the environment during the construction and operation of the project (see section 6.1). A summary of relevant components of the system is presented as follows: mitigation measures (section 6.2); monitoring programs (section 6.3); costs, schedule and responsibilities (section 6.4); and health and safety and contingency plans (section 6.5).

### **6.1 Environmental Management System**

- 6.2 The basic concepts and objectives related to environmental and social protection and control for the Project are defined in the project Quality Plan that includes a Quality Control Manual (QCM or “Manual de Calidad”) and an Environment Management Manual (EMM or “Manual de Gestión Ambiental”). Both manuals are formatted in an ISO 14000 framework. The EMM identifies the organization, legal, operational, and procedural requirements to execute the project and includes a commitment from the concessionaire to propose and develop mitigation measures, the procedures for preparing reports on environmental impacts and resource inventories, environment verification and control procedures, and the procedures, terms, and methods to perform environmental audits.

- 6.3 The specific details for the environmental and social protection and control of the Project are presented in the Environmental Management Plan (EMP). The EMP includes objectives, various procedures, identification of impacts, mitigation and monitoring programs, responsibilities, and list of required permits, public communication plan, and a list of required additional documents. The EMP includes procedures for document control, audits, training, inspections, inventories, contingencies/emergencies, and health and safety. The documents related to the environmental management system listed in the EMP include:

- Procedures for identification of the most significant environmental impacts;
- Procedures for environmental inventories;
- Procedures for installation of construction camps;
- Procedures for communication, training, and document control;
- Procedures for elaboration, and distribution of documents;
- Procedures for corrective and preventive actions;
- Procedures for quality control;
- Procedures for general, and internal audits; and.
- Contingency Plan and Procedures.

- 6.4 All of the project environmental management documentation was developed based upon existing information (e.g., different EIAs, etc.), the DNV Environmental Manual for Roadway Projects (Manual de Evaluación y Gestión Ambiental para Obras Viales de la Dirección Nacional de Vialidad, July 1993), the World Bank Environmental Assessment Sourcebook, and other general literature.

## 6.2 Mitigation Measures

### 6.2.1 Construction Phase - Environmental

- 6.5 The environmental mitigation programs during construction (see Table 6.1) provide measures to reduce impacts to air, noise, hydraulics and sedimentology, water quality and ecology. It also includes a plan for managing dredge material and for implementation of sound construction practices and training. In addition, it recommends measures, to be implemented by the government, to reduce the effect of human pressure on the ecosystem.
- 6.6 Air quality will be maintained by wetting surfaces of stored materials to reduce fugitive dust emissions and keeping surfaces free of dust and fine aggregate by washing, cleaning or sweeping. Equipment will be maintained in good running condition, maintaining filters and valves and forbidding waste burning will control pollutant emissions. During transportation on the bridgeheads dust emissions will be controlled by limiting the maximum loads of trucks (in accordance with existing regulations) and by covering or wetting loads. A subcontractor will be chosen with adequate technology will fulfill control of fugitive emissions and toxic gasses at asphalt plants. The escape of dust will be controlled on land operations by limiting equipment speeds.
- 6.7 Noise levels will be suppressed by preventative maintenance of equipment, use of noise suppression devices on compressors and generators, programming tasks so that nocturnal emissions are kept below local thresholds, and by locating naturally noisy operations far from housing and noise sensitive ecosystems.
- 6.8 Hydraulic and sedimentology impacts will be mitigated by creating channels to maintain flow and creating a “custody ditch” far enough away from the embankment to minimize the risk of erosion, and will minimize the impacts that result from stopping the flow of water. Personnel safety at deep borrow pits and scour holes under the bridges will be maintained by signage and fences. Bridge scour and erosion along the river edges will be monitored during construction work to quantify the erosive processes. The Control Body should maintain adequate communication with the concessionaire of the Hidrovía to determine if dredging has altered the navigation channel, and to generate baseline information on the evolution of the main riverbed resulting from the project.
- 6.9 Water quality impacts can be protected through the following measures: stormwater retention and drainage systems; sediment and structure traps for rain water; maintaining natural drainage free of obstructions; and avoiding pollution with flammables, oils and tailings. Fuels and lubricants will be stored in tanks that comply with safety rules, and are contained within enclosures with waterproof floors. Any material spilled from equipment will be immediately recovered or cleaned.
- 6.10 Dredging will cause some increase in turbidity, but the technology to be used in dredging will limit its effects. Extracted material from each borrow and dredge area will be sampled and the samples will be analyzed for contaminants, prior to dredging.

- 6.11 Placement of pilings could affect water quality by releasing bentonite; however, the effects will be minimized by assuring that compounds such as lignosulfate will not be used. Additional measures to minimize impacts include avoiding the use of excess or unnecessary quantities of mud, and restricting the release of concrete during sub-aquatic applications.
- 6.12 The transportation of cement to the island zone poses a risk to water quality and will be minimized by the transport of cement in closed containers (hermetically sealed if possible), and in safe conditions. Also operators will be trained in appropriate accident responses.
- 6.13 Ecosystems mitigation is based on inventories and evaluations of wildlife and wildlife habitats before and after construction and adopting a series of measures to ease or compensate for negative effects. Specific mitigation measures in the form of a series of recommendations include:
- Make collections in areas that are in or near the construction sites;
  - Lend particular attention to biologically diverse habitats;
  - Disposal of tailings in aquatic habitat should be avoided;
  - Commercial fishing should be prohibited in work areas;
  - Hunting should be prohibited along the road;
  - A conservation program for trees should be implemented;
  - Responsible organizations should control hunting in the valley that will be encouraged by new access;
  - Following construction, worker areas and other disturbed areas not used for operation should be restored to a natural state;
  - Use fencing that will allow wildlife to migrate across the facility;
  - Carefully develop a revegetation plan to use multiple native species of trees;
  - Minimize the runoff of water from the embankment;
  - Evaluate the best position for a service channel;
  - Careful handling of dredged material, keeping areas clean; and
  - Avoid the creation of stagnant pools.
- 6.14 A Plan for Managing Dredged Material will be implemented to define the best technology for dredging, the loan areas, material volumes to be extracted and the operative limits of the dredged material. The first step in the plan is to obtain the results of dredge material sampling and analysis. If materials are not polluted, then based on vegetation, topography and hydrologic studies, the most suitable location for loan and deposit will be matched. The basic standard for the dredging operation is to minimize disturbed areas. This will be best accomplished by the construction of a parallel-dredging channel that will also serve as a service channel. Additional mitigation measures in the plan include:
- Reconstruction of saddles along creeks;
  - Observation of natural slopes;

- Soft transitions between dredged and non-dredged areas;
- Avoid unnecessary vegetation removal;
- Maintain natural corridors;
- Construct saddles at a level of 7.0 m IGM or at original levels;
- Use the main river channel for dredging when possible;
- Avoid breaking landforms;
- Rejected loan material will be placed in borrow areas;
- Avoid constructing large lagoons that cause water to stagnate; and
- The dredge material management plan will contain specification for the location of loan material and dredging that considers the effects on ecosystems, the islanders, cultural resources, and other natural resources.

6.15 The use of sound construction practices includes:

- Limitation of vegetation removal on the bridge heads and in the valley to minimize disturbance of natural ecosystems;
- Use procedures that minimize soil disturbance;
- Prohibit the distribution of material surpluses in the river or floodplain;
- Assure that worker areas at the bridge heads are kept clean and insect free;
- Flammables, oils, chemicals and other pollutants will be apportioned to keep them from polluting water or soils;
- All residuals will be properly reused, removed or incinerated according to their characteristics;
- Drinking water will be provided for cooking, bathing and consumption;
- Direct runoff of wash waters from concrete trucks will be kept from water courses; and
- Systematic removal of rubbish from water courses.

6.16 Training of personnel by the concessionaire will be performed to define employee responsibilities with respect to the environment, inform workers of environmental problems, implementation of control measures, preservation, environmental protection, contingency plans, and applicable environmental regulations. It will also assign roles and responsibilities for environmental management and in emergency response situations. This program will be continuously expanded and improved throughout the construction process.

6.17 Measures related to effects of the increase in human pressure facilitated by the project on the environment and social system will be implemented, including:

- Development of a better understanding of the structure and operation of the socio-cultural system;
- Development of an updated legal framework, reporting system and control system for exploitation of the ichthyological resources, particularly those that have declined in recent years;
- Determine the system of use to regulate access, camping, settlement and eventually establish hunting seasons;

- Establish strict control of human activities during extraordinary flood events;
- Evaluate the effects of cattle-raising on native fauna;
- Place size limitations of certain fish;
- Develop plans for Eco-tourism;
- Establish seasons and other restrictions on sport-hunting; and
- Establish a protected natural area in compensation for the loss of natural habitat and wetlands.

### **6.2.2 Construction Phase - Social**

- 6.18 Construction phase mitigation measures related to socio-economic and cultural aspects of the environment are in the areas of land transportation, river navigation, health and accidents, vulnerable populations and archaeological patrimony (see Table 6.2 for listing).
- 6.19 Land transportation includes planning access routes to limit interference of trucks with the normal traffic flow, coordination of trucks to avoid simultaneous operations, enforcing load limits. The concessionaire will organize a system of information exchange with local authorities to regulate traffic, provide notice when main traffic arteries will be disrupted and provide proper signalization around work areas. Local police should provide traffic police officers to direct traffic.
- 6.20 River navigation includes preventative measures designed to reduce the accidents for construction vessels including: as a passive measure, floating equipment will have adequate signals in daylight and at night; work zones will also have signage limiting access to smaller vessels in the vicinity of work; and signage will also be placed in construction areas in navigable courses. Additionally, local authorities will be notified weekly of the work plans, and a system of emergency actions will be developed. Radio and rapid response will facilitate emergency response, and first aid will be available at work sites.
- 6.21 Health and Accidents measures includes vehicle safety measures, such as sound and luminous signs, signaling for dangerous activities in work areas, signs indicating safety measures, preparation of contingency plans, and inspection and monitoring of safety measures. Safety plans will be posted on dredges and will show the position of various safety items. Part of these measures will be handled in the concessionaire's health and safety plan (see section 6.4). Hospitals are available in both Rosario and Victoria and procedures will be verified with these hospitals. Distances and travel times from different points to health centers will be calculated to assure a rapid arrival. Additionally an evacuation plan will be developed for the event of a serious accident or natural diseases. Elements of this plan include routes, communications, vehicles, publication of the plan in work areas, first aid and personnel training in fire fighting.
- 6.22 Vulnerable Populations. The backwater fishermen and islanders are the most vulnerable populations. Although it may be important to gain a deeper understanding of their socio-cultural systems to define their needs, an improvement plan is recommended to increase

their productive possibilities by managing the natural resources and facilitating access to services. The objectives of the plan include: generate economic opportunities, improve the utilization of natural resources, develop agreements for community participation, and provide a strategic vision for change. The plan also must include a coordinated development plan for economic human, physical and community aspects, and must define the involved communities, identify available resources, and identify base conditions to measure success. The responsibility and cost of this plan is assigned to the Municipal and Provincial authorities and it will be developed in a participatory manner that will include the affected population. The assigned costs are presented in section 6.4.

- 6.23 Archaeological Patrimony. The impacts will be mitigated through a survey to identify archaeological sites that could be affected by the project followed by data retrieval at sites within the area of effect. Materials discovered during construction will be reported to the authorities to assure their protection.

### **6.2.3 Operation Phase**

- 6.24 The principal proposed environmental measures during operation include (see Table 6.3 for complete list):

- Monitoring of channel water levels;
- Corrections to channel depths if siltation occurs;
- Maintenance of signalization in water courses;
- Coordination with Hidrovía regarding channel depth, signalization, and navigation;
- Enforcement of vehicles safety inspections;
- Enforcement of hunting and fishing regulations;
- Monitoring of flora, fauna, and water condition; and
- Creation of a protected natural reserve in compensation for the loss of natural habitat and wetlands.

- 6.25 The measures proposed to mitigate the social and cultural aspects are presented in Table 6.4 and summarized below.

- Identify areas for rezoning to optimize positive effects.
- Organize the urban space to function harmoniously.
- Identify infrastructure and service demands.
- Indicate programs in existence to satisfy those demands.
- Propose measures to resolve conflicting situations.
- Plans for regulations of soil use must follow environmental criteria and be compatible with community characteristics. Measures should be taken to avoid the use of green areas and ecologically sensitive zones. Development plans should be balanced with community goals.
- The municipal government should implement a system of control to coordinate services with growth related to alterations in Rosario's land-use induced by the project and educational and sanitary service shortages are likely to occur.

- Implement improvements in land transportation in Rosario and Victoria, including adequate routes to connect to the bridge such as Entre Rios planned investment in improvement to Route 11, widening Route 26 and creating a route between Victoria and Viale via R.N. 18 and Rosario plans to improve the Avenue at the bridge connection.
- Mitigation of health problems and accidents resulting from the operation include contingency plans in case of emergencies, and safety and hygiene procedures that are the obligation of the concessionaire.
- The Municipalities need greater coverage of their sanitary infrastructures and health professionals to facilitate programs and sanitary control and to develop information campaigns so that the citizens acquire basic notions of disease prevention.
- Mitigation measures for the impacts to cultural resources focus on the revaluation and conservation of the architectural resources of Victoria; however, Rosario should also implement a plan. The architecture of Victoria is an important and fragile resource that is inherent in community's image. The installation of the Bridge can provoke a change in that image; therefore, the goal is to achieve the benefits of the bridge while preserving the city's heritage.
- A Program of Architectural Patrimony is proposed for both cities that establish a series of regulations and urban intervention strategies. The initial step is a complete inventory of city buildings and classification according to characteristics to identify different areas within the city and relate that analysis to urban dynamics. Then regulations to protect areas of patrimonial value through establishing historical protection zones. Also, legal incentives that permit the care and rehabilitation of zones and buildings of special value should be developed. This program includes municipalities, governmental and non-governmental organizations of the two cities.

### **6.3 Monitoring Programs**

- 6.26 The concession will complete four inventories in order to complement the information presented in the project Environmental Impact Assessment: one initial, a second at the end of construction, a third at the first year of operation and the last at the end of the concession. The initial inventory, which is presently being performed, will include five principal programs (hydrological, flora and fauna, air quality, epidemiology, and archeological) and will be used to more completely define baseline (i.e., pre-construction) conditions and to allow modification, if necessary, of project-related mitigation measures. The inventories at the end of construction and during the first year of operation will confirm the status of environmental conditions, identify potential impacts that may have arisen due to project-related activities, and identify, if necessary, additional corrective actions or mitigation measures. The final inventory will be used to define environmental conditions at the time the concession is returned to the government. A summary of the five principal monitoring programs is presented (see also Tables 6.1 to 6.4 for complete list).
- 6.28 A hydrological (hydrology, sedimentology, erosion control and water quality) program is intended to measure currents, sediments, water levels, and water quality. It will sample the river channel at bridgeheads, watercourses and other locations. The frequency of



measurement will be determined by agreement with the concessionaire and the Control Body and monitoring will be done jointly. Inspecting bridge embankments after flood events of a “meaningful” magnitude will check erosion. These measurements are also the joint responsibility of the concessionaire and the Control Body. Initially ten locations will be sampled for water quality analysis, with the frequency and types of analysis will depend on the results of the initial inventory.

- 6.29 A flora and fauna program will include sampling of ecosystems identified in the inventory. Sample locations and methodologies will be agreed upon in the concession contract, and explained and documented so they can be replicable.
- 6.30 An air quality program will be implemented in different zones of Rosario since it is approaching the permissible standards. The bridgehead or the intersection with NR 11 will be one of the zones selected for monitoring. The results will be analyzed by the Environmental Policy Secretariat of Rosario who will have the responsibility of adopting relevant measures if pollution levels surpass permissible limits. The first year of the concession includes air sampling. Subsequent sampling would be done in five-year intervals and would be the responsibility of the municipal government.
- 6.31 An epidemiology program will be implemented to assess potential social impacts due to the project on the spread of disease from the urbanized, highly populated City of Rosario to the isolated and remote City of Victoria. Each municipality, through its relevant health dependency, should develop a permanent monitoring program for health statistics. The detection of any anomaly should be followed by the notification of the government at the local and provincial level to implement measures to reverse its effects.
- 6.32 Assessments and analyses of the archaeological conditions will be conducted prior to and/or during construction as appropriate (these are described as a mitigation measure in section 6.3)

## **6.4 Cost, Schedule and Responsibilities**

### **6.4.1 Cost**

- 6.33 Tables 6.5 and 6.6 provide the estimated costs of individual mitigation and monitoring programs that are the responsibility of the concessionaire. The total concessionaire cost for the proposed mitigation (including both construction and operation phases) is estimated at US\$ 11,646,735. The total monitoring cost for both phases is estimated at US\$ 812,000. The estimated costs for the mitigation and monitoring measures that are the responsibility of the GOA are presented in Table 6.7. A fixed cost of approximately US\$ 737,000 is required for mitigation and monitoring during both construction and operation.

### **6.4.2 Schedule**

- 6.34 The schedule for the implementation of the concessionaire's mitigation measures and monitoring programs for the construction phase is presented in Tables 6.5 and 6.6. During operation, the mitigation measures and monitoring programs will be implemented on a continuous basis. The mitigation and monitoring activities to be performed by the government will be performed during construction and operation (see Table 6.7).

### **6.4.3 Responsibilities**

- 6.35 The Environmental Management Plan (EMP) establishes an organization chart and defines the specific responsibilities related to environment, health and safety. The Environmental Manager, who has been assigned full time to the project since March 1998, reports directly to the General Manager and is responsible for supervision and implementation of the environmental programs, preparation, distribution, and dissemination of environmental documentation, compliance with environmental objectives and procedures, and coordination of internal and external audits.
- 6.36 Under Concession Contract, the Concessionaire responsibilities are limited to those impacts related to the construction activities and the GOA assumes responsibility for the impacts related to the location and design and the project operation. This provision limits the environmental risks and liabilities of the concessionaire during construction to construction related accidents and natural forces such as floods during construction period.
- 6.37 The presently estimated assignment of responsibilities between the concessionaire and the government for the implementation of the project mitigation measures and monitoring programs is listed in Tables 6.1 to 6.4. This assignment of responsibilities was submitted by the concessionaire to the Control Body as a separate document on July 17, 1998. In general, the mitigation and monitoring measures assigned to the concessionaire include: controls and monitoring during the dredging and embankment construction operations; erosion protection of bridge footings; forestation of the embankment; a series of monitoring programs for hydrology, sedimentology, flora, fauna, and epidemiology during construction and operation; waste disposal; and air traffic, roadway and waterways signalization. The measure assigned to the government (the Control Body has the specific responsibility to ensure implementation), in general, include: environmental education, sanitary controls, monitoring and coordination with local institutions, cultural patrimony, developing and implementing a social communication plan, traffic safety, and the creation of a natural protected area to compensate for the loss and degradation of natural habitats.
- 6.38 The Concessionaire is responsible for worker health and safety during the construction and operations phases of the project. The organizational chart in the EMP assigns an expert on Health and Safety operating directly under the general manager.

- 6.39 The Concessionaire's reporting requirements, per the concession contract, include preparation of environmental reports every three months during the construction activities, preparation of environmental reports every four months during the operation, preparation of yearly annual synthesis at the end of each year. In addition, the concessionaire must perform three additional resource inventories: 1) when construction is completed; 2) the first year after the operation begins; and 3) prior to finalization of the concession.
- 6.40 The Concessionaire will perform various supervision and monitoring activities as described in the Environmental Management Plan. The governmental Transitory Committee will oversee all the daily operations of the project, acting as the operating arm of the Control Body. This committee will contract the services of an Independent Consulting Team to perform monitoring, supervision, quality control, and audits. The Bank will also perform project (loan) supervision activities.

### ***6.5 Health and Safety and Contingency Plan***

- 6.41 The Concessionaire will be responsible for worker health and safety during the construction and operations phases of the project. Health and safety procedure for the project are prescribed in the components of the Implementation and Operational Manual of the EMP and includes:
- General Procedures on Health and Worker Safety Plan
  - Instructions for Navigational Safety.
  - Instructions for Signalization in Open Construction Areas.
- 6.42 The Boskalis Company (company to perform dredging operations) has a manual for International Dredging Contractors which includes a specific section on health and safety, describing the company policies for working on ships and barges in the water environment. Boskalis also has a field booklet on safety instructions covering: safe use of tools, crane signals, basic health, pollution prevention measures, first aid, sexually transmitted diseases, fire prevention, alcohol consumption, handling of dangerous and radioactive materials, use of explosives, fuel tanks, and precautions for sea going vessels.
- 6.43 The Concessionaire is preparing a series of documents to address contingency plans in case of emergencies or accidents and includes:
- Procedures for prevention and action during emergencies;
  - Instructions for an action plan in case of fires;
  - Instructions for an action plan in case of spills;
  - Instructions for an action plan in case of flooding; and
  - Instructions for an action plan in case navigational accidents.

These documents have been finalized as of January 1999 and the concessionaire has the resources available for their execution within its contingency fund.

## **VII. PUBLIC CONSULTATION AND PARTICIPATION**

- 7.1 The people of the cities of Rosario and Victoria are well aware of the project, since a physical link between both cities has been planned for more than fifty years. A summary of specific actions that have been performed in properly inform and consult the public are listed below.
- 7.2 The project Environmental Impact Assessment (EIA) was made available to the public on July 10, 1998 at various locations (e.g., cities of Rosario, Victoria, Santa Fe and Buenos Aires at the Ministry of Public Works in Rosario, Ministry of the Environment and Ecology in Santa Fe, Municipality of Victoria, and MEPW in Buenos Aires). In addition, a summary of the EIA (including environmental impacts, mitigation and monitoring programs) was published in the newspaper La Capital from Rosario on August 23, 1998.
- 7.3 The pre-feasibility EIA (1994) included an extensive public participation process and concluded that the general perception of the bridge is positive. The objectives of the process included: determining the current uses of the existing transportation routes of the Rosario community and projecting new uses resulting from the proposed project, determining inter-provincial movement with destinations from Rosario toward Entre Rios about motivations and frequencies, and determining the predisposition to redirect travel routes based on the proposed connections. Three mechanisms were used to meet the objectives:
- Consultations with numerous government representatives, administrators, independent and non-government consultants to obtain their perspective of the bridge;
  - Two public meetings one each in Victoria and Rosario;
  - Home survey of 200 Rosario residents during the last days of December 1993; and
  - Interviews with a sample of the local population.
- 7.4 The study published by the Unidad de Ecologia y Medio Ambiente of the Government of Entre Ríos in June 1994 concluded that the general perception of the bridge is positive in nearby localities. Perceived positive benefits include commercial development in both cities and relief from a state of Victoria's cultural isolation. Concerns centered on potential adverse changes in the local way of life especially in Victoria.
- 7.5 Recent efforts by the Concessionaire have also been performed to provide information on the project. For example, the Concessionaire has placed at the future location of each bridgehead a large billboard that summarizes critical information about the project, such as cost, schedule, and the name of the concessionaire and a description of the project.

- 7.6 The Public Communication Plan in the EMP provides a series of activities to be performed to inform the public (e.g., written documents, public signs, radio, etc.). These activities include: project information, publication and dissemination of the EIA, disruption to transit and navigable channels, quarterly reports, disposal of garbage, protection of vegetation, contingency in case of flooding, fire protection, and public complaints.

## **VIII. RECOMMENDATIONS**

- 8.1 The IDB will require, as part of the Loan Contract, that Borrower comply with the following: (i) all applicable environmental, health and safety Argentine regulatory requirements; (ii) all requirements associated with any environmental, health and safety related permits, authorizations or licenses that apply to Project; (iii) all environmental, health and safety aspects of the Concession Contract; (iv) all components of the Environmental Management Plan; (v) implementation of all actions and requirements in any project related environmental, health and safety document, including without limitation, project Environmental Impact Assessment, health and safety plans and procedures, contingency plan, etc.; and (vi) the applicable environmental and social IDB policies and guidelines.
- 8.2 Prior to presentation of the project Loan Report to the Bank's Board of Directors, the following conditions are required to be fulfilled by the Borrower:
1. Submit confirmation that the project Environmental Impact Assessment and Environmental Management Plan have both been approved by the GOA.
  2. Provide evidence that the Government of Argentine commitment to carry out its part of the Environmental Management Plan.
  3. Provide evidence that a public meeting has been held, related to the environmental and social aspects of the project, in the city of Rosario or in Victoria.
- 8.3 Prior to project financial closure, the following conditions are required to be fulfilled by the Borrower:
1. Provide, subject to IDB approval, the final Environmental Management Plan, including cost estimates for each project mitigation measure, monitoring program, or environmental management component, including guarantees that the required resources will be made available, and a time schedule for performance and completion of each activity.
  2. Provide confirmation that the Government of Argentina is committed to the proper and timely implementation of all mitigation measures and monitoring programs, identified in EIA or EMP, which are the government's responsibility per the concession contract.
  3. Provide confirmation of sufficient insurance to properly cover all environmental related risks associated with project construction.
  4. Present a project Contingency Plan for the Construction Phase (e.g., spill and emergency response procedures, etc.), including assurances that adequate resources will be provided to ensure the plan will be fully implemented; and
  5. Present a proposed Project Supervision Plan, subject to IDB approval, which will include the specific methods to be implemented to ensure all environmental and social measures and programs for the Project are completely and properly implemented by all responsible parties. The plan will include the use of an independent consultant to confirm compliance with the project environmental and social requirements.

- 8.4 The following conditions are required to be fulfilled by the Borrower prior to each disbursement:
1. Certification of compliance by with all environmental and social loan requirements.
  2. Description of any non-compliance with any environmental and social loan requirement and an action plan to correct such non-compliance.
  3. Description of any known environmental and social liability, including without limitation environmental claim, or material compliant, or unforeseen environmental, health or safety impact or risk.
- 8.5 After beginning the commercial operation of the project, and no later than 180 days, the Borrower shall submit a Final Report on the Construction Component of Environmental and Social Mitigation and Monitoring Measures, including the following:
1. Certification by the Borrower that the project has successfully implemented and complied with all environmental and social requirements;
  2. Any material deviation from the original construction plan, including a brief technical description and major reasons for such changes, as well as any adjustment to the relevant environmental and social measures that have been taken;
  3. Description of any existing or anticipated environmental or social liability, risk or non-compliance; and
  4. Copies of any major environmental or social report or document prepared in order to satisfy regulatory requirements, except those already submitted with the reports during construction period.
- 8.6 During the term of the loan, the Borrower must prepare and submit an Annual Environmental and Social Compliance Report, which will be due 60 days after the close of each Fiscal Year. The report must include, at a minimum, the following:
1. Certification that the Company is complying with all environmental and social loan requirements;
  2. Description of any material non-compliance with any environmental and social loan requirement, which occurred, and a description of measures taken to correct the non-compliance.
  3. Description of any changes in the company's operations which may have a material environmental or social effect, the reasons for such changes and any actions taken to mitigate the impact of such change.
  4. Description of any material environmental or social problem (such as accident, unplanned event, etc.) and a description of the actions taken to resolve the problem and the measures taken to prevent the event from occurring in the future.
  5. Description of any contact by a third party (including governmental agency, public, non-governmental organization, company employee, etc.) regarding material environmental, social or health and safety issue.

6. Description of planned environmental and social related activities to be performed during the next year, including estimated cost, schedule, and responsibility, including any environmental impact assessment to be developed.
  7. Copy of any environmental and social document or report written to comply with any governmental regulatory requirements.
- 8.7 During the term of the loan, the Borrower must comply with the following requirements:
1. Consult with the Bank before implementing any action which will have a material environmental or social impact.
  2. Provide written notification, within 30 days after the Company becomes aware, of any material non-compliance with environmental and social loan requirements, environmental health or safety material affect, environmental claim, or material complaint related to environment health or safety related to the Project or Properties, including a description of the situation (extent, magnitude, impact, etc.), the cause, proposed corrective or remedial actions, actions taken, and proposed schedule for future actions.
  3. Implement an Environmental Management System which is consistent with ISO 14001.
  4. Ensure compliance by construction contractors with the all environmental and social requirements.
  5. Eventhough no resettlement is anticipated under the current project plans, if any resettlement actions are required in the future, then they will fully comply with the Bank's Policy on Involuntary Resettlement (dated August 1998).
- 8.8 The mitigation measures proposed by the concessionaire include the creation of a protected natural reserve as compensation for the loss of natural habitat due to the location of the project.
- 8.9 Based of the facts that the responsibility of this measure is assigned to the government without a specific commitment and approval process, that the area to be taken by the project has no distinct characteristics from the surrounding sections of the Paraná River Delta, and that two other natural protected areas (see section 4.1) are already proposed on Municipal lands within the Department of Victoria; a more effective way to safeguard the natural environment, maybe through a combination of environmental education and the ecologically compatible use of the lands already expropriated for this project.
- 8.10 As part of the expropriation process, the concessionaire takes control of 5,000 Ha within the Paraná River Delta, of which only 700 Ha will be occupied by the project. More important the project provides easy access to islands that are very isolated today. The control of these areas provides an opportunity for a signalization and access management program that will promote environmental education, an appreciation of the ecological values of the delta, control of garbage disposal along the roadway and exit ramps, and the avoidance of the sporadic settlement that could occur on the lands adjacent to the roadway. Thus, a program that could achieve these objectives could be prepared and included in the concessionaire s' Environmental Management System. The estimated



costs of these proposed programs are assigned to the concessionaire, and included in section 6.4 and table 6.5. The elimination of the cost to acquire and maintain a protected at the government expense is also reflected in section 6.4 and table 6.7.

**Table 3.1: Environmental Legislation - National Jurisdiction**

Impacto Ambiental	Ley 24.354 Sistema Nacional de Inversiones Públicas. Decreto 1427/94. Decreto 720/95 Resolución DNV N° 1656/93.
Preservación y vigilancia de la contaminación de las aguas fluviales	Decreto 1886. Ley 22.190.
Tratado de la Cuenca del Plata	Ley 18.590. Tratado de la Cuenca del Plata. Ley 23.027. Comité Hídrico de la Cuenca del Plata.
Seguridad en la circulación: Señalización	Ley 24.449 Decreto 779/95 Decreto 2977/83 Ordenanza Marítima N° 2/83
Conservación de Suelos	Ley 22.428
Defensa de la Riqueza Forestal.	Ley 13.273
Flora y Fauna	Ley 22.421. Ley 23.918. Ley 23.919. Ley 24.375.
Protección del Patrimonio Mundial	Ley 21.836
Residuos Peligrosos	Ley 24.051 Decreto 831/93
Calidad del aire	Ley 20.284
Protección ambiental en la actividad minera	Ley 24.585
Restos Arqueológicos y Paleontológicos	Ley 9080
Seguridad e Higiene en el Trabajo	Ley 19.587. Decreto N° 911/96.

**Table 3.2: Environmental Legislation - Province of Entre Ríos Jurisdiction**

Conservación de Suelos	Ley 7728 (adhiera a Ley nacional 22.428). Ley 6752 Ley 8318
Riqueza Forestal	Ley 3623 (adhiera a Ley nacional 13.273)
Arqueología, Antropología y Paleontología	Ley 5581 Ley 450/85 M.A.S.
Caza	Ley 4841 Ley 6821 Ley 7552
Pesca	Ley 4892
Plaguicidas	Ley 6599 Decreto 4483/95 Decreto 5575/95
Sistema Provincial de Areas naturales Protegidas	Ley 8967/95
Impacto Ambiental: Comité permanente de Seguimiento y Evaluación de Impacto Ambiental	Decreto 4.886/95 Decreto 866/96
Residuos Peligrosos	Ley 8.880

**Table 3.3: Environmental Legislation - Province of Santa Fe Jurisdiction**

Conservación de Suelos	Ley 8.829 (adhiere a Ley nacional 22.428). Ley 10.552 Decreto 3445/92
Defensa de la Riqueza Forestal	Ley 8.074 (adhiere a Ley nacional 13.273) Ley 11.111
Intereses Difusos	Ley 10.000 Ley 10.915
Contaminación de Recursos Hídricos	Ley 10.550
Atentados contra la Salud Pública y Equilibrio Ecológico	Ley 10.703
Desarrollo Urbano	Decreto 7.317/67
Ley Orgánica de Comunas	Ley 2439
Ley Orgánica de Municipalidades	Ley 2756
Subsecretaría de Medio Ambiente y Ecología	Decreto N° 1550/96

**Table 3.4: Municipal Jurisdiction**

<b>Rosario</b> Calidad del Aire	Ordenanza Municipal N° 5820/94
<b>Victoria</b> Plan de Ordenamiento Urbano	Ordenanza Municipal N° 1265/95
Normas para el Ordenamiento para el Suelo Urbano	Ordenanza Municipal N° 1266/95
Patrimonio Arquitectónico y Urbanístico	Ordenanza Municipal N° 1267
Modificación al Plan Urbano en virtud de la ampliación del ejido Municipal.	Ordenanza Municipal N° 1417/96

**Table 4.1 : Floods Registered at Rosario**

Year	Month	Maximum Level Meters (Zero Rosario)
1905	June	6,24
1966	April	6,06
1977	March	5,53
1982	January	5,86
1983	March	6,17
1987	July	5,04
1990	February	5,13
1992	June	6,27
1998	May	6,43

**Table 4.2 : Statistical Analysis Of The Height Of The Parana**

LEVEL [m] Relative to Zero IGM = 3.05 m Rosario (1884 – 1996)			
Occurrence [years]	Confidence Interval Below (90%)	Estimated Mean	Confidence Interval above (90%)
5	7,73	7,89	8,06
10	8,09	8,31	8,53
25	8,53	8,83	9,13
50	8,85	9,22	9,58
100	9,18	9,60	10,02
500	9,93	10,49	11,05
1.000	10,25	10,87	11,49
5.000	10,99	11,75	12,52
10.000	11,31	12,14	12,96

**Table 4.3: Average Daily Traffic (ADT), Victoria (ISIT, 1995)**

Route	Year			Composition of Traffic	
	1990	1991	1992	Heavy	Light
RP 11	708	1096	987	66	34
RP 26	576	448	---	82	18

**Table 4.4: Average Daily Traffic, Rosario (ISIT, 1995)**

Route	1990	1991	1992	1993	Autos	Utility Vehicles	Buses	Trucks Class S	Trucks Class C	Tractor-trailers
					Percent					
Route Nac. 9	8780	9850	10600	12100	56	11	7	6	10	10
Route Nac. 11	1473	1450	1500	1500	31	23	4	16	47	9
Route Nac. 33	4200	4200	4300	5500	44	17	3	9	23	4
Route Nac. 34	2270	2550	2950	3300	33	20	4	9	23	11

**Table 5.1: Project Activities**

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Generation of project expectations prior to construction of the bridge complex</li><li>2. Determination of decision to execute project</li><li>3. Expropriations of lands</li><li>4. Preparatory work (de-vegetation, construction access roads, etc.)</li><li>5. Construction of auxiliary projects</li><li>6. Dredging and disposal</li><li>7. Soil movement</li><li>8. Excavation for foundations</li><li>9. Movement of equipment and material transport</li><li>10. Purchase of goods for construction and operation</li><li>11. Contracting of laborers for construction and operation</li><li>12. Construction of embankments</li><li>13. Construction of main bridge and 12 bridges in the island zone</li><li>14. Construction of access and bridge-road ramp from Rosario</li><li>15. Installment of signals</li><li>16. Construction of access accessories and services</li><li>17. Forestation and landscaping</li><li>18. Construction of toll stations</li><li>19. Construction of crash-defenses along the main bridge</li><li>20. Activities to finalize project</li><li>21. Transport of vehicles and passengers along the bridge complex</li></ol> |
|---|

**Table 5.2: Description of Construction Impacts - Environmental**

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Diverse impacts due to construction practices</li><li>2. Diverse Impacts</li><li>3. Air quality changes due to vehicular gaseous emissions and fugitive dust</li><li>4. Noise increases at each end of the bridge embankment</li><li>5. River bottom alteration due to borrowed dredge material</li><li>6. Erosion around embankments</li><li>7. Generation of stagnant water and reduced circulation and deposition of floating matter and increased deposition</li><li>8. Modification of hydraulic regime along transportation channel</li><li>9. Modification of hydraulic regime along maintenance channel</li><li>10. Increase in river levels upstream of bridge embankment complex</li><li>11. Potential water quality reduction due to discharge of contaminated effluents and discharge and disposal of construction material</li><li>12. Reduced water quality due to dredging actions</li><li>13. Elimination of vegetative cover along bridge tram</li><li>14. Reduction in habitat quality along fluvial valley</li><li>15. Elimination of species due to construction</li><li>16. Elimination of biota in the dredge zone</li><li>17. Modification and loss of wildlife habitat</li></ol> |
|---|

**Table 5.3: Description of Construction Impacts - Social**

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Alteration of vehicular traffic circulation</li><li>2. Navigational interference</li><li>3. Increase of risk of navigational accidents</li><li>4. Increase of risk of accidents during construction</li><li>5. Alteration in local economy and employment opportunities</li><li>6. Disturbances and inconveniences to local population</li><li>7. Alteration in River social-cultural structure</li><li>8. Alteration of the archeological patrimony</li></ol> |
|---|



**Table 5.4 : Description of Operation Impacts - Environmental**

1. Generation of stagnant waters and sediment and deposition of floating elements.
2. Erosion of bridge structures along the river plain
3. Modification of the sedimentological and morphological hydraulic regime.
4. Reduction of the air quality due to vehicular gaseous and fugitive dust emissions
5. Increase in the noise level along the river plain
6. Alteration of the drainage patterns and current velocities
7. Generation of eutrophic water quality conditions in stagnant waters and in areas along the embankment of the bridge
8. Alteration in the quality of the river habitats
9. Alteration in the distribution of the habitats
10. Loss of habitats due to submersion associated with increased water levels
11. Creation of barrier effect on fauna
12. Increase in wildlife hunting
13. Increase in fishing in the island zones

**Table 5.5: Description of Operational Phase Impacts – Social**

1. Cost savings for bridge users
2. Alteration in the economy and employment opportunities
3. Transit by passengers, tourists, and recreational users
4. Interference with navigation
5. Increase in navigational accident risks
6. Increase in navigation
7. Changes in land use in Victoria and the Greater Victoria Metropolitan Areas
8. Perception of decline in security in Victoria
9. Increase in accidental risk and changes in community health
10. Alteration of the archeological and architectural patrimony

**Table 6.1: Proposed Environmental Mitigation and Monitoring Measures - Construction**

<b>Construction Impacts</b>	<b>Mitigation</b>	<b>Responsible Entity</b>
1. Diverse impacts due to construction practices	Personnel Training	Concessionaire
2. Diverse impacts	Environmental Education Program	Government
3. Air quality changes due to vehicular gaseous emissions and fugitive dust	Implementation of Adequate Construction Practices, including Equipment Maintenance	Concessionaire
4. Noise increases at each end of the bridge embankment	Scheduling of Tasks – Equipment Maintenance	Concessionaire
5. River bottom alteration due to borrowed dredge material	Dredge Material Management Plan	Concessionaire
6. Erosion around embankments	Protection of bridge-footings (estribos) using cement blocks in geotextiles mats	Concessionaire
	Monitoring of river embankments	Government
7. Generation of stagnant water and reduced circulation and deposition of floating matter and increased deposition	Eventual establishment of diversion canals or inter-connection of low lands	Concessionaire
	Placement of navigation traffic signs at low depth zones	Government
8. Modification of hydraulic regime along the main transportation channel	Coordination with “Hidrovia Project” and joint collection of data regarding the river-basin modifications	Government
9. Modification of hydraulic regime along maintenance channel	Monitoring of the river hydraulic regime. Eventual installment of controls at the end of the construction phase	Concessionaire
10. Increase in river levels upstream of bridge embankment complex	None	N/A
11. Potential water quality reduction due to discharge of contaminated effluents and discharge and disposal of construction material	Implementation of preventive measures and contingency plans	Concessionaire
12. Reduced water quality due to dredging actions	Water quality and sediment monitoring. Dredge Material Management Plan	Concessionaire
13. Elimination of vegetative cover along bridge tram	Adequate management of extracted vegetation. Limit the areas affected to the a minimum	Concessionaire
14. Reduction in habitat quality along fluvial valley	Environmental Education, Access Management & Signalization Program	Concessionaire
15. Elimination of species due to construction	Environmental Education, Access Management & Signalization Program	Concessionaire
16. Elimination of biota in the dredge zone	Environmental Education, Access Management & Signalization Program	Concessionaire
17. Modification of habitat	Inventory and Monitoring	Concessionaire
Loss of wildlife habitat	Limit to a minimum. Re-vegetate the embankments with selected species and in accordance with their studied distribution	Concessionaire

**Table 6.2 : Proposed Social Mitigation Measures - Construction**

<b>Construction Impacts</b>	<b>Mitigation</b>	<b>Responsible Entity</b>
1. Alteration of Vehicular Traffic Circulation	Public Notice and Traffic Signals and Signs  Rerouting of vehicular traffic	Concessionaire and Municipalities  Municipalities
2. Navigational Interference	Coordination with the Naval Coast Guard Travel Advisories to Navigators	Concessionaire Naval Coast Guard
3. Increase in Risk of Navigational Accidents	Contingency Plans Traffic Signals and Signs	Concessionaire Naval Coast Guard
4. Increase in risk of accidents during construction	Work Health and Safety Plans	Concessionaire
5. Alteration in Local Economy and Employment Opportunities	None	N/A
6. Disturbances and Inconveniences to Local Populations	Community Information Program	Transitory Commission in coordination with the Concessionaire
7. Alternation in River Social-cultural Structure	Economic Strengthening Program and Access to Infrastructure	Government
8. Alteration of the Archeological Patrimony	Activities to Identify and Salvage, prior to the construction phase	Government in coordination with Museums and Universities

**Table 6.3 : Proposed Environmental Mitigation and Monitoring - Operation**

<b>Operation Impacts</b>	<b>Mitigation Measures</b>	<b>Responsible Entity</b>
1. Generation of stagnant waters and sediment and deposition of floating elements.	Monitoring and eventual minor correction of channel depths (especially non-navigational). Maintenance of traffic signs at low depth zones	Concessionaire
2. Erosion of structures along the river plain	Evaluation by the Government of the protective structures and eventual repairs	Government
3. Modification of the sedimentological and morphological hydraulic regime.	Acquire information from the “Hidrovía Project” and generate database	Government
4. Reduction of the air quality due to vehicular gaseous and fugitive dust emissions	Enforcement to ensure vehicle in accordance with legislation  Monitoring at Rosario	Government  Municipality
5. Increase in the noise level along the river plain	None	N/A
6. Alteration of the drainage patterns and current velocities	Monitoring	Government/ Concessionaire
7. Generation of eutrophic water quality conditions in stagnant waters and in areas along the embankment of the bridge	Monitoring/Inspections  (Eventual channelizations)	Government/ Concessionaire  Government
8. Alteration in the quality of the river habitats	Monitoring of Flora and Fauna  Environmental Education, Access Management & Signalization Program	Government  Concessionaire
9. Alteration in the distribution of the habitats	Monitoring of Flora and Fauna/Inventory	Government/ Concessionaire
10. Loss of habitats due to submersion associated with increased water levels	Environmental Education, Access Management & Signalization Program	Concessionaire
11. Creation of barrier effect on fauna	Monitoring of Flora and Fauna/Inventory.  Environmental Education Access Management & SignalizationProgram	Government/ Concessionaire  Concessionaire
12. Increase in wildlife hunting	Enforcement of Hunting Laws Establishment of restrictions Controls on access to islands	Government
13. Increase in fishing in the island zones	Enforcement of Fishing Laws Establishment of restrictions Controls on access to islands	Government

**Table 6.4 : Proposed Social Mitigation and Monitoring Measures - Operation**

<b>Operation Impacts</b>	<b>Mitigation Measures</b>	<b>Responsible Entity</b>
1. Cost Savings for Bridge Users	None	N/A
2. Alteration in the Economy and Employment Opportunities	Improvement in the Inter-connecting Transportation Corridors	Government
3. Transit by Passengers, Tourists, and Recreational Users	Improvement in the Transportation Corridors	Government Government PNA
4. Interference in Navigation	Signal System	See Maintenance Contract
5. Increase in Navigational Accident Risks	Safety Contingency Plans	Government
6. Increase in Navigation	None	N/A
7. Changes in Land Use in Victoria and the Greater Victoria Metropolitan Area	Environmental Territorial Plan	Municipalities Provincial Governments Government (national)
8. Perception of Decline in Security in Victoria	Strengthening Security and Education Measures	Government
9. Increase in Accidental Risk and Changes in Community Health	Safety Contingency Plans Health and Sanitary Control Plan	Government
10. Alteration of the Archeological and Architectural Patrimony	Archeological and Architectural Preservation Program	Government

**Table 6.5: Cost of Mitigation Programs – Responsibility of Concessionaire (US\$)**

Item	Year of Execution							Total Item Cost
	1998	1999	2000	2001	2002	2003	Operation	
Hazardous Waste Disposal	4080	12240	12240	10200	2040			40800
Reforestation of Embankments		745000	894000	596000	447000	298000		2980000
Signalization-Borrow pits		1728	1728	1728			3456	8640
Sand sedimentation plant	12944							12944
Field Offices Effluents treat.	2800							2800
Fuel Storage	4000	6000	7000					17000
Roadway Signalization		833	833	833				2500
Waterways Signalization	39475	59875	59875	59875	7500	7500	36250	270350
Air Traffic Signalization		833	833	833				2500
Training	1600	2400	2400	2400	2400			11200
Communications	3000	2000	1000	1000	1000		10000	18000
Erosion Protection of Bridge-footings (total of 24)				4000000	4000000			8000000
Environmental Education, Access Management, & Signalization	40000	40000	40000	40000	40000	40000	40000	280000
<b>Sub-Total</b>	107,899	870,910	1,019,910	4,712,870	4,499,940	345,500	89,706	280,000
<b>Total Construction Phase</b>				<b>11,557,029</b>				
<b>Total Operation Phase</b>				<b>89,706</b>				
<b>Total</b>				<b>11,646,735</b>				

**Table 6.6 Cost of Monitoring Programs – Responsibility of Concessionaire (US\$)**

Item	Year of Execution							Total Item Cost
	1998	1999	2000	2001	2002	2003	Operation	
Water Sampling	12350				12350	12350	12350	49400
Soil Sampling	5050				5050	5050	5050	20200
Air Monitoring	9600				9600	9600	9600	38400
Flora & Fauna Monitoring	22500				22500	22500	22500	90000
Sociocultural Inventories	21600				21600	21600	21600	86400
Hydraulic/ Sediment Sampling	23500				23500	23500	23500	94000
Public Consultation	3450							3450
Internal Audits	2000	6000	6000	6000	6000	1500	30000	57500
External Audits	10000	10000	10000	10000	10000	5000	100000	155000
System Control Cost	23400	31200	31200	31200	31200	4500	65000	217700
<b>Sub-Total</b>	133450	47200	47200	47200	141800	105600	289600	
<b>Total Construction Phase</b>				<b>522,450</b>				
<b>Total Operation Phase</b>				<b>289,600</b>				
<b>Total</b>				<b>812,050</b>				

**Table 6.7: Cost of Mitigation and Monitoring – Responsibility of Government  
(US\$)**

<b>CONSTRUCTION</b>	<b>INITIAL COST</b>	<b>ANNUAL COST</b>
1. TRAFFIC CONTROL & REROUTING	110,000	
2. PUBLIC CONSULTATION/DISCLOSURE	40,000	
3. ECONOMIC STRENGTHENING PROGRAM	70,000	
4. CONTINGENCY AND SIGNALING	20,000	
5. ARCHEOLOGICAL RESCUE/PRESERVATION	40,000	
6. ENVIRONMENTAL EDUCATIONAL PROGRAM (8,000) & COMMUNITY INFORMATION (4,000)	12,000	
<b>TOTAL</b>	<b>292,000</b>	
<b>OPERATION</b>		
1. HUNTING CONTROL	150,000	30,000
2. FISHING CONTROL	150,000	30,000
3. WATER AND CHANNELING MONITORING	80,000	
4. CONTAMINATION CONTROL (ROSARIO)	15,000	2,500
5. INSTITUTION AND STRENGTHENING		
a) Sanitary and Health Control	10,000	
b) Security and Education	10,000	
c) Land Use Planning	10,000	
d) Historical & Archeological Preservation	10,000	
e) Naval Security	10,000	
<b>TOTAL</b>	<b>445,000</b>	<b>62,500</b>
<b>GRAND TOTAL</b>	<b>737,000</b>	<b>62,500</b>



## **ANNEX - FIGURES**