

**BANK MANAGEMENT RESPONSE TO  
REQUEST FOR INSPECTION PANEL REVIEW OF THE  
COLOMBIA – CARTAGENA WATER SUPPLY, SEWERAGE AND  
ENVIRONMENTAL MANAGEMENT PROJECT (Loan No. 4507-CO)**

Management has reviewed the Request for Inspection of the Colombia – Cartagena Water Supply, Sewerage and Environmental Management Project (Loan No. 4507-CO), received by the Inspection Panel on April 20, 2004 and registered on April 22, 2004 (RQ04/02). Management has prepared the following response.



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## ABBREVIATIONS AND ACRONYMS

ACUACAR	Aguas de Cartagena, S.A. E.S.P.
AGBAR	Aguas de Barcelona
BOD	Biological Oxygen Demand
CARDIQUE	Corporación Autónoma Regional del Canal del Dique
CCH	Corporación Cartagena Honesta
EA	Environmental Assessment
EMP	Environmental Management Plan
FS	Feasibility Study
FMR	Financial Monitoring Report
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
INGEOMINAS	Instituto de Investigación e Información Geocientífica, Minero-Ambiental y Nuclear
IPN	Inspection Panel
LBS Protocol	Protocol Concerning Pollution from Land-Based Sources and Activities of the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region
NGO	Non-Governmental Organization
OD	Operational Directive
OP	Operational Policy
PAD	Project Appraisal Document
PAHO	Pan American Health Organization
PMR	Project Management Report
POE	Panel of Experts
QAT	Quality Assurance Team (World Bank Latin America and Caribbean Region)
SA	Social Assessment
SIAB	Sociedad de Ingenieros y Arquitectos de Bolivar
TICOL	Transparency International, Colombia
TOR	Terms of Reference
TSS	Total Suspended Solids
WHO	World Health Organization

### MEASUREMENTS

km	kilometer
m	meter
m <sup>3</sup> /s	cubic meters per second
mg/l	milligrams per liter

### CURRENCY EQUIVALENTS

(Exchange Rate Effective May 13, 2004)

Currency Unit = Colombian Peso

CP 2,735 = USD 1.00 / USD 0.00037 = CP 1.00

### FISCAL YEAR

January            December



## I. INTRODUCTION

1. On April 22, 2004, the Inspection Panel registered a Request for Inspection, IPN Request RQ04/02 (hereafter referred to as “the Request”), concerning the Colombia – Cartagena Water Supply, Sewerage and Environmental Management Project (“the project”), Loan No. 4507-CO, financed by the International Bank for Reconstruction and Development (“the Bank”).

2. After careful review of the Request and the Bank’s project files, Management takes the view that the Request does not show that there has been non-compliance with Operational Policies or Directives in the preparation or implementation of the project. The Response also demonstrates that the Bank has responded to correspondence from the Requesters in a timely manner throughout project preparation and implementation. In an effort to comply with Bank policies and procedures, as well as to ensure transparency, the Bank disclosed to the public important project documents. Furthermore, the Bank has participated in many public meetings to discuss important environmental and social concerns, while also carrying on, in partnership with the water utility, Aguas de Cartagena (ACUACAR, the project implementing agency), a series of consultations (during project preparation and implementation) with the affected communities.

3. Management maintains that this project is technically sound and carefully prepared and supervised by the Bank with support of top level experts from academia and the private and public sectors. The project has been designed in such a way as to provide an environmentally and socially sound solution to problems of water supply and wastewater management in Cartagena, in a fiscally responsible manner. Based on the design and results to date, Management is of the view that this project will successfully address serious health and environmental problems now plaguing Cartagena and the surrounding areas. The project will provide water and sewerage services, especially in the city’s poor and marginal areas, and improve the quality of the water bodies surrounding the city. These efforts will improve the lives of poor people in the most affected areas, while also improving the climate for investment in the growing tourism sector.

4. This response to the Inspection Panel Request has been prepared through an in-depth review of project documentation, discussions with Bank staff, informed parties in Colombia and legal opinions regarding Colombian law. The analysis has been divided into five sections as follows: Section I provides a brief introduction, Section II gives a brief summary of the Request, followed by Section III, project background information. Section IV is organized around the three harms claimed in the Request. A summary of project supervision and a set of conclusions close that section. In Section V, Management provides a brief concluding response to the Request. The main text is accompanied by fourteen Annexes. Annex 1 presents the Requesters’ claims, together with Management’s responses, in table format. Annexes 2 through 13 provide supporting materials to Management’s conclusions, as referenced throughout the document. The reader will find that the narrative – Sections I through V – presents an overview of the project and a discus-

sion of major issues raised in the Request. Annex 1 provides detailed responses to the specific claims made in the Request.

## II. THE REQUEST

5. The Request for Inspection was submitted by Corporación Cartagena Honesta (CCH, hereafter referred to as the “Requesters”) on its own behalf and on behalf of 125 residents of Punta Canoa, 139 residents of Arroyo de Piedra, 41 residents of Manzanillo, and 119 residents of Cartagena.

6. Attached to the Request are:

- (1) Power of Representation Forms
- (2) Sworn Affidavit of William Dau
- (3) Map of Affected Area
- (4) Map of Main Wastewater Conveyance and Outfall System
- (5) Letter from Jairo Morales Navarro, William Dau, et al. to Dr. Carlos Ossa Escobar, Controller General of Colombia (June 1, 2001)
- (6) Letters from Office of Internal Control to Mayor Gina Benedetti de Velez (November 17, 1999) and to Dau (March 17, 2000)
- (7) Report from the Sociedad de Ingenieros y Arquitectos de Bolivar (SIAB) to Mayor Carlos Diaz (January 16, 2002) and related SIAB materials
- (8) Letter with attachments from William Dau of CCH to Dr. Carlos Ossa Escobar, Controller General of Colombia (July 16, 2001)
- (9) “Advierten sobre volcanes de lodo,” *El Universal* (August 1, 2000)
- (10) Geologic Map of Colombia (detail) and key
- (11) Letter from Adolfo Alarcon Guzman, Director General of INGEOMINAS to Menahem Libhaber, World Bank Task Manager (September 4, 2000)
- (12) Memo from William Dau re: Interview with Punta Canoa Residents (March 20, 2004)
- (13) Fundación Social, “Punta Canoa,” in *Elementos de la Cultura Tradicional de las Comunidades de la Zona Norte de Cartagena* (Doris Zuluaga ed.) 63-74 (1998)

- (14) Elvis Martinez Bermudez, “Punta Canoa, en busca del turismo,” *El Universal* (April 5, 2004)
- (15) 1895 Map of the Department of Bolivar
- (16) The Global Internal Displacement Project of the Norwegian Refugee Council, “Indigenous People and Afro-Colombians are the Groups Most Affected by Displacement” (2003)
- (17) Photos of Punta Canoa Fisherman
- (18) Agreement between ACUACAR and Punta Canoa Representatives (November 6, 2002)
- (19) ACUACAR Report by Raul Quintero, “El Emisario Submarino de Cartagena”
- (20) Scheduled and documents from a Workshop on Community Consultation for the Cartagena Sanitation Project
- (21) Letter from Francisco Alberto Castillo Gonzalez to Menahem Libhaber (February 2, 2000)
- (22) Letter from the Executive Committee of the Red de Veeduría Ciudadana de Cartagena to the General Manager of ACUACAR (January 22, 2002)
- (23) Letters and Report from Controller Simon Herrera to Mayor Carlos Diaz (May 29, 2001) and Rafael Calixto Arenas Rosillo (June 1, 2001)
- (24) Letter from SIAB to Major Diaz (February 1, 2002)
- (25) Letter from William Dau to Hyun Um and Al Sharp (July 30, 1999)
- (26) Letter from William Dau to Hyun Um and Al Sharp (August 23, 1999)
- (27) Letter from Hyun Um and Al Sharp to William Dau (August 24, 1999)
- (28) Letter from William Dau to Hyun Um and Al Sharp (September 1, 1999)
- (29) Letter from William Dau to Hyun Um and Al Sharp (September 3, 1999)
- (30) Letter from Hyun Um and Al Sharp to William Dau (September 3, 1999)
- (31) Letter from William Dau to John McCormick (December 22, 1999)
- (32) Letter from John McCormick to William Dau (December 23, 1999)
- (33) Email from William Dau to Menahem Libhaber (May 25, 2000) and Email from Menahem Libhaber to William Dau (June 12, 2000)

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- (34) Letter from William Dau to James D. Wolfensohn (August 2, 2001) with attachments
  - (35) Letter from Olivier Lafourcade to William Dau (August 29, 2001)
  - (36) Letter from William Dau to Diomedes Berroa and Claudia Alderman (December 14, 2001)
  - (37) Letter from William Dau to Diomedes Berroa (December 27, 2001)
  - (38) Letter from William Dau to James D. Wolfensohn (January 17, 2002)
  - (39) Letter from William Dau to Diomedes Berroa (February 3, 2002), with attachments
  - (40) Letter from Maarten de Jong to William Dau (February 28, 2002)
  - (41) Letter from William Dau to Diomedes Berroa with letters from Punta Canoa residents (March 4, 2002)
  - (42) Letter from William Dau to Diomedes Berroa (April 19, 2002)
  - (43) Letter from Claudia Alderman to William Day (May 13, 2002)
  - (44) Letter from William Dau to Diomedes Berroa and Claudia Alderman (August 23, 2002)
  - (45) Miscellaneous Correspondence with Colombian officials regarding the Project.
7. No further materials were received by Management in support of the Request.
8. The Request contains claims that the Panel has indicated may constitute violations by the Bank of various provisions of its policies and procedures, including the following:
- OD 4.01, Environmental Assessment, October 1991
  - OP 4.04, Natural Habitats, September 1995
  - OP 4.07, Water Resources Management, July 1993
  - OD 4.15, Poverty Reduction, December 1991
  - OD 4.20, Indigenous Peoples, September 1991
  - OP 10.02, Financial Management, August 1997
  - OP 10.04, Economic Evaluation of Investment Operations, September 1994

- OD 13.05 and OP/BP 13.05, Project Supervision, January 1996 and July 2001, respectively.

### III. PROJECT BACKGROUND

9. **The Project.** The Cartagena Water Supply, Sewerage and Environmental Management Project (P044140) was prepared during the period 1995-1999, and approved by the Bank Board of Directors in July 1999 (Loan No. 4507-CO). The total project cost is USD 117.2 million, which is financed by USD 85 million in an IBRD loan, with contributions of USD 4.6 million from ACUACAR (the water company), USD 7.6 million from the District of Cartagena and USD 20 million from the Government of Colombia. Three legal agreements are pertinent to the project. The Loan Agreement with the District of Cartagena (the Borrower) specifies that the District will make the proceeds of the loan available to ACUACAR, the project implementing entity, with whom the Bank signed a Project Agreement. A Guarantee Agreement with the Republic of Colombia guarantees the payment obligations of the Borrower. All three agreements were signed in December 1999. The project became effective in January 2000.

10. **Project Context – Cartagena and ACUACAR.** Cartagena de Indias, the fifth largest city of Colombia, currently has a population of about 900,000 which has been growing in recent years at a rate of 2.5 percent per year. It is surrounded by the Caribbean Sea, Cartagena Bay and the Ciénaga de la Virgen lagoon, an in-city large coastal lagoon, as shown in Map 1, and traversed by interconnected water courses. Thanks to its historical landmarks, spectacular natural scenery, and tropical climate, Cartagena is Colombia's largest tourism area, with an annual influx of about 700,000 national and foreign visitors. In 1984 UNESCO declared the Old City, Fortresses and a Group of Monuments in Cartagena, as a Cultural Heritage Site of Humanity. The city's economy is heavily dependent on the tourism industry, which generates an estimated USD 300 million in annual revenue. Cartagena has a thriving industrial sector with important petrochemical, beverage and seafood processing industries, most of which are located in the Mamonal industrial estate; its port is a gateway for supplies, goods, lumber, and general merchandise imports, moving over 10 million tons of cargo per year.

11. Cartagena is also a destination for rural Colombians displaced by violence in the countryside and looking for better economic opportunities. As a result of high immigration of the poor, 84 percent of the resident population is of low and medium-low income, 31 percent of which is extremely poor; about 14 percent of the population is of medium and medium-high income and less than 2 percent is of high income. Cartagena has doubled its population in the past twenty years.

12. The city's water bodies are resources with the potential to contribute to the quality of life of its residents by providing venues for both leisure (swimming and water sports) and commercial activities (fishing and commerce). Unfortunately, the water bodies surrounding Cartagena are severely befouled by wastewater, because they are the repositories of the untreated municipal and industrial liquid wastes of the city, with a total flow of

about 145,000 m<sup>3</sup>/day. Overflows from the overloaded sewage collectors in the wealthier neighborhoods of the city contaminate the beaches and the in-city water courses, while industrial wastes from the Mamonal industrial estate area contribute additional contamination loads to Cartagena Bay (see Map 2). The population residing in the poor neighborhoods around the Cienaga suffers from the worst sanitation conditions. Although the wealthier parts of Cartagena, including the hotel areas, have high water and sewerage coverage, the poorer parts of the city do not. This situation has generated severe public health and environmental problems, which, in addition to their direct impact on the population, seriously restrict Cartagena's sustainable economic development, especially in the tourism sector, which is the city's main income source.

13. A major restructuring of the water and sanitation sector in Colombia took place in 1991. The right of municipalities to provide water and sanitation services was confirmed in the constitution. In 1994, a new law was enacted (Law 142), which established a legislative and regulatory framework that emphasizes efficiency of service provision through the introduction of competition in the sector. The District of Cartagena was the first municipality in Colombia to introduce private sector participation. As part of sector dialogue, the Bank encouraged reform and discussed options for the privatization process. In December 1994, Aguas de Barcelona (AGBAR, the privately owned water company of Barcelona) was selected as the municipality's partner, the mixed enterprise ACUACAR was created and the new company took over responsibility for provision of water and sewerage services in June 1995.

14. ACUACAR has made significant efforts to develop and implement the Master Plan of Water and Sanitation of the city. Major investments have been carried out, financed by the District of Cartagena and ACUACAR, with Government support. For that purpose, ACUACAR took on loans from local commercial banks, and also a loan from the Inter-American Development Bank (IDB), for an amount of USD 24 million, used exclusively for sewerage works in the Cartagena Bay drainage basin.

15. Since its creation, ACUACAR has been a well-managed water and sewerage service company, the operational performance of which compares well with international standards. The ACUACAR model brings together a private operator and a public authority in a service company under transparent corporate governance rules, with accountability to customers and shareholders. Cartagena's privatization of water and sanitation services is considered the most successful in Colombia and has served as a catalyst for similar privatization processes in other Colombian cities.

16. During its first seven years of operation, ACUACAR has achieved significant improvements in operational performance. Its efforts have resulted in: (i) accreditation under ISO 9002 for its quality of operations and laboratory (the first water utility in Latin America to obtain such accreditation), ISO 9001 for quality management, and ISO 14001 for environmental management; (ii) high customer satisfaction ratings achieved in customer surveys; and (iii) services improvements such as water and sewerage coverage increased by 27 and 19 percent respectively, and continuity of service from 7 to 24 hours a day.

17. The achievements of ACUACAR are further demonstrated by the improvement of its performance indicators (Table 1).

**Table 1. Performance Indicators of the Water Utility of Cartagena Before and After Takeover by the Private Sector**

Indicators	Before PSP (1994)	After PSP (2002)	Common Values in Industrialized Countries
Number of employees	1,300	272	N/A
No of employees per 1,000 connections	15	2.4	2
Water coverage	68%	95%	100%
Sewerage coverage	56%	75%	100%
Domestic metering	30%	99%	100%
Number of connections	84,143	117,194	N/A
Unaccounted for water	60%	41%	25%
Production capacity (m <sup>3</sup> /s)	1.6	3.1	N/A
Continuity of service (hrs/day)	7	24	24
Response to complaints (days)	6	0.6	0.5

18. **Project Need.** The principal challenges for the project are to support improvements that will remedy:

- *Insufficient water supply coverage*, especially in poor neighborhoods;
- *Insufficient sewerage services*, exposing the city’s poor population to about 60 percent of the city’s untreated sewage, because either there is no sewerage coverage and raw sewage flows in open channels in the streets, or open canals carry raw sewage through poor neighborhoods on their way to the Cienaga discharge (see Figure 1); and
- *Inadequate wastewater management*, with liquid wastes from municipal and industrial areas discharged without treatment to Cartagena Bay (30 percent of the discharge), the Cienaga (60 percent), and in-city water courses (10 percent), which eventually reach the bay and the Cienaga, and consequent environmental and health problems and adverse effects on economic development.



**Figure 1. Cartagena wastewater in open channels**

19. **Project Objectives.** The development objectives of the project are to: (i) improve the water and sewerage services of Cartagena and the sanitary conditions of the city's poorest population, by expanding water and sewerage coverage, particularly in the city's poor neighborhoods; (ii) facilitate the environmental clean-up of water bodies surrounding the city (Cartagena Bay, Caribbean beaches and Ciénaga de la Virgen lagoon) by providing adequate collection, treatment and disposal of the entire flow of the city's wastewater; and (iii) improve the sustainability of water and sewerage services in Cartagena by leveraging Bank support to support the private sector participation (PSP) model pioneered by ACUACAR, the city's mixed-capital water and sanitation utility, against the prospect of political interference.

20. **Project Components.** The project supports implementation of the Master Plan of Water and Sanitation developed by ACUACAR over the past few years. The Master Plan includes a comprehensive time-bound investment plan to be carried out in the short, medium and long term. The project has eight components, as described below:

- **Component A. Expansion of the Water Supply System – USD 9.9 million.** Completion of the second stage of the Master Plan of Water and Sanitation, i.e., provide the installations required to satisfy needs up to the year 2006. This component includes: (i) expansion and improvement of the water production system; (ii) increasing water coverage in the city; (iii) replacement of primary distribution mains; (iv) mitigation of environmental impact of water treatment sludge; (v) remote control systems; and (vi) implementation of an Unaccounted For Water (UFW) reduction plan.
- **Component B. Expansion of the Sewerage System in the Ciénaga Basin – USD 35.7 million.** Improved sanitation conditions in the areas of the Ciénaga drainage basin that do not have sewerage systems at present or where service is deficient. This component includes: (i) enhancement of conveyance capacity of existing sewage collectors in the southwest, southeast, and central parts of the city that currently drain to the Ciénaga; (ii) expansion of the secondary sewerage network in the southwest, southeast, and central parts of the city, as well as the Boquilla area, that currently drain to the Ciénaga; (iii) construction of new pressure lines and pumping stations; and (iv) construction of new gravity collectors in residential areas.
- **Component C. Construction of the Main Conveyance System of the Wastewater to the Treatment Plant – USD 28.1 million.** Clean-up of the water bodies surrounding Cartagena (the Bay, the Ciénaga, the beaches and the water courses crossing the city), which currently receive raw wastewater. This component includes: (i) upgrading of the Paraiso pumping station; (ii) construction of the pipeline from



Figure 2. Effluent Pipeline and Outfall

Paraiso pumping station to the treatment plant site; and (iii) construction of the effluent pipeline from the treatment plant to the submarine outfall at the Caribbean shoreline. The conveyance system would consist of a 72 inch pressure pipe with a total length of 23.85 km. See Figure 2.

- *Component D. Construction of Treatment Installations – USD 6.8 million.* Preliminary treatment to remove floatable materials, grease, oil, sand and grit. Installation features include six rotary screens (0.6 mm clearance) followed by two vortex-type grit chambers. Rotary screens remove rags, floatable material, and large solids.
- *Component E. Construction of the Submarine Outfall – USD 22.7 million.* Construction of a submarine outfall for the safe discharge of the treated effluent to the Caribbean Sea near Punta Canoa. The main conveyance system will connect the treatment plant with the submarine outfall. The outfall will be constructed using a 72 inch pipe and have a total outfall length of 2,850 m, with a discharge point (diffuser) submerged at a depth of 20 m.
- *Component F. Industrial Wastewater Discharge Control – USD 0.6 million.* Activities include: (i) a survey to identify key sources of industrial pollution; (ii) establishing a system for regulating the discharge of industrial wastes to the sewerage system or to receiving bodies; (iii) establishing a system for auditing the status of industrial waste discharges; (iv) defining strategies to control small and dispersed sources of industrial pollution discharging to the sewerage networks (gasoline stations and mechanical repair shops); and (v) providing technical assistance in selection and design of pretreatment processes.
- *Component G. Environmental and Social Component – USD 3.3 million.* Implementation of measures to mitigate environmental and social impacts of the project. The Environmental Management Program includes: (i) environmental supervision during construction; (ii) restoration and conservation of the Cienaga de la Virgen nature reserve; (iii) carrying out a monitoring program before and after construction of the marine outfall to study the fate of pathogenic coliforms and other contaminants discharged through the outfall; and (iv) an environmental institutional strengthening program. The Social Impact Mitigation and Community Development Program includes: (i) organization and strengthening of the community; (ii) construction, rehabilitation and equipping of community centers; (iii) support for in-house basic sanitation in La Boquilla; and (iv) strengthening of the Community Relations Unit of ACUACAR. The District will supply piped water to the communities of the North Zone as a condition of the Loan.
- *Component H. Project Management, Technical Assistance, Studies, Design and Supervision of Works – USD 9.1 million.* Support and partial financing for: (i) project management; (ii) design and supervision of the water supply systems works; (iii) design and supervision of the sewerage systems works; (iv) design of the main wastewater conveyance system, treatment installations and submarine outfall; (v) supervision of the main conveyance system works; (vi) supervision of

the treatment installation and submarine outfall works; and (vi) procurement audits.

21. The following table provides a timeline of key project activities to date:

<b>Date</b>	<b>Activity</b>
December 15, 1995	<ul style="list-style-type: none"> <li>Project Concept Meeting</li> </ul>
Summer 1997	<ul style="list-style-type: none"> <li>Feasibility Study (FS) Terms of Reference (TOR) prepared and reviewed by the Bank</li> </ul>
Nov. 3-5, 1997	<ul style="list-style-type: none"> <li>First preparation mission - established schedule for Environmental Assessment (EA) and review TORs</li> </ul>
January 23, 1998	<ul style="list-style-type: none"> <li>Social Assessment (SA) mission with visit to potential submarine outfall sites</li> </ul>
February 22-28, 1998	<ul style="list-style-type: none"> <li>Mission reviewed FS and met with the environmental authority, Corporación Autónoma Regional del Canal del Dique (CARDIQUE) to review licensing procedures</li> <li>Held 3 day meeting of Panel of Experts (POE) to review progress on FS</li> <li>Held 2 day stakeholders meeting to review project's environmental and social impacts</li> </ul>
April 17, 1998	<ul style="list-style-type: none"> <li>Environmental license request submitted by ACUACAR to CARDIQUE for the outfall</li> </ul>
July 6, 1998	<ul style="list-style-type: none"> <li>CARDIQUE held public meeting to outline TORs for the EA</li> </ul>
August 1998	<ul style="list-style-type: none"> <li>FS completed</li> <li>POE met regarding the FS</li> </ul>
August 1998 – Mar. 1999	<ul style="list-style-type: none"> <li>EA carried out by Neotropicos – TORs agreed to by Bank and ACUACAR</li> </ul>
November 22-27, 1998	<ul style="list-style-type: none"> <li>WB mission discussed findings of SA and consultation process with EA team</li> </ul>
February 9-16, 1999	<ul style="list-style-type: none"> <li>Held two day workshop with communities, non-governmental organizations (NGOs) and others to discuss draft EA and SA</li> <li>Held 1 day workshop with 150 community leaders to present detailed info. on project</li> </ul>
March 1999	<ul style="list-style-type: none"> <li>Fifth and final Environmental Data Sheet completed</li> </ul>
March 26, 1999	<ul style="list-style-type: none"> <li>EA Summary in English sent to the Board</li> </ul>
March 30, 1999	<ul style="list-style-type: none"> <li>ACUCAR delivers the EA to CARDIQUE – and posts it on website.</li> </ul>
March 31, 1999	<ul style="list-style-type: none"> <li>EA was reviewed by the Bank and disclosed in country and INFOSHOP</li> </ul>
April 14, 1999	<ul style="list-style-type: none"> <li>Quality Assurance Team (QAT) approval to move to Appraisal</li> </ul>
April 12, 1999	<ul style="list-style-type: none"> <li>Final Environmental Data Sheet submitted</li> </ul>
April 20, 1999	<ul style="list-style-type: none"> <li>Project Appraisal Document (PAD) Review Meeting</li> </ul>
May 14, 1999	<ul style="list-style-type: none"> <li>QAT review memo for EA, FS, SA, PAD and Environmental Diagnostic - grant approval of Loan Agreement and clearance for negotiations</li> </ul>
May 17-21, 1999	<ul style="list-style-type: none"> <li>Appraisal mission</li> </ul>
Before negotiations	<ul style="list-style-type: none"> <li>Environmental Manual for Contractors prepared and to be included in bidding documents and contracts</li> </ul>
June 4, 1999	<ul style="list-style-type: none"> <li>Negotiations</li> </ul>
July 20, 1999	<ul style="list-style-type: none"> <li>Board approval</li> </ul>
January 19, 2000	<ul style="list-style-type: none"> <li>Effectiveness</li> </ul>
January 31-February 5, 2000	<ul style="list-style-type: none"> <li>Project launch workshop (first WB supervision mission)</li> </ul>
March 1-5, 2000	<ul style="list-style-type: none"> <li>WB supervision mission met with representatives of Punta Canoa in the village</li> <li>POE convened to discuss design concepts for marine outfall</li> </ul>

Date	Activity
March 25-27, 2000	<ul style="list-style-type: none"> <li>• WB supervision mission to discuss technical issues with ACUACAR, Mayor</li> </ul>
June 9, 2000	<ul style="list-style-type: none"> <li>• Mayor of Cartagena and communities visited outfall of neighboring city of Santa Marta</li> </ul>
June 20, 2000	<ul style="list-style-type: none"> <li>• Hearing on the environmental license with community leaders (led by CARDIQUE)</li> </ul>
August 21-23, 2000	<ul style="list-style-type: none"> <li>• POE convened to discuss the detailed design for marine outfall</li> </ul>
September 2000	<ul style="list-style-type: none"> <li>• Feasibility / EAs were also reviewed and cleared by the CIOH (Oceanographic Institute)</li> </ul>
October 2000	<ul style="list-style-type: none"> <li>• WB supervision mission to discuss technical issues with ACUACAR</li> </ul>
June 5, 2001	<ul style="list-style-type: none"> <li>• Environmental license issued by the regional Environmental Authority</li> </ul>
June 2001	<ul style="list-style-type: none"> <li>• WB supervision mission of Auditor to analyze CARDIQUE, District of Cartagena</li> </ul>
June 27, 2001	<ul style="list-style-type: none"> <li>• WB supervision mission with Country Director, Res. Rep., ACUACAR, CARDIQUE and others to discuss implementation progress</li> </ul>
July 12-20, 2001	<ul style="list-style-type: none"> <li>• WB supervision Mission to begin pre-qualification for submarine outfall and on-shore force main</li> </ul>
Sept. 3-9, 2001	<ul style="list-style-type: none"> <li>• Study tour to visit outfalls in Chile and Uruguay - attended by members of Mayor's office, ACUACAR, CARDIQUE, Engineering Society, Hoteliers and communities</li> </ul>
November 14-16, 2001	<ul style="list-style-type: none"> <li>• POE met and reviewed design and bidding documents</li> </ul>
November 19, 2001	<ul style="list-style-type: none"> <li>• Bank Country Manager met with CCH Executive Director to discuss the project in response to his request</li> </ul>
December 28, 2001	<ul style="list-style-type: none"> <li>• WB supervision mission to discuss with Ministers of Environment and Economic Development the appeal to the license</li> </ul>
January 30, 2002	<ul style="list-style-type: none"> <li>• WB supervision mission to discuss social issues</li> </ul>
March 2002	<ul style="list-style-type: none"> <li>• WB supervision mission to discuss technical issues with ACUACAR</li> </ul>
April 12, 2002	<ul style="list-style-type: none"> <li>• Appeal on the environmental license rejected by the Minister of Environment</li> </ul>
May 2002	<ul style="list-style-type: none"> <li>• Official effectiveness date of environmental license</li> </ul>
August 14-18, 2002	<ul style="list-style-type: none"> <li>• WB supervision mission of Social Expert supervised progress and met with the communities</li> </ul>
November 4-8, 2002	<ul style="list-style-type: none"> <li>• WB supervision mission reviewed progress on Environmental Management Plans (EMPs) and prepared actions required by outfall license</li> </ul>
March 26-28, 2003	<ul style="list-style-type: none"> <li>• POE met on final design and specs. for the submarine outfall.</li> </ul>
August 19-22, 2003	<ul style="list-style-type: none"> <li>• WB supervision mission to discuss technical issues with ACUACAR</li> </ul>

22. **Two Phases of Sewage Treatment Investments.** The project's Feasibility Study (FS) proposed that the Wastewater Management Plan for Cartagena be implemented in two phases: Phase I (2005-2015) and Phase II (2015-2025). The first phase, which is funded under the project, would include the pumping station, land conveyance system, preliminary treatment and submarine outfall. The concept proposed by the FS for the second phase was to construct toward the year 2015 an aerated flow-equalization basin at the Paraiso pumping station site. However, after CARDIQUE issued the environmental license, Phase II was altered to upgrading of the treatment plant from preliminary treatment to primary or the equivalent. In the period leading up to Phase II, an intensive monitoring program of sea water and sea bed at the outfall vicinity will be carried out. If monitoring indicates that fecal coliforms discharged through the outfall are reaching bathing beaches (which is highly unlikely), or should it point to any other water quality problems resulting from the effluent discharge (some form of unforeseen emergency), the

design of the Phase I treatment plant includes as a precautionary measure chlorination installations that would eliminate or greatly reduce pathogenic organisms in the effluent discharged into the sea. Another possible measure would be to add coagulants to the raw wastewater prior to entry to the treatment plant to remove solids and organic material.

23. At the completion of the Bank-financed project, the sewerage coverage in Cartagena is expected to rise to 95 percent, and an adequate system of collection treatment and disposal of the city's wastewater will have been constructed, making Cartagena a model in the developing world with a full cycle of water services, from intake of raw surface water to safe disposal of wastewater, and a sustainable institutional model based on a unique public-private partnership.

24. **Level of Sewage Treatment.** The project and the EA teams spent considerable resources and effort to determine the optimal location of the outfall and the wastewater treatment level. Sewage treatment levels generally fall within three categories: preliminary, primary and secondary. Preliminary treatment consists of removing coarse solids, floating materials and oil and grease by screening the wastewater and passing it through a grit removal chamber. Primary treatment refers to removal of settleable solids from the wastewater through the use of sedimentation tanks. Secondary treatment refers to the employment of biological processes for removal of dissolved organic matter and fine solids from the wastewater. In this case, the decision was made to utilize, during a first phase, preliminary treatment of the wastewater prior to its discharge to the outfall, coupled with an extensive monitoring program. Preliminary treatment was considered appropriate because a combination of this type of treatment and an effective outfall poses low risk to human health and can well comply with Colombian and international standards (see para. 30). The cost of this system is affordable and its financing has been secured under the project. Primary treatment would have added about USD 40 million to the cost of the project and secondary treatment USD 100 million. The selection was based not only on cost issue but also considered that due to the expected effective performance of the proposed outfall, any additional treatment beyond preliminary would not provide meaningful benefits. The decision regarding the proposed level of treatment and the selected wastewater management strategy coincides with the position of the World Health Organization (WHO), which in its recent guidelines<sup>1</sup> identifies an effective outfall preceded by preliminary treatment to have low risk of human health impacts, and does not consider that a higher than preliminary level of treatment reduces the human health risk. Notwithstanding the decision regarding the first phase level of treatment, there is a commitment, through the environmental license, that primary or equivalent treatment will be in place by 2015.

25. **Project Status.** The project has been effective for approximately four and a half years. As of May 12, 2004, 31.9 percent of the loan had been disbursed. Component A is fully committed, a major part of its works has been completed and the rest are under construction and will be completed before end of calendar year 2004. The water supply

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<sup>1</sup> WHO (2003) "Guidelines for Safe Recreational Water Environments. Volume 12, Coastal and Fresh Waters", World Health Organization, Geneva, Switzerland, 2003, p. 80 ([http://www.who.int/water\\_sanitation\\_health/bathing/srwe1/en/](http://www.who.int/water_sanitation_health/bathing/srwe1/en/))

works for the North Zone, originally the responsibility of the municipality of Cartagena under the terms of the environmental license for the outfall (see Component G above), will now be funded by the project due to savings achieved in the implementation of Component A. Component B is also fully committed and will be completed before end of 2004.

26. The implementation of components C, D, and E, which constitute the wastewater management system, including the submarine outfall, has suffered delays due to the lengthy authorization of an environmental license for these works. Currently, all works for these components are at the end of the bidding process. Bids are due before end of May 2004, and selection of winning bids (and subsequent no objections from the Bank) are expected to be finalized by August 2004. Components F, G and H are well advanced, and will continue for the entire implementation period, as planned. The Loan is scheduled to close on June 30, 2005, but it is expected that an extension will be required.

#### IV. SPECIAL ISSUES

27. **Background to the Requesters' Claims.** The Request for Inspection is the most recent in a series of communications from CCH on the project. CCH, acting on its own behalf and not as a representative of the three communities, has written to the Bank a total of fourteen times, dating back to July 30, 1999. All correspondence has been answered in a timely fashion (See Exhibits 25-44 of Request). Only one item from this correspondence was to the Task Manager, requesting a meeting. The Task Manager was on mission at the time, but did promptly respond to CCH. Further information on this issue is provided in Annex 1, Item 27.

28. **Technical, Social and Fiscal Issues Raised by the Requesters:** This section is divided into three sub-sections to best address the three major harms alleged by the Requesters. These include: (i) harm to the environment and human health; (ii) harm to North Zone communities and their way of life; and (iii) undue fiscal strain on the city and region. Management also provides at the end of the section some information regarding the extensive supervision activities undertaken during project implementation. Finally, the section closes with some conclusions supporting the Bank's position. Detailed responses to each issue raised by the Requester can be found in Annex 1.

#### MARINE ENVIRONMENT AND HUMAN HEALTH

29. **International Experience with Marine Outfalls.** Extensive experience in many countries has shown that domestic sewage can be safely discharged into coastal waters through long outfalls equipped with efficient diffusers. According to the Pan American Health Organization (PAHO, 2000), about 100 outfalls similar to that proposed for Cartagena were in operation in Latin America (<http://www.cepis.ops-oms.org/bvsaca/i/fulltext/alternai/alternai.pdf>). Among these are outfalls situated in prime beachfront areas in Brazil, Uruguay, Chile and Colombia, where they have functioned without problem. Many of the outfalls constructed in the region since that time also use

preliminary treatment, and outfalls of this type are common in coastal cities elsewhere around the world. At the present time, there are 29 outfalls in Chile, of which 25 discharge municipal effluents. All use preliminary treatment similar to that proposed in Cartagena.

30. **Colombian Law.** Colombian legislation recognizes the importance of submarine outfalls as a legitimate method for wastewater disposal and the capacity of such systems to function as a treatment installation. The Technical Norm of the Water and Sanitation Sector in Colombia – RAS (Resolution 1096 of November 17, 2000) in Article 180, which was amended in 2000, states that: “Pretreatment prior to discharge via submarine outfalls is required so that, in combination with the processes of initial dilution, dispersion, assimilation and decay [it] will guarantee compliance with the quality objectives of the receiving body, indicated by the environmental norm in effect and with other provisions which modify, expand or substitute it.”

31. This legislation recognizes: (i) the importance of submarine outfalls as a disposal method; and (ii) the fact that the outfall is part of the treatment system, so that the combination of pretreatment and the outfall must comply with the quality standards, not just the pretreatment alone. Articles 177-179 of the RAS specify the procedures for design and construction of outfalls, the studies required prior to design and the mathematical modeling required, all of which were undertaken as required.

32. **Recreational Water Protection and Management.** The WHO guidelines noted above support Management’s assertion that the submarine outfall poses little risk of harm to human health. Table 3 below presents the WHO findings on relative risks from exposure according to various schemes of sewage discharged from outfalls.

**Table 3. Relative Risk Potential to Human Health through Exposure to Sewage Through Outfalls (From WHO, 2003)<sup>2</sup>**

Treatment	Discharge type		
	Directly on beach	Short outfall	Effective outfall
None	Very high	High	NA
Preliminary	Very high	High	Low
Primary (including septic tanks)	Very high	High	Low
Secondary	High	High	Low
Secondary plus disinfection	—	—	—
Tertiary	Moderate	Moderate	Very low
Tertiary plus disinfection	—	—	—
Lagoons	High	High	Low

33. The WHO guidelines classify wastewater management schemes, which consist of preliminary treatment followed by discharge through an effective outfall, as low risk to

<sup>2</sup> The sewage discharges, or outfalls, are classified into three principal types: (i) discharge directly onto the beach; (ii) “short” outfalls, where sewage-polluted water is likely to contaminate recreational waters; and (iii) “effective” outfalls, designed so that the sewage is efficiently diluted and dispersed and to ensure that it does not pollute recreational water areas. While the terms “short” and “long” are often used, outfall length is generally less important than proper location and effective diffusion. An effective outfall is assumed to be properly designed, with sufficient length and diffuser discharge depth to ensure that the sewage does not reach the recreational area.

human health, while a wastewater management scheme consisting of oxidation lagoon treatment with discharge to the beach or from a short outfall, is rated as high risk. Treatment through oxidation lagoons and discharge through an effective outfall is rated as low risk, but would be considerably more expensive than preliminary treatment and discharge through an effective outfall, as proposed under the current project.

34. ***Marine Outfall Alternative.*** In determining how to proceed with identifying the appropriate wastewater disposal solution for Cartagena, a multi-phased approach was used, which included: the Feasibility Study for Wastewater Treatment and Disposal in Cartagena, containing the analysis of alternatives (Hazen & Sawyer, 1998); Environmental Diagnostics of Outfall Alternatives for the Disposal of Wastewater in Cartagena (Hazen & Sawyer, 1998); the Social Impact Assessment of the Cartagena Sanitation Project (Vasquez and Baquero, 1998); and the EA for the Wastewater Management Plan of Cartagena (Fundación Neotropicos, March 1999). The studies were supplemented by evaluations from an internationally recognized independent Panel of Experts (POE, see summary qualifications in Annex 2), which held six meetings to review the FS, EA and final design specifications for the marine outfall, as well as ongoing studies after project approval in July 1999.<sup>3</sup> It is Management's conclusion that this EA process was in compliance with OD 4.01 for Category A projects and takes into account the goal of avoiding damage to human health and the marine environment. More detail is provided in Annex 1, Item 1.

35. These extensive studies determined that from a technical, economic, environmental and social perspective, the optimum alternative for disposal of Cartagena's wastewater was preliminary treatment and a marine outfall to the Caribbean Sea (see Box 1 below). Oceanographic studies were used to determine the best discharge site. After consideration of the patterns of wind, current speed and direction, wastewater coliform loadings, and bacterial decay rates, Punta Canoa, located about 20 km north of Cartagena, was selected. Although located at the greatest distance from the city, this site was the least cost alternative because the sea bottom slope there is quite steep, so the length of an outfall that reaches comparably deep water at that site is only 2.85 km. Other sites nearer the city have very mild bottom slopes, requiring a very long outfall (of about 9 km) to reach deep enough water. Therefore, the combined cost of the onshore and offshore pipes was lowest for the Punta Canoa site.

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<sup>3</sup> The POE held extensive discussions during six meetings of 2-3 days each. In advance of each meeting, the POE members received reports and material from ACUACAR and Hazen & Sawyer which they reviewed. During the meetings they provided much input to the feasibility studies and detailed design, and after the meetings each of them submitted a report. All of the major decisions regarding the selection of the wastewater treatment and disposal alternative were approved by the POE, and the detailed design was also reviewed and approved by the POE.

### Box 1. How and Why Marine Outfalls Work

Marine outfalls rely primarily on currents and the size of receiving water bodies to dilute effluents. Wastewater consists of 99.9 percent water and 0.1 percent of solids, mostly dissolved and partly suspended. Effluent from a marine outfall immediately undergoes very effective mixing processes and after a short distance from the discharge point, loses its identity as effluent. Typical dilutions are more than 100:1, which is equivalent to a 99 percent reduction in contaminant levels, far higher in terms of organic matter than any conventional land-based treatment plant can accomplish.

Field studies of operating outfalls show few measurable effects of discharged sewage beyond a short distance from the discharge point. Results of five years of measurements undertaken at two outfalls in Chile (Leppe, 1999) show that even as close as 100 m from the discharge, water quality is virtually indistinguishable from natural sea water. Treatment prior to discharge is similar to that proposed for Cartagena, i.e., preliminary treatment. The combination of pretreatment and long outfall is an effective one.

The effective elimination of pollutants at such a short distance from the outfall discharge point is the result of a series of hydrodynamic dilution and biological decay processes that occur in the marine environment. These processes, often referred to as near field dilution, far field dilution, and bacterial decay, have been extensively studied (Roberts, WQI Casebook, May/June, 1998). For a well designed outfall, dilutions achieved within the near field, also sometimes known as initial dilution, are typically of the order of hundreds or even thousands to one. The combination of near and far field dilution is usually in the thousands. For example, the average concentration of Biological Oxygen Demand (BOD) and of Total Suspended Solids (TSS) in the raw wastewater of Cartagena, is about 250 mg/l for each. A dilution of 1,000:1 (a conservative estimate) reduces the concentration of BOD and TSS to about 0.25 mg/l. The oxygen content of the sea water, which is usually close to saturation (around 8 mg/l) would not be reduced below 6 mg/l, even in a limited zone, and this would have no negative impact on marine life. Organic matter, represented by BOD, will further dilute and decompose in the marine environment.

A conventional secondary treatment plant removes 80-90 percent of BOD. If Cartagena wastewater were subject to secondary treatment then effluent would contain approximately 25 mg/l BOD. After dilution (at the conservative estimate of 1,000), this concentration would be reduced to 0.025 mg/l, compared with 0.25 mg/l for preliminary treatment. The impact on the sea at either level remains negligible. Both are well below the standards for Class 1 waters as defined in the Land-Based Sources Protocol of the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region.

Contaminants in wastewater that may affect health are toxic chemicals and bacteria. Concentrations of heavy metals and other toxic material in the raw wastewater of Cartagena are lower than the levels prescribed by Colombian Law as permissible for discharge to any receiving water body, and the heavy metals concentration is also lower than the level permitted for potable water according to Decree 475 of 1998. These levels will further decrease following dilution.

Pathogenic bacterial contamination is the main public health risk resulting from effluent discharge to the sea. The common indicator for pathogenic bacterial contamination is fecal coliforms. The concentration of fecal coliforms in raw wastewater is about  $10^7$  MPN/100 ml. After a dilution of 3,000 (the combined effect of near and far field) the concentration of fecal coliforms is reduced to less than  $10^4$  MPN/100 ml, which is still high. Outfalls help to address this problem through the physical dilution processes and biological decay of bacteria, since the marine environment is hostile to them. Bacterial die off is further controlled by appropriate selection of outfall length, since a longer outfall means a longer travel time towards shore and thus a higher die off. A properly designed outfall ensures control of bacterial contamination by maintaining the concentration of fecal coliforms below permissible levels, while leaving only a small area around the discharge point with higher values. Secondary treatment does not have a meaningful impact on fecal coliforms, unless the secondary effluent is disinfected through chlorination.

36. **Conditions at the Selected Outfall Site.** Water at the Punta Canoa site is highly turbid due to current from the Rio Magdalena that flows into the sea at an average flow rate of over 7,000 m<sup>3</sup>/s and a maximum flow rate of over 10,000 m<sup>3</sup>/s, carrying large amounts of suspended solids and silt deposits, as well as wood, plastics and other waste materials (see Figure 3). The shore currents are such that the suspended solids, silt deposits and waste material flow from Baranquilla towards Cartagena and directly off the shores near Cartagena, including the beaches of Punta Canoa. As a result of the Rio Magdalena's impact, the sea in the vicinity of Punta Canoa contains high concentrations of suspended solids (between 10 and 30 mg/l). At the location of the effluent discharge point, the water is obscure; light does not penetrate even during daytime and visibility is limited to approximately 50 cm. Fish and other marine organisms are not abundant in this area. Discharge of 2 m<sup>3</sup>/s (when discharge begins) to 4 m<sup>3</sup>/s (after 20 years) of preliminary treated effluent with a concentration of suspended solids, after the near field dilution, much lower than that of the sea at the discharge site, will have no negative effect on that habitat.



Figure 3. Top – Satellite photo of sediment dispersion at mouth of Rio Magdalena; Bottom – Beach at Punta Canoa

37. Due to a delay in obtaining the environmental license for the outfall, extensive measurements of current direction and intensity, temperature and salinity, waves, and tidal heights in the coastal waters around the site continued for nearly four years and a separate dilution modeling study was undertaken by a member of the POE, the results of which are summarized in Annex 1, Item 3. Annex 3 contains this study (Roberts, 2003) along with recent additional information (Roberts, 2004). This modeling was in addition to that prepared as part of the FS; the resulting information constitutes an unusually large database for a submarine outfall.

38. **Environmental Licensing.** According to Colombian law, ACUACAR was required to obtain an environmental license to operate the outfall. CARDIQUE acknowledged the request for a license in May 1998. The license was issued in June 2001, and was appealed thereafter by representatives of SIAB, the village of Punta Canoa, and others. The appeal set forth a series of legal arguments that are identical to the series of claims made in the current Request to the Inspection Panel. The appeal was rejected by the Ministry of Environment in April 2002 and the license became effective in May 2002.

The primary obligation imposed by CARDIQUE in environmental license No. 345 of June 5, 2001 Article 2-a. indicates that the company ACUACAR should carry out the following tasks: “a. Before 2010, submit to the environmental authority—CARDIQUE—the alternatives and design of a treatment system that will meet the removal standards established in Decree 1594 of 1984, for existing users. The approved alternative should be built and start working in time for the second phase of the project (2015).” Accordingly, the District will be responsible for upgrading the plant to primary treatment. In its rejection of the appeal, the Ministry classified the area of the outfall discharge site as consisting of Class II waters, according to the definition in the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. Class II waters are defined as waters which, due to oceanographic, hydrological, climatic or other factors, are less sensitive to the impact of domestic wastewater discharged into them.

### **HARM TO NORTH ZONE COMMUNITIES AND THEIR WAY OF LIFE**

39. **Indigenous Peoples.** As discussed in Annex 1, Item 12, SA findings indicate that while the communities in the North Zone—La Boquilla, Manzanillo, Arroyo de Piedra and Punta Canoa—are indeed long-established communities with strong family ties and traditions, they do not meet the criteria for OD 4.20 with regard to ancestral territory, self-identification, indigenous language or presence of customary social and political institutions. This was confirmed by the appropriate specialists at the time of project appraisal and is still considered a valid finding now by the Bank and the Colombian authorities (see Annex 1, Item 12).

40. **Project Opposition.** Large wastewater management projects, not only those which involve submarine outfalls, and not only in developing countries, typically generate opposition and fears regarding possible pollution on the part of those living or working nearby, no matter which alternative is selected. The project in Cartagena is no different in this respect, so opposition to it was expected, as anticipated in the PAD, from communities in the North Zone located near the outfall. ACUACAR and the Bank understand and respect their concerns and have expended considerable efforts to allay them. Consultations with these affected groups were extensive, thorough and were reflected in the project’s design.

41. **Consultation.** Project preparation utilized a participatory approach consisting of consultation with communities in the project area to identify and address their concerns under three discrete processes. The first process took place during preparation of the separate social and environmental assessments. The SA—one of the first in the Bank—was carried out during project preparation. The SA: (i) assessed social and economic conditions of the target population, including the communities of the North Zone, and established a baseline for monitoring and evaluation purposes; (ii) consulted beneficiaries about their priority needs and views about the project; (iii) identified community-based organizations to support project execution; (iv) identified obstacles and social risks; and (v) prepared, as required, an impact mitigation program. This consultation process has continued (see Annex 1, Item 8), primarily through a phased Communication Strategy being implemented by ACUACAR between 2001 and 2005 that includes: (i) information

events with local newspapers and dissemination campaigns; (ii) a presentation series on ACUACAR's Master Plan of Water and Sanitation; and (iii) a radio campaign. Activities undertaken to date with community leaders in the North Zone have included: (i) support for creation of an association of La Boquilla organizations supporting the project; (ii) information meetings with young leaders in Punta Canoa; and (iii) specific campaigns addressing community fears about the outfall.

42. As part of the second process, and in order to provide the communities with greater assurance about the planned investments and a concrete basis on which to view the subject project, ACUACAR and the Bank project team organized a study tour in September 2001 to Chile and Uruguay to: (i) see functioning outfalls similar to the one proposed for Cartagena; (ii) allow stakeholders to obtain first hand relevant performance data; and (iii) discuss issues and understand the views of the local authorities, citizens and fishermen involved in these similar projects. Official representatives of Punta Canoa, Manzanillo, Arroyo de Piedra and La Boquilla, along with representatives of other areas of Cartagena, representatives of NGOs and other public officials (a total group of 23 stakeholders) took part in the study tour.

43. Lastly, further consultations were conducted in these communities as part of the Government's confirmation of the villages as Afro-Colombian (commissioned by the Ministry of the Interior through its Negritudes Commission, see Annex 1, Item 12 for more details).

44. ***Project Impacts.*** The social assessment revealed opposition to the project by some members of the communities in the North Zone. These communities—La Boquilla, Manzanillo, Arroyo de Piedra and Punta Canoa—have seen rapid change during the last twenty years following the construction of the Caribbean Road. The affected area also contains many properties owned by some of the wealthiest families in Colombia. The combination of quick urban growth, land speculation, and general mistrust on the part of rural communities has exacerbated the reaction of groups to the project. The main opposition to the outfall builds on two issues: (i) the possible impact on tourism and fishing; (ii) the potential impact on property taxes and public services tariffs due to increasing land values (linked to service improvements) and corresponding changes in the area's poverty classification (Colombia uses a six level stratification for poverty measurement; populations in the first three strata are considered poor). The surveys commissioned by the Negritudes Commission identified the additional issues of: (i) the need to strengthen community organizations; and (ii) the need to extend the consultation process through the implementation phase to continue providing information to address community concerns.

45. ***Project Design Response.*** Issues of impact on the local environment and fishing activities were fully assessed under the project. The EA, the POE review, and assessment by the Government of Colombia and the Bank all concluded that the risk of environmental damage from the outfall would be minimal. Moreover, there is no evidence that the outfall will interrupt the economic activity of fishermen from Punta Canoa, Arroyo de Piedra and Manzanillo. The area in the vicinity of the outfall has little marine life (see Annex 1, Item 10) and dilution modeling work (Annex 1, Item 3) has shown there will be no effects on nearshore areas and beaches. Thus, fishing activity, to the extent it might

occur in these areas, would not be adversely affected. The environmental monitoring program supported by the project, combined with the availability of technical mitigatory measures if needed (chlorination and/or future waste stream treatment beyond preliminary treatment), will continue to ensure that fishing and tourism in the North Zone will not be impacted by the proposed outfall.

46. The SA also identified potential social impacts that may result from increased land values and possible pressures on households that do not have title, which is less of an issue in the North Zone than in the southeast area of Cartagena. The Social Impact Mitigation and Community Development Program incorporates activities to strengthen community organizations and participation in a program of land regularization. A Community Leaders Network has been established for this purpose. The Project's Environmental and Social Component (see PAD, page 8) provides support for monitoring environmental impacts before and after construction of the outfall, strengthening community organizations, constructing community centers, supporting in-house sanitation and conducting communications campaigns.

47. ***Sharing in Project Benefits.*** The communities of the North Zone will benefit from the project in many ways:

- Piped water services will be provided to Punta Canoa, Arroyo de Piedra and Manzanillo, and two additional communities not involved in the present Request (Portezuela and Bayuca).<sup>4</sup> This is a condition of the Loan Agreement for the project prior to construction of the outfall, see Loan Agreement Section 3.04(b) and Schedule 1, para. A3(b);
- Should additional funds exist from project savings, sanitation services through a sewerage network will be provided to the same communities;<sup>5</sup>
- Project funds have provided La Boquilla, which already had piped water services, with sanitation services through a sewerage network;
- Punta Canoa, Manzanillo and La Boquilla will receive in-house sanitation facilities that will be installed in the poorest households;
- Two community centers, one in La Boquilla and another in Punta Canoa, will be built to complement the District's urban rehabilitation program aimed at stabilizing urban growth and consolidating these communities;

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<sup>4</sup> Works to provide these communities in the North Zone with water services are about to begin.

<sup>5</sup> While water services to the North Zone were a condition in the project Legal Agreements, sanitation services were not, due to lack of financing. However, to date bidding for project works and activities indicates the likelihood of considerable costs savings in Components C, D, and E. It is the intention of the project counterparts to use these additional project funds to extend sewerage services to the North Zone.

- A study on optimizing fishing activity in Punta Canoa is underway, including improvements in commercialization practices, and project funds will be available to implement the study recommendations;
- The project will finance an orchard for Punta Canoa, which will be used by the residents to support post-construction reforestation activities, as well as to provide an additional potential revenue source;
- During project construction, the North Zone residents will benefit from work opportunities in construction activities; and
- In general, the improvement in the environment as a result of better wastewater disposal will help bolster tourism in the region, creating jobs and economic opportunities for North Zone residents.

48. The Social Impact Mitigation and Community Development Program of the project also features some activities to be financed jointly with the District Government. The District of Cartagena will support this program by: (i) including in its Urban Development Plan a strategy to protect and consolidate the integrity of the communities around the Ciénaga de la Virgen and the North Zone by regularizing land ownership and providing property titles; and (ii) providing these two areas with priority attention through the Citizens Participation and People Development Program, which offers training and assistance to develop small productive activities. The Social Impact Mitigation and Community Development Program of the project was updated in 2002 to adjust to community conditions and incorporate some of the urban development initiatives of the new District Government at that time. The mayor of Cartagena fully endorsed this Program, which has helped to accelerate its execution.

49. Regarding piped water service to the North Zone, as set out in the Loan Agreement, the construction of the water supply system for Punta Canoa, Manzanillo and Arroyo de Piedra were to be completed no later than December 31, 2003. Due to fiscal restrictions, the Municipality could not provide the funds to construct the system by that date.<sup>6</sup> However, ACUACAR has since taken on the responsibility of constructing the water supply system, and the financing will be provided through savings under Components A and B of the project. The contract for construction has now been awarded, and it is expected to be completed within calendar year 2004.

#### **UNDUE FISCAL STRAIN ON THE CITY AND THE REGION**

50. A thorough analysis of the capacity of the District to repay the Loan was carried out during project preparation, as evidenced by the financial analysis, financial projec-

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<sup>6</sup> Though a condition in the loan, the water investments for the mentioned communities did not originally form part of the project funded activities. As further discussed in Annex 1, Item 15, counterpart funds for project execution and for loan repayment are earmarked from stable sources of funds for the Municipality and passed directly to trust funds. This arrangement helps assure availability of counterpart funds for project investment and loan repayment. As investments for the communities' water systems were part of the project, they were not protected by this financial structure.

tions and risk analysis (see PAD, Annex 5). As stated in that Annex: “The sensitivity and risk analysis showed that the proposed financial scheme is robust, with nearly 80 percent probability that there will be no financial shortfall, both in terms of counterpart provision and debt service. Although the project’s financial viability depends largely on the District’s capacity to improve tax collection rates, as well as local currency stability, the proposed financial scheme allows for sufficient cushion.” See also Annex 1 of this response, Items 15 and 16. The District of Cartagena provides its counterpart funds (and future repayments of the loan) from the following earmarked sources, which are being deposited into two trust funds created for the project: (i) 18 percent of property tax collected; (ii) 20 percent of National Government transfers (as determined by Law 60, modified to Law 715); and (iii) 10 percent of royalties. Sources (ii) and (iii), which account for a significant portion of the loan repayment, come directly from the Central Government to the trust funds, thereby significantly reducing risk of default on this amount. The 18 percent of property tax collected by the Municipality is deposited directly into the trust funds, and depends on the collection rate. Experience has shown that collection fluctuates within a narrow range. ACUACAR will also contribute USD 15.4 million for repayment of the loan.

## **SUPERVISION**

51. Management maintains that the supervision of the project has been thorough and in compliance with OD 13.05 and OP/BP 13.05. Subsequent to the project reaching effectiveness on January 19, 2000, the Bank conducted thirteen missions to Cartagena. In conjunction with supervision missions, the Bank reviewed quarterly Project Management Reports (PMRs) prepared by ACUACAR that summarized project progress and provided thorough financial and procurement information. The Bank participated in many of the consultation meetings, making several presentations on the technical aspects of the project. Despite delays due to the license procedure, the Bank has taken the necessary time to stay abreast of that procedure.

52. Bank supervision has focused on the environmental issues addressed in the Environmental Management Plan (EMP). The EMP provides for a series of activities to be conducted, both in the bidding, contracting and actual construction of infrastructure works; and also as stand alone activities. Key actions prescribed by the EMP include (among others): (i) use of construction manuals that address environmental issues for all Bank-funded works; (ii) the Social Impact Mitigation and Community Development Program; (iii) Phases I and II of the Communications Strategy; (iv) outreach activities to strengthen community organizations; and (v) institutional strengthening with regard to environmental management at ACUACAR and other institutions. The EMP has been updated to include specific actions required under the environmental license.

## **CONCLUSIONS**

53. It is Management’s conclusion that the project will have substantial public health benefits in providing water and sewerage services, especially in the city’s poor and marginal areas, and in improving the quality of the water bodies surrounding the city (Cartagena Bay, the Cienaga, the Caribbean beaches, and the in-city water canals). It will im-

prove overall standards of living in the city, especially in the poor neighborhoods around the Ciénaga. Finally, the project will enhance the socio-economic development of the region, which is dependent on tourism, by reducing environmental pollution and public health risks.

54. The environmental benefits can be appreciated by comparing the current situation, prior to improvements in wastewater management disposal, with the situation after construction of a wastewater conveyance system, treatment installation and submarine outfall. Map 3 shows the water bodies currently contaminated by raw sewage close to the shoreline and the urban areas contaminated by sewage flowing in open channels in the streets. Map 4 shows the situation after completion of construction of the wastewater management works according to the Colombian standards for water quality for primary and secondary contact (Decree 1594 of 1984).

55. Management acknowledges the concerns of the Requesters, and understands how a marine outfall can seem threatening, despite a significant body of experience with the operation of similar outfalls elsewhere. The exhaustive and thorough scientific analysis that has been undertaken, as summarized above and detailed in the annexes to this document, demonstrates that the selection of the outfall was the optimum choice for Cartagena based on technical, economic and environmental criteria. As these and subsequent studies showed, preliminary treatment with effluent disposal to a long, submarine ocean outfall off of Punta Canoa poses negligible risk to the health of the communities or to marine life at or near the outfall site. The treatment plant will be upgraded within ten years to provide for primary treatment, based on the environmental license. To insist upon a higher, more expensive, level of treatment or other disposal alternative at this time would have minor benefits compared to the current design, would not be affordable and would thus derail the project and deprive Cartagena, in particular its poor neighborhoods, of a cost effective solution to its current unacceptable sanitation conditions. It would also ignore the scientific analysis in favor of the outfall approach and the planned phasing. This sentiment has been expressed by the “Letter of the Leaders” (from the President of the “Foundation of United Leaders for the Development of the Southeastern Zone of Cartagena” and signed by 350 community leaders, see Annex 4) and is shared by the majority of the residents of Cartagena.

## **V. MANAGEMENT’S RESPONSE**

56. The Requesters’ claims, accompanied by Management’s detailed responses, are provided in Annex 1.

57. Management has reviewed the Requesters’ complaint in detail and consulted Bank staff, informed parties in Colombia, written project records, and legal opinions regarding Colombian law. It is Management’s conclusion that the Bank correctly applied its policies and procedures, and pursued thoroughly its mission statement in the context of the project. It is Management’s position that the project will not cause any harm to the marine environment or to human health as claimed in the Request. In Management’s

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view, the Bank has followed the guidelines, policies and procedures applicable to the matters raised by the Request. As a result, Management posits that the Requesters' rights or interests have not been, nor will they be, directly and adversely affected by a failure of the Bank to implement its policies and procedures.

**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**ANNEX 1**  
**CLAIMS AND RESPONSES**

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<b>Environment</b>				
1.	<p><b>Environmental Assessment.</b>  The EA ... failed to adequately consider potential damage to human health and the marine environment ... the Bank ignored the preference set out in OP 4.01 for preventive over mitigatory or compensatory measures.</p>	4.01	11	<p><b>Comments.</b> It is Management's position that the EA for the wastewater conveyer, treatment plant and submarine outfall, and the process leading to EA preparation are in compliance with OD 4.01 for Category A projects, and took into account the goal of avoiding damage to human health and the marine environment. The EA report and its summary (PAD, Annex 9) demonstrate that the EA addressed both human health and the marine environment, based on the comprehensive analysis of alternatives in the Feasibility Study (FS).</p> <p>The EA report (Environmental Impact Assessment of the Wastewater Management Plan of Cartagena, Fundación Neotropicos, March 1999) is part of a multi-faceted, participatory process that entailed multiple studies to address environmental and social impacts. In addition to the EA report, these studies included the Feasibility Study for Wastewater Treatment and Disposal in Cartagena, containing the analysis of alternatives (Hazen &amp; Sawyer, 1998), Environmental Diagnostics of Outfall Alternatives for the Disposal of Wastewater in Cartagena (Hazen &amp; Sawyer, 1998); the Social Impact Assessment of the Cartagena Sanitation Project (Vasquez and Baquero, 1998). simplified EMPs for minor non-outfall related works (ACUACAR, 1999, see TORs attached as Annex 5); and Environmental Manual for the Construction of Water and Sewerage Networks (ACUACAR, 1999). The studies were supplemented by evaluations from the POE, which held six meetings between February 1998 and March 2003, and on-going studies after project approval in July 1999.</p> <p>To prepare the EA report, ACUACAR (the project implementing agency) contracted Fundación Neotropicos (an independent group and a longstanding NGO in Colombia, specialized in wetland conservation) with Fundación Vida, reinforced by a group of national and international consultants. The Terms of Reference (TORs) for the EA were jointly prepared by ACUACAR and CARDIQUE (the regional environmental authority), with Bank support, and were discussed in a documented two-day seminar in Cartagena (February 1998) with the relevant stakeholders, including representatives of federal and local governmental agencies and NGOs, ACUACAR and other Colombian water and sewerage companies, CARDIQUE, community leaders, professional associations such as SIAB and others, and the general public (see Annex 1 of the EA, and Annex 6 of this report for the EA TORs). The TORs were modified based on this input, and issued as a document of CARDIQUE and the Bank. Additional public consultations that took place during EA preparation are recorded in the final EA. A final public consultation workshop with similar participants to the first was held in February 1999. In compliance with Bank policy and procedures, the EA Summary in English was sent to the Bank's Board on March 26, 1999. The EA report was disclosed in country and at the INFOSHOP on March 31, 1999. The EA report and the supporting studies named above were reviewed by the Regional QAT prior to its clearance for appraisal (Memo of April 14, 1999).</p> <p>The assessment of cumulative impacts within the EA addressed con-</p>

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				<p>ervation of wetlands and other ecosystems, expansion of the urban area, the Cartagena Bay sewerage network financed by IDB, a new outlet for the Cienaga de La Virgen lagoon funded by the Netherlands, a proposed national highway, expansion of the airport and tourism development.</p> <p>The EA included a comprehensive EMP, which incorporated environmental management and supervision during construction, an environmental baseline program to monitor oceanographic, biological and ecological indicators, a community public awareness and communications program, and activities to enhance environmental quality. These activities entailed restoration and creation of wetland ecosystems and studies to create a protected area; an industrial pollution survey, establishment of a regulatory framework for non-domestic hook-ups (heavy industry is not connected to the sewer system); environmental education; and an institutional strengthening program to implement the EMP. The PAD, Annex 9 (Table 3) summarizes the EMP measures.</p> <p>The FS leading to the EA also addressed human health and marine environment impacts. PAHO prepared the TORs for the FS, with Bank input on environmental issues. Hazen &amp; Sawyer undertook the study and submitted it to the Bank and ACUACAR in October 1998. The FS examined a range of alternatives, including treatment technologies, treatment levels, disposal sites and right of way alternatives (see Item 4) and identified the submarine outfall as the preferred alternative.</p> <p>Per Colombian legal requirements, Hazen &amp; Sawyer also prepared the stand alone document "Environmental Diagnostic of Outfall Alternatives for the Disposal of Wastewater in Cartagena" to be submitted as part of the outfall licensing process. This document presented the analysis of alternatives with particular emphasis on environment impacts.</p> <p>Considering the project's complexity and sensitive issues, in February 1998 a POE was retained to provide advice on technical design, technology, dispersion modeling and construction methods; review technical studies; participate in public consultation meetings; and provide training to ACUACAR and CARDIQUE. Members of the POE (see Annex 2 for more details on the POE) were international experts—an internationally renowned sanitary engineer and professor emeritus, an environmental engineer, an expert in modeling and design of ocean outfalls and professor, and three expert consultants, two in ocean outfall design and one in wastewater treatment plant design. After the feasibility stage, it was decided to utilize more specific expertise, and, therefore, three of the members with broad wastewater management expertise were replaced by two new experts, one in pipe design and installation and trenchless technology and one in High Density Polyethylene (HDPE) submarine outfall installation.</p> <p>The FS and EA were also reviewed and cleared by the CIOH (Colombian Oceanographic Institute) as required by National Law (all marine infrastructure requires such clearance). The environmental license was issued by the regional environmental authority, CARDIQUE, and later ratified by the Ministry of Environment. The right of way for the land portion of the outfall, plus the area for the wastewater treatment, and the area for the Protected Area have been incorporated in Cartagena's Land Use Plan (Plan de Ordenamiento Territorial, POT).</p> <p>Other project components, such as the water and sewerage networks, expansion of water storage and treatment systems, pumping stations</p>

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				<p>and water intakes were screened and twenty-four simplified EMPs for the proposed infrastructure were prepared by ACUACAR as required by Colombian law. Related licenses and permits were issued by CARDIQUE and the documentation disclosed in CARDIQUE's public information center. The simplified EMPs were complemented by Environmental Manuals for Contractors, prepared by ACUACAR prior to negotiations. The scoping of the EA for the project left these minor works out of the report by Neotropicos, as the works are indeed minor and mostly construction related. There are no concerns from the community regarding these minor works.</p> <p>Human health impacts of the project were further examined in the SA, which was carried out in the urban neighborhoods located at the southeast of Cartagena and in the rural communities in the North Zone, where the outfall is located. The SA conducted its own consultation program (see Items 8 and 9). The social program under the EMP featured a communication program, establishment of community information centers, sanitary education, and provision of water and sewerage services to Punta Canoa and Manzanillo.</p> <p>OD 4.01 (1991), the directive under which project preparation was conducted, does not contain the language cited by the Requesters concerning preventive measures in preference to mitigatory or compensatory ones. Nevertheless, the choice of the outfall was not a mitigatory or compensatory measure, but was instead the most cost effective and environmentally sound solution to severe pollution problems caused by inadequate wastewater disposal in Cartagena and surrounding communities.</p> <p>In summary, Management considers that, in compliance with OD 4.01, the EA and supporting studies, technical oversight from the POE, consultation of relevant stakeholders and disclosure demonstrate that the EA process fully analyzed wastewater disposal alternatives and accounted for human health and marine impacts in selection of the preferred technical solution.</p>
2.	<p><b>Monitoring.</b> The Project Appraisal expressly acknowledges the risk that harmful bacteria from the waste flow may reach nearby beaches and reports that this problem will be dealt with through "intensive monitoring" of coliforms and retrofitting if necessary... Simply monitoring bacteria levels, however, will not provide adequate protection against potentially life-threatening pollution... In fact, the terms of the environmental license granted to ACUACAR to operate the outfall system already indicate that a costly environmental problem is anticipated: the license effectively requires the addition of at least a primary treatment retrofit within the next ten years.</p>	4.01	3-5	<p><b>Comments.</b> The submarine outfall as designed for Cartagena is international good practice for environmentally sound wastewater disposal and provides adequate protection against harmful bacteria from the waste flow reaching nearby beaches. As precautionary measures, the treatment plant design includes chlorination installations and the project supports the development of a contingency plan for the collection, treatment and disposal of wastewater.</p> <p>The PAD (page 21) states that "a submarine outfall has the potential to cause, if not properly mitigated, negative environmental impacts" and for this reason the project was categorized as A, i.e., to ensure that proper analysis and mitigation measures were incorporated in its design and implementation. The dilution modeling and findings in the FS and EA, corroborated by the additional 4-year dilution modeling study (<i>Dilution Modeling for the Cartagena Ocean Outfall</i>, prepared for ACUACAR by Roberts, 2003, see Annex 3) discussed in Item 3 below, support the conclusion that this particular outfall site poses negligible risk to nearby beaches.</p> <p>The "intensive monitoring" referred to by the Requesters is a precautionary measure, as well as a means to gather information and guide the second stage of development, which is prescribed by the environmental license. Wastewater management projects are often done in stages, especially when funding is limited. According to the environmental license issued by CARDIQUE, a subsequent stage would</p>

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				<p>be for the project to upgrade the treatment plant to the level of primary treatment or its equivalent prior to marine disposal through the outfall. The upgrade should be implemented by 2015.</p> <p>Chlorination installations will be activated if needed to eliminate or greatly reduce pathogenic organisms in the effluent. Another precautionary measure would be to add coagulants to the raw wastewater prior to entry to the treatment plant to remove suspended solids and organic material should such reduction be required. The contingency plan for the collection, treatment and disposal of wastewater provides plans and recommendations for mitigating or preventing vulnerability and possible risk, as required by the environmental license.</p> <p>The appropriateness of outfall design in regard to human health and environmental impacts is supported by experience with similar outfalls in many developed and developing countries. Extensive experience in many countries has shown that domestic sewage can be discharged to coastal waters through long outfalls with few measurable effects of the discharged sewage beyond the discharge point. See, for example, "Dispersion from Ocean Outfalls" (Phillip Roberts, <i>Water Quality Int'l</i>, May/June 1998), <i>Submarine Outfalls: A Viable Alternative for Sewage Discharge of Coastal Cities In Latin America and the Caribbean</i> (PAHO, Henry J. Salas, November 2000), and "Environmental Protection Misapplied: Alleged Versus Documented impacts of a Deep Ocean Sewage Outfall in Hawaii" (Richard W. Grigg and Steven J. Dollar, <i>Ambio</i> 24:2, March 1995).</p> <p>Colombian law also recognizes outfalls as a viable method of sewage disposal (Technical Norm of the Water and Sanitation Sector in Colombia – RAS, Resolution 1096, Article 180 (2000)), provided that: "Pretreatment prior to discharge via submarine outfall is required so that, in combination with the processes of initial dilution, dispersion, assimilation and decay [it] will guarantee compliance with the quality objectives of the receiving body, indicated by the environmental norm in effect and with other provisions which modify, expand and substitute it." This legislation recognizes that the combination of pretreatment and the outfall have to comply with the effluent standard, not just the pretreatment (i.e., the dilution effect is taken into account).</p> <p>Management considers that the proposed submarine outfall protects against harmful bacteria from reaching nearby beaches and is in line with international best practice and as such is in compliance with OD 4.01.</p>
3.	<p><b>Coastal Zone Impacts.</b></p> <ul style="list-style-type: none"> <li>- The EA ... offers almost no analysis of the impacts the residential, commercial, and industrial waste discharge will have on the immediate coastal zones near Punta Canoa, Arroyo de Piedra, and Manzanillo.</li> <li>- The environmental uncertainties at issue involve questions of when and how, not whether, this wastewater disposal system will harm the marine environment surrounding the outfall discharge</li> </ul>	4.01	12	<p><b>Comments.</b> Management deems the Bank to be in compliance with OD 4.01 with regard to coastal zone impacts. Contrary to the claim, the outfall, along with the project's support for construction of sewerage networks in poorer neighborhoods, will help relieve the current situation of severe pollution resulting from improper wastewater disposal. The outfall is designed to minimize the risk of harmful impacts, and will also eliminate existing harmful impacts of current untreated sewage discharges.</p> <p>The EA does analyze the impact of the planned outfall on coastal zones near Punta Canoa, Arroyo de Piedra and Manzanillo. In addition, during project preparation, analyses were prepared for the FS and reviewed by the POE. These included oceanographic studies and dilution modeling, which were extended beyond the project preparation period into the execution period, while waiting for the environmental license (Roberts, <i>Dilution Modeling for the Cartagena Outfall</i>, October 2003 and Roberts, <i>Additional Water Quality Modeling for the</i></p>

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	<p>and the people whose nourishment and livelihood depend on that environment.</p> <ul style="list-style-type: none"> <li>- The impacts of an outfall pollution problem on the residents of the City of Cartagena could be similarly grave: even the threat of pollution of the waters around the City's prized beaches, just several miles south of the Punta Canoa area, could cause a public relations scandal and the loss of valuable tourist business.</li> </ul>			<p><i>Cartagena Ocean Outfall</i>, May 2004). All studies concluded that the planned outfall would minimize the risk that the discharged effluent would have any harmful effect on the coastal zones, including those near Punta Canoa, Arroyo de Piedra, and Manzanillo, and those near Cartagena's beaches.</p> <p>The wastewater of the Cartagena municipal sewerage network is domestic and contains very little toxic pollutants; the industrial zone of Mamonal is not connected to this network and would thus not flow to the planned outfall. In spite of the low concentration of toxic pollutants in the wastewater of Cartagena, the project includes a component for further controlling the discharge of industrial toxic materials to the sewerage network. This component entails identification of polluting industries and support for enactment of municipal waste codes obligating polluting industries to treat their waste prior to discharge to the network. The code will be enforced by the Environmental Unit of the Municipality (<i>Entidad Publica Ambiental</i>, EPA). As a result of these measures, the risk of toxic pollutants at the outfall site is not a concern.</p> <p>Pathogenic bacterial contamination is the main public health risk posed by the proposed outfall. This risk is reduced by appropriate choice of the outfall location. On top of the physical dilution processes, bacteria undergo a process of biological decay in the marine environment. The bacterial die off can be controlled by proper selection of the outfall length, since a longer outfall means a longer travel time towards the shore and thus a higher die off. A proper design of the outfall can ensure control of bacterial contamination, maintaining the concentration of fecal coliforms (the indicator organism) at permissible levels in accordance with the prevailing norm, while leaving only a small area around the discharge point with somewhat higher values than the prevailing norm.</p> <p>The proposed outfall extends about 2.85 km from shore and discharges into water about 20 m deep. Initial modeling of coastal zone impacts was carried out by Hazen &amp; Sawyer as part of the FS. Subsequent and further detailed modeling, outlined in the 2003 study by Roberts, demonstrates that the impacts of the proposed submarine outfall will not harm the coastal zone. For the purpose of modelling and to predict shore contamination levels, extensive baseline measurements of currents, temperature, salinity, waves, density stratifications, and tidal height were carried out. Extensive mathematical modeling (NRFIELD and FRFIELD) of the wastewater plume behavior was done using the oceanographic data collected. About 35,000 simulations of near field mixing and dilution and transport in the far field at one hour intervals were done for the nearly four years of data collected. The results of this modeling arrived at the following conclusions:</p> <ul style="list-style-type: none"> <li>• The proposed outfall location is favorable to marine wastewater discharge. Currents in the vicinity of the proposed diffuser are consistent and generally fast and the diffuser is oriented perpendicular to the major current axis, which will result in efficient and rapid mixing near the diffuser with high initial dilutions.</li> <li>• Onshore currents are weak. Density stratifications are weak, so the plume will usually reach the surface. Because of the high dilutions, however, it will not generally be visible.</li> <li>• Because of the high initial dilutions, adverse environmental effects, for example from toxins, near the diffuser will be minimal.</li> </ul>

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				<ul style="list-style-type: none"> <li>• Near field dilutions will generally be much greater than 100, with a median value around 250, and maximum values of almost 1000. These dilutions are usually attained within 100 m from the diffuser. Although some minimum dilutions of less than 100 were predicted, these are not significant as they occur only infrequently – less than 15 percent of the time.</li> <li>• Transport of the plume to shore is highly unlikely. Should it occur, the combination of high initial dilution, oceanic diffusion, and bacterial decay will reduce the bacteria to low levels. The predicted time series of total coliform at four points around the shores of Punta Canoa indicate that coliform levels are zero for 99.9, 99.3, 99.7, and 100 percent of the time, respectively.</li> <li>• The far field simulations were done using the mathematical model FRFIELD. FRFIELD is coupled to the near field model and uses the current meter data to predict the spatial variations of frequency of exceedance of various bacterial levels around the diffuser. The results were compared to the standards of the California Ocean Plan and local criteria. It was predicted that bathing water standards will be met at least 2 km from shore, as noted above, and so should be met at the beaches with a large margin of safety. While the outfall could, in theory, be lengthened so that the probability of onshore transport is near zero, this would require an unrealistically long outfall with a considerable increase in cost. Any improvement in shoreline water quality would be negligible.</li> </ul> <p>In addition to no adverse impacts on the northern coastal zone, the outfall also will not have adverse impacts on the residents of Cartagena. The city is currently suffering from severe pollution as a result of improper wastewater disposal and the water bodies surrounding the city are befouled by untreated waste discharged into Cartagena Bay, Ciénaga de La Virgen and in-city water courses. At present, overflow from the overloaded sewage collectors contaminates the beaches and the water courses. It is Management's position that the project will address these problems by completing the construction of the sewage networks in the poorer areas and by collecting and discharging sewage through a submarine outfall. Improved sewage collection and disposal will likely improve tourism by reducing health, odor and other problems caused by current sewage collection and disposal.</p> <p>The WHO guidelines on safe recreational water environments noted above in para. 24 indicate that a wastewater management scheme that consists of preliminary treatment followed by discharge through an effective outfall is of low risk to human health, while a wastewater management scheme consisting of oxidation lagoon treatment with discharge to the beach or from a short outfall is rated as high risk. The WHO findings are consistent with the proposed project and contradict the Requesters' assertion that the proposed outfall will cause significant harm to human health.</p>
4.	<p><b>Analysis of Alternatives.</b> The EA ... unjustifiably dismissed more environmentally-sound and financially-viable (and certain) alternatives. For example, the EA summarily concluded that a wastewater treatment and reuse system was not a viable option.</p>	4.01	13-14, 30	<p><b>Comments.</b> It is Management's conclusion that the analysis of alternatives carried out in the FS (Hazen &amp; Sawyer, 1998), upon which the EA is based, is exhaustive and sound and is in compliance with OD 4.01.</p> <p>The FS identified and analyzed a comprehensive set of alternatives. The main options for final disposal of domestic sewage in Cartagena were: (i) Cartagena Bay; (ii) Ciénaga de La Virgen lagoon; (iii) the</p>

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	<p>... This assertion has since been publicly countered by independent experts from the Sociedad de Ingenieros y Arquitectos de Bolivar (SIAB) and by a commission appointed by [the Mayor of Cartagena at the time] to study the outfall project ("Outfall Commission").</p> <p>Similarly the EA presented an alternative that involved the use of oxidation lagoons for treatment before final dumping into the Caribbean Sea as being prohibitively expensive. This analysis, however, was based on unrealistic cost figures.</p> <p>[...] The analysis of other alternatives seems to have been made with similarly suspicious figures that effectively inflated their costs in comparison to those of the chosen outfall system. For example, one proven ecologically sustainable and economically advantageous alternative, the combination of biological treatment lagoons and irrigation of Cartagena's mangrove swamps with the treated effluent, was not even considered in the environmental assessment.</p> <p>The Commission concluded that the outfall was not the best solution to the City's sewerage problem and recommended a new, more comprehensive evaluation of alternatives by an independent panel of experts. The scientists at SIAB followed with their own report and presentation in January 2002 that also concluded that there was a significant basis for questioning and reconsidering the submarine outfall project. SIAB recommended that Cartagena's mayor ask the World Bank to rethink the project and finance only a solution that would include a more rigorous treatment of wastewaters and be overseen by an independent group and a project leader other than ACUACAR.</p>			<p>Caribbean Sea; and (iv) reuse and irrigation. The study considered five treatment options, four sites for an outfall, four outfall pipe diameters, five types of pipe material, nine land conveyance routes in four corridors, and four different diffuser depths. Overall, fifteen alternatives combining different treatment levels and final disposal sites were considered. The options considered in the FS include all options raised in the Request except for the combination of biological treatment in oxidation lagoons and irrigation of Cartagena's mangrove swamps with the treated effluent. All alternatives were evaluated from technical, economic, environmental and social perspectives. Effluent quality, initial investment costs, operation and maintenance costs, and land uptake were the main comparison criteria. Additional environmental and social criteria were used as well (see PAD, Annex 9, Table 2). As stated in the response to item 1 above, the POE reviewed and commented on the FS, and was also asked to later endorse the final conclusions and recommendations.</p> <p>Concerning wastewater reuse for irrigation, the FS determined this not to be a viable option due to: (i) lack of institutional framework capable of handling complex system; (ii) no demand for irrigation water in the area; (iii) the additional costs in treatment, irrigation and agriculture infrastructure that a reuse project would require; and (iv) the availability of unlimited fresh water resources for irrigation from Canal del Dique at much less cost. Furthermore, any wastewater reuse scheme would need to be coupled with installation of alternative discharge of the wastewater during the seasons that irrigation is not required as well as in emergency situations. A submarine outfall could serve as an alternative discharge option and the project does not exclude future partial reuse of wastewater. The conveyance and submarine outfall system could support any such initiative in the future.</p> <p>Concerning the use of oxidation lagoons for treatment, the conclusion of the FS's cost effectiveness analysis was sufficiently robust, such that large changes in the land price assumption would not affect the outcome of the analysis. The cost of oxidation lagoons depends mainly on the design criteria: a lagoon system that yields high effluent quality is costly. The cost of a large plant cannot be extrapolated from the cost of small plants existing in Colombia. In addition, the land cost estimates in the FS followed market information available at the time. Determination of land values in such a site, where occupancy and land use are likely to change as a result of the proposed project, is a complex process and subject to much discussion. Such disagreement is even noted in the evidence provided by the Requesters in Exhibit 7 (minutes from the round table of SIAB and ACUACAR, December 20, 2001).</p> <p>While oxidation lagoons are a viable wastewater treatment solution for small and medium size cities with lagoons located at a distance from the city they serve, they are not generally a viable option for large cities. The treatment process in lagoons is a natural process, not controlled by equipment. As a result, there is no means to easily control problems if the biological process collapses or the lagoons become overloaded. In addition, the required land to service the large population of big cities is often not available. For these reasons, wastewater treatment in oxidation lagoons is not common for large cities, especially not in close vicinity to the city limits. The number of oxidation lagoon plants in the world serving coastal cities of the size of Cartagena, with the lagoon plant located within the city, is very limited. Hazen &amp; Sawyer did not consider oxidation lagoon treatment in the vicinity of a tourism city such as Cartagena to be a viable option. The</p>

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				<p>POE agreed to this approach and the Bank accepted it.</p> <p>In contradiction to the Requesters' position that the use of oxidation lagoons for wastewater treatment before final discharge of the effluent into the Caribbean Sea is more environmentally sound and financially viable than the selected alternative, the WHO (2003) considers that a wastewater management scheme consisting of lagoon treatment with discharge of effluent on the beach or from a short outfall constitutes a high risk to human health (see Item 3).</p> <p>Finally, also in response to the Requesters' insistence on an oxidation lagoon plant, it should be clarified that such a plant already exists in the city, since the Cienaga functions currently as an oxidation lagoon plant. Therefore, it would not make sense to add another lagoon plant at a high cost.</p> <p>The combination of biological treatment in oxidation lagoons and irrigation of Cartagena's mangrove swamps with the treated effluent was not considered in the FS because of the sensitivity of the mangrove ecosystems, considered to be natural habitat under OP 4.04. Even if this concern were not present, irrigating mangrove swamps with effluent is not a technically viable option because: (i) mangroves need saline water, and "sweet" water such as wastewater effluent could cause irreversible damage; and (ii) oxidation lagoon effluent contains high levels of nutrients (Nitrogen and Phosphorous) that can also damage mangroves. Furthermore, District authorities plan to use the waters around the mangroves as waters of primary contact (a higher level of water quality under Decree 1594 of 1984), thereby prohibiting the option of discharging oxidation lagoon effluent into these waters because of the ensuing contamination.</p> <p>Concerning the recommendation of the SIAB report and the "Outfall Commission" that options other than the outfall should be considered, Management considers that the assessment of options in the FS was exhaustive and sound. The FS was conducted by an international consulting firm of high repute, with review by a POE whose members included internationally recognized wastewater management experts. Management does not believe that the SIAB work constitutes an adequate basis for reconsidering the alternatives. The Bank team has no knowledge of any official request having been submitted by the Mayor asking the Bank to rethink the project.</p>
5.	<p><b>Geological Conditions.</b> According to studies by INGEOMINAS ... the area around Punta Canoa and Arroyo de Piedra is subject to diapirism, also known as mud volcanism. This phenomenon is characterized by the sudden, violent expulsion of thousands of cubic meters of mud, clay, and gases. The INGEOMINAS study prepared in 2000 indicated that because this condition exists under the land and seabed through which the 2.8 kilometer outfall pipeline will be laid, a geological event could rupture the line without warning at any time and cause wastewater to</p>	4.01	5, 14-15	<p><b>Comments.</b> Management takes the view that the Bank is in compliance with OD 4.01 in relation to the analysis of geological conditions and associated risks of the proposed submarine outfall. The potential risks associated with diapirism were analyzed in the Feasibility Study and included in the EA. Following up on the issues raised by INGEOMINAS and upon the recommendations of the EA, additional work was undertaken (detailed below). The subsequent study (Ver-nette, March 2001) confirmed the conclusions of the FS and EA, that: (i) the risk of diapirism in the outfall area is small; and (ii) the low geologic risks should nevertheless be taken into account in the technical specifications for the outfall.</p> <p>A study entitled "Geophysical Investigations Offshore Punta Canoa, Colombia" (prepared by Marine Resources, as part of the FS, 1998) analyzed diapirism and rated the risk to be low, because the geological characteristics associated with diapirism are not directly located in the proposed outfall location.</p> <p>Based on the recommendations of the EA, and in response to the concerns raised by INGEOMINAS, ACUACAR hired an international</p>

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	<p>be released much closer to shore ...</p> <p>Hazen &amp; Sawyer's feasibility study and the EA ... failed to properly account for the geological conditions surrounding the project and entirely ignored the potential impact a geological event could have on the outfall line itself and consequently on the environment and the health, safety, and culture of the people of the villages of Punta Canoa, Arroyo de Piedra, and Manzanillo</p> <p>... Where World Bank policy would seem to dictate that a reassessment be done to consider this new information, the World Bank Task Manager responded to the INGEOMINAS report by threatening the jobs of INGEOMINAS scientists.</p>			<p>expert in February 2001 to review in more detail possible diapirism associated with the submarine outfall. This review (Vermette, March 2001) found no basis for the claims of high risk in the INGEOMINAS study. The potential impact of diapirism on the submarine outfall is low and the proposed outfall is viable from geological and geophysical standpoints; specifically, there is an absence of large magnitude seismic activity and magnetic volcanism. See summary in Annex 7.</p> <p>The Colombian Ministry of the Environment also commented in April 2002 on this point in its ratification of the outfall environmental license. INGEOMINAS reported to the Ministry that its existing studies were regional in nature and that more detailed geological and geophysical studies were required. As part of the environmental licensing process, CARDIQUE reviewed the Marine Resources study and concurred with its findings. Accordingly, articles 5 and 6 of the outfall license stipulate that these low geologic risks should be taken into account by the District of Cartagena in the technical specifications for the outfall. This will be done through the following: (i) a Contingency Plan that can be swiftly activated in the event of an emergency of any sort in the outfall line and involving deployment of a team of geotechnical specialists and engineers specialized in this type of work; and (ii) a long-term Monitoring Plan for the environmental parameters in the marine area (water quality, sea dynamics, seabed topography, soil mechanics, seismic and diapiric activity and their possible relationship).</p> <p>Management believes the statements in the Request (see pg. 5) to be misleading on the issue of diapirism. The evidence provided in the request is a letter quoting studies by Dr. Vermette (the same consultant used by the project), which Management believes have been taken out of context. This same expert has provided a signed written statement to the Bank that the risk is low at the project site. Furthermore, the evidence in Annex 9 of the Request does not show that INGEOMINAS found that "no engineering design could provide an outfall that can withstand the effects of a submarine explosion...", but rather presents a general discussion of possible diapirism risks in the area. The letter provided by the Requesters in Annex 11 from INGEOMINAS to the Bank Task Manager indicates that the INGEOMINAS expert quoted was not discussing the viability of the outfall project, but instead providing general concepts on the diapirism phenomena in the area.</p> <p>Close examination of evidence in the Request's Exhibit 11 shows no evidence that the Task Manager threatened the jobs of INGEOMINAS scientists and he asserts that no such threats were made. Management has no information to indicate that this occurred, and, as such, finds the claim baseless.</p>
6.	<p><b>Violation of National Norms.</b></p> <ul style="list-style-type: none"> <li>- The primary domestic norm that will be violated by this project is Decree 1594 of 1984, the section of Colombia's Code of Natural Resources that establishes water quality criteria and limits on the discharge of contaminants into bodies of water.</li> <li>- ... Additionally, the EA does not discuss or even mention another national law that will</li> </ul>	4.01	15-16	<p><b>Comments.</b> The Requesters have set forth a series of legal arguments in this Item and Item 7 that are identical to a series of claims made previously in the Colombian administrative adjudication process concerning the outfall. The Requesters fail to note that each of the arguments raised has already been fully adjudicated under Colombian law. Even had the Colombian system not already adjudicated this matter, Management considers that the claims do not arise directly out of "an action or omission of the Bank as a result of a failure of the Bank to follow its own operational policies and procedures..." (Inspection Panel, 1993 Resolution, para. 12). Thus, Management suggests that this is not the appropriate venue to adjudicate whether a national government has properly applied national law.</p> <p>Nevertheless, in order to provide full information to the Panel and the</p>

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	<p>be violated by the outfall, Decree 2811 of 1974. Articles 42 and 43 of this law establish quality criteria for water resources with primary and secondary recreational uses and set standards for levels of coliform bacteria, phenolic compounds, nitrogen, phosphorus, and other contaminants.</p> <ul style="list-style-type: none"> <li>- ... Resolution NO. 0842 (2000) by CARDIQUE, the local environmental licensing agency, required ACUACAR to complete biological analysis of waters in the region that would be affected by the outfall project, including the fishing areas off of Punta Canoa. ACUACAR has not undertaken this analysis. [...]the Outfall Commission set up by Cartagena Mayor Carlos Diaz in 2000 determined that [an] ex-post monitoring approach was insufficient.</li> <li>- Citing Article 24 of Colombian Decree 1753 of 1994 ... the Joint Commission [also] reported: <i>One must study the indices of stability, diversity, abundance and rarity, and the use of bioindicators, which mark the effect of untreated discharges from the submarine outfall on the marine water quality. The assessment of these impacts, which has not been done, must be undertaken in order to compare the proposal of the submarine outfall with the alternatives.</i></li> <li>- These violations include acquiescence in the terms of the environmental license that was recently granted to the project and that, to our knowledge, effectively gives the executing agency, ACUACAR, ten years to come into compliance with existing national environmental standards.</li> </ul>			<p>public, Management attaches as Annex 8 the ruling, concerning each of the claims set forth by the Requesters, by the Colombian Ministry of Environment on the appeal of the award by CARDIQUE of the outfall license. In addition, Management retained the services of an attorney, who had also earlier provided legal service for CARDIQUE, to prepare an analysis of the claims (Annex 9). As these documents point out, Colombian law makes clear that marine outfalls are permissible, provided that the process of conducting the appropriate studies is properly carried out and that the license fits within the appropriate parameters of the receiving waters. The process for and substance of the FS and the EA demonstrate compliance with OD 4.01.</p> <p>The Request fails to reflect that the EA, in accordance with OD 4.01, noted the applicable legislation concerning discharge standards. Colombian standards are among the most stringent, and the design of the proposed system not only complies with these standards, it exceeds them.</p>
7.	<b>Violation of International Norms.</b> The project also violates	4.01	17-18	<b>Comments.</b> The issues of this claim are related to those in Item 6 to the extent that the Requesters seek to re-examine issues particular to

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	<p>Colombia's obligations under the 1983 Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region ... Under the Protocol [Concerning Pollution from Land-Based Sources and Activities], wastewater dumped into Class 1 Caribbean waters ... must meet stringent standards for total suspended solids, biological oxygen demand, pH, greases and oils, fecal coliforms, enterococci (fecal bacteria), and floating substances. With only a preliminary treatment component and no removal of biological or chemical contaminants, the submarine outfall proposal will violate these norms.</p>			<p>whether the Colombian government has complied with its legal obligations. Reference to international law was also addressed at the national level and Management notes the treatment of these issues by the Colombian Ministry as set forth in Annexes 8 and 9.</p> <p>As noted in the ruling by the Ministry of Environment, and the attached legal opinion, while Colombia is party to the Cartagena Convention, it is not a party to the Land-Based Sources Protocol of the Cartagena Convention (LBS Protocol). Convention Article 7 urged countries, in general terms, to try to "prevent, reduce and control pollution" from land-based sources. Thus, it appears that the Convention recognized that such practices would continue. In any event, any more specific obligations that would have pertained to marine outfalls would be reflected in the LBS Protocol. While Colombia signed the Protocol in 1999, it has never ratified it, and therefore the Protocol is not binding and the "norms" referred to by the Requesters are not applicable. In fact, not a single country that is party to the Cartagena Convention has ratified the Protocol since the Protocol opened for ratification in 2000. <a href="http://www.cep.unep.org/law/cartstatus.html#lbs">http://www.cep.unep.org/law/cartstatus.html#lbs</a></p> <p>Even if the LBS Protocol were to apply to the project, the planned outfall would be authorized under it. As the government decided the class of waters affected by the planned outfall is Class II, not Class I as the Requesters state. (For Class II waters, discharge is permitted, as follows: TSS 150mg/l; BOD 150mg/l; pH 5-10; and grease and oil at 50 mg/l; and there are no restrictions on discharge of pathogenic organisms.) Finally, even if the Protocol were applicable, parties to the Protocol have up to ten years to implement provisions that enable the standards of the Protocol to be met.</p>
8.	<p><b>Consultation.</b> Project officials blatantly failed to even take community concerns seriously. Because this was a Category A project, this omission constitutes a clear violation of OP 4.01 (15). ACUACAR representatives held a town meeting in Punta Canoa in 1998 during which they promised residents that they would soon receive many benefits from ACUACAR, including a system for potable water. ... Punta Canoa residents were told at a second meeting at ACUACAR headquarters ... that they had already approved the outfall project in writing. [They] were understandably shocked and angered when ACUACAR brandished the <i>attendance sheet</i> from the prior meeting and claimed that it proved the villagers' support for the project.</p>	4.01	18-19	<p><b>Comments.</b> Management takes the view that the provisions of OD 4.01 on EA consultation have been met. Following good practice on consultation, a participatory approach was used during project preparation, starting in February 1998, with a first Stakeholders Workshop. At this workshop, the first draft of the project design was discussed. In February 1999, a second general Stakeholders Workshop took place to discuss final project design, environmental and social impact mitigation programs, and monitoring processes. Consultations were also undertaken for the Environmental and Social Assessments, as noted below.</p> <p><i>Social Assessment – Consultations:</i> A local team, comprised of a sociologist and social workers, carried out the SA in 1998 under TORs prepared by a Bank social specialist who also oversaw their execution. The SA focused on two areas: (i) urban neighborhoods in southeast Cartagena along the Ciénaga de la Virgen; and (ii) the rural communities in the North Zone of the city where the outfall would be built. A survey was carried out in 222 households that covered 1,163 people (see PAD, Annex 10). Four workshops were carried out in 1998 in critical communities—Pozon, San Jose de los Campanos, Olaya Herrera and La Boquilla, the last of which was attended by representatives of the above-mentioned North Zone communities. See Annex 10.</p> <p>Common concerns expressed during these workshops were the following: (i) an increase in water tariffs beyond their means; (ii) increased land value resulting in higher taxes and loss of subsidies; (iii) nuisance during construction; and (iv) the risk of accidents at the pumping site or along the pipeline. The North Zone communities also expressed their concern about a possible impact on fishing and bearing the problems of construction without clear benefits. To provide the</p>

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				<p>communities a direct and specific benefit, the project was expanded to provide water services, from La Boquilla to Punta Canoa, through the so-called North Aqueduct. Construction of these works is included in the project's Loan Agreement as a condition to be met prior to construction of the outfall (see Section 3.04(b) and Schedule 1, para. A3(b) of the Loan Agreement).</p> <p><i>Environmental Assessment – Consultation.</i> In compliance with OD 4.01, consultations comprising around 250 events involving communities and other stakeholders were carried out between 1998 and 2003; these included community meetings, training workshops and other events; notable events were a study tour for 23 community leaders, including representatives from the North Zone communities, to 6 similar outfall sites in Colombia, Chile and Uruguay; and participation of 23 key stakeholders, including community representatives, in an international course on the submarine outfall alternative for coastal cities in the Caribbean, organized by PAHO/WHO in Barbados. See also Item 1 above.</p> <p><i>Communication Strategy</i> – To better inform the public in general and the communities in particular about progress in project implementation, ACUACAR, at the request of the Bank, implemented a Communication Strategy between 2001 and 2002. A survey carried out in 2001 under this strategy indicated that 79 percent of Cartagena's overall population support the project, and 36 percent of the North Zone communities oppose it. Some relevant actions under this strategy include: (i) information events with local newspapers and dissemination campaigns; (ii) a presentation series on ACUACAR's Master Plan of Water and Sanitation (see Annex 11); and (iii) a radio campaign. Specific activities with community leaders in the North Zone include: (i) support for creation of an association of La Boquilla organizations supporting the project; (ii) support to strengthen the Fishing Association in Manzanillo; (iii) information meetings with young leaders in Punta Canoa; and (iv) specific campaigns addressing community fears about the outfall (Emisario de Vida and Opportunities).</p> <p>With regard to the Request's claim that an attendance sheet from an early consultation meeting was used to show support for the project, Bank staff have no recollection of such an incident and believe that it is the result of a misunderstanding. It may have been that the attendance sheet was held up as proof of participation in a prior event, at which information that was being repeated at the second meeting had first been provided. Management notes that such an attendance sheet would not be construed as support for the project. However, it is also Management's view that the large number of consultations described above ensure compliance with Bank policy and to support the selection of the optimum alternative for wastewater disposal for Cartagena.</p>
9.	<p><b>Social and Economic Effects.</b> The EA addressed the project's social and economic effects on the villages of Punta Canoa, Arroyo de Piedra, and Manzanillo in only the most cursory fashion, and, as a result, the Project Appraisal and EA reflect neither the magnitude of the project's impact on these communities nor their residents' level</p>	4.01	19	<p><b>Comments.</b> Management considers that the social and economic effects of the project on the villages of Punta Canoa, Arroyo de Piedra and Manzanillo (the North Zone) have been appropriately assessed and that ACUACAR and Bank staff have taken adequate steps to address the concerns of the village residents.</p> <p>The SA discussed in Item 8 above: (i) assessed social and economic conditions of the target population, including the communities of the North Zone, and established a baseline for monitoring and evaluation purposes; (ii) consulted beneficiaries about their priority needs and concerns about the project; (iii) identified community-based organizations to support project execution; (iv) identified obstacles and social</p>

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	of concern and opposition.			<p>risks; and (v) prepared, as required, an impact mitigation program.</p> <p>The main outcomes and recommendations of the SA were built in to project design to better target beneficiaries and enhance project quality. A detailed summary of the SA is included in the PAD, Annex 10. Following these recommendations, the project incorporates an Environmental and Social Component (see PAD, page 8). The Social Impact Mitigation and Community Development Program (funded by the project) also features some activities to be financed jointly with the District Government. The District of Cartagena will support this program by: (i) including in its Urban Development Plan a strategy to protect and consolidate the integrity of the communities around the Ciénaga de la Virgen and the North Zone by regularizing land ownership and providing property titles; and (ii) providing these two areas with priority attention through the Citizens Participation and People Development Program, which provides training and assistance to develop small productive activities.</p> <p>With regard to the communities in the North Zone, provision of piped water services for Manzanillo, Punta Canoa and Arroyo de Piedra is a condition of the Loan Agreement for the project prior to construction of the outfall (see Loan Agreement Section 3.04(b) and Schedule 1, para. A3(b)). Works to provide these communities in the North Zone with water services are about to begin. To complement this activity, “sanitation packages” comprising in-house facilities will be installed in the poorest households in La Boquilla. Moreover, two community centers, one in La Boquilla and another in Punta Canoa, will be built to complement the District’s urban rehabilitation program aimed at stabilizing urban growth and to help consolidate these communities.</p> <p>The Social Impact Mitigation and Community Development Program was updated in 2002 to adjust to community conditions and incorporate some of the urban development initiatives of the new District Government at that time. The mayor of Cartagena fully endorsed this Program, which helped to accelerate its execution.</p> <p>In sum, Management maintains that the analysis conducted under the SA, the resulting North Zone water supply and the Social Impact Mitigation and Community Development Program, together with the activities to be supported by the District, address the project’s social and economic impacts in general, and, in particular, impacts on the communities of Punta Canoa, Arroyo de Piedra and Manzanillo.</p>
10.	<p><b>Natural Habitats.</b> [...]he Bank ignored the ... precautionary principle that OP 4.04 adopts as a guide for projects that affect natural resources like the fisheries at stake here.</p>	4.04	11	<p><b>Comments.</b> Studies carried out as part of project preparation (see Item 1 above) concluded that the impacts of the proposed outfall on natural habitats and fishing would be negligible. Management concludes that this work conforms to the precautionary approach referred to in OP 4.04 and is in compliance with that policy.</p> <p>As stated in the PAD, Annex 9 and the EA (pp. 63-66), underwater surveys at the outfall site show that the area has poor benthic activity and almost non-existent biological resources. This situation, together with the low context of toxic materials and heavy metals in the effluent discharge, precludes the risk of biological assimilation at the outfall site. It should also be noted that in the analysis of alternatives, shorter outfalls were considered but rejected because of proximity to coral reef ecosystems.</p> <p>In addition, water quality off the coastline of the three communities is already degraded by the Rio Magdalena (the largest river in Colombia), as discussed in detail in para. 36 of the main text. The discharge of preliminary treated effluent, taking into account initial dilution, will</p>

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				<p>have a much lower concentration of TSS (1mg/l or less) than that of the sea at the discharge site, thus having no negative effect on that habitat.</p> <p>Dispersion modeling (see Item 3 of this matrix) has confirmed that the outfall discharge will have no effect on beaches. Furthermore, the project has included, in its Component G, activities for the restoration and establishment of a Protected Area around the Ciénaga de la Virgen, thereby contributing to the protection of natural habitats and sensitive ecosystems.</p> <p>Finally, as indicated in Item 7 above, the Colombian Ministry of Environment has recognized that the waters at the outfall discharge site are Class II. (See Annexes 8 and 9.) Class II waters, due to oceanographic, hydrological, climatic or other factors, are less sensitive to the impact of domestic wastewater discharge.</p>
<b>Water Resources Management</b>				
11.	The Bank has violated [OP 4.07 on Water Resources Management] ... by supporting a water resources project that will degrade a critical marine habitat and that is neither environmentally sustainable, socially equitable, nor economically viable.	4.07	11	<p><b>Comments.</b> The Request does not make reference to a specific violation of OP 4.07 but notes that the project would involve degradation of marine habitat, and questions its environmental and social sustainability and economic viability. Management posits that the analyses undertaken in the FS, EA, SA, dilution modeling, and financial and economic analysis have been sound and exhaustive and contain sufficient evidence to demonstrate that effluent disposal through a submarine outfall is highly sustainable on technical, economic, environment and social grounds. Further information on these topics can be found under the items corresponding to OD 4.01, OP 4.04 and OP 10.04, respectively (Items 1-4, 10 above, and 18 below in this matrix).</p>
<b>Indigenous Peoples</b>				
12.	<p><b>Identification.</b> The Bank violated its indigenous peoples directive in this project by failing both to identify the affected communities as indigenous and to ensure that the project's adverse effects on these communities would be avoided or adequately mitigated and that the project would have a net benefit for them. Furthermore, the Bank should not have approved the project or loan without an appropriate "indigenous peoples development plan" as required under OD 4.20 (13).</p>	4.20	20-21	<p><b>Comments.</b> Management takes the view that the project complies with OD 4.20. The Region's QAT concluded in its clearance memo for appraisal (April 14, 1999) that there was no indication that indigenous peoples would be affected by the proposed works. There was therefore no need for an Indigenous Peoples Development Plan.</p> <p>OD 4.20, Indigenous Peoples, defines "indigenous peoples" as ethnic minorities with a social and cultural identity distinct from the dominant society. To facilitate identification of indigenous peoples, OD 4.20 establishes the following features:</p> <ul style="list-style-type: none"> <li>- A close attachment to ancestral territories and to the natural resources in these areas;</li> <li>- Self-identification, and identification by others as members of a distinct cultural group;</li> <li>- An indigenous language, often different from the national language;</li> <li>- Presence of customary social and political institutions; and</li> <li>- Primarily subsistence-oriented production.</li> </ul> <p>SA findings indicate that while the communities in the North Zone—La Boquilla, Manzanillo, Arroyo de Piedra and Punta Canoa—are indeed long-established communities with strong family ties and traditions, they do not meet the criteria for OD 4.20 with regard to ancestral territory, self-identification, indigenous language or presence of customary social and political institutions.</p> <p>With regard to subsistence-oriented production, the construction in the mid-1980s of the Cartagena-Barranquilla Road (Troncal del</p>

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				<p>Caribe) had a strong impact on North Zone communities by spurring urban growth and land-use changes. Traditional activities, such as fishing, while still important, have been reduced in their economic significance as tourism and other service activities have grown. While traditional methods of capture are still common, fishing is a market-oriented activity closely related to tourism and not a subsistence activity.</p> <p>With regard to national requirements, the Minister of the Interior, in a letter dated August 11, 1998, determined that the communities in question were not considered "indigenous" under Colombian law (see Annex 12). In a later letter (July 30, 1999), the Ministry of Interior certified that the communities were, however, considered Afro-Colombian under the provisions of Law 70 (1993). (See Annex 13). The Colombian Law 70, (Article 2, item 5), specifically defines "Black Communities (<i>Comunidad Negra</i>)" as "the group of families of Afro-Colombian descent with their own culture, sharing history, traditions and customs, within a country-town relation that keeps their own identity different from other ethnic groups." Law 70 specifically focuses on Afro-Colombian communities; its definition of territory, culture and production means are more generic than OD 4.20, and it does not make reference to indigenous language or customary self-government.</p> <p>Because North Zone communities were not included in the official register of Afro-Colombian communities, ACUACAR requested an official ruling from the Ministry of the Interior. Through its "Negritudes" Commission, the Ministry of the Interior designated the Jorge Ardel Foundation to carry out the certification study under guidelines established in Law 70. The Foundation concluded that La Boquilla, Manzanillo, Arroyo de Piedra and Punta Canoa are Afro-Colombian descendent communities.</p> <p>In conclusion, Management maintains that the Bank correctly determined that OD 4.20 does not apply. Colombian law was also followed by assuring the implementation of the required analysis and consultations under Law 70 and incorporating the findings of the consultations into project design. Nonetheless, the project applied the requirements of Law 70 with regard to consultation (see Item 13 below). The project's Social Impact Mitigation and Community Development Plan (see Item 9 above) comprises activities to ensure that these communities benefit from and participate in the project.</p>
13.	<p><b>Consultation under 4.20.</b> The Appraisal claims that during the preparation of the EA, public consultation meetings were held in Punta Canoa and other villages, that "community concerns were registered," ... and that the communities accepted the nuisance of construction. ... It does appear that ACUACAR held two public hearings or meetings in Punta Canoa in 1998. However, these meetings did not adequately register public concern. Residents' accounts of at least two meetings indicate that executing agency ACUACAR was</p>	4.20	22-23	<p><b>Comments.</b> Management concluded, as described in item 12 above, that OD 4.20 does not apply to this project. However, Management notes that extensive consultations were carried out under the project, as discussed in Item 8 above.</p> <p>Because no indigenous peoples were identified within the project area, as defined under OD 4.20, consultation under this OD was not required. Nevertheless, consultations were conducted as part of the SA process and the discussion of the preparation and results of the Social Impact Mitigation and Community Development Program. Moreover, once the Minister of the Interior delivered his official ruling (Aug. 11, 1998) as to the application of Colombian Law 70 to Manzanillo, Arroyo de Piedra, La Boquilla and Punta Canoa, mandatory consultation under a process defined in Decree 1320 as "consulta previa" was carried out in compliance with this mandate.</p> <p>As stated in Item 12 above, the Jorge Ardel Foundation carried out this consultation process, which consisted of: (i) selection of commu-</p>

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	not honest with them about the potential effects of the outfall and even used deception to portray village support for the project as higher than it actually was.			<p>nity representatives; (ii) community meetings; and (iii) a general assembly meeting. The Regional Negritudes Commission was responsible for oversight of this consultation process, which took place March 9-30, 1999.</p> <p>The main concerns expressed through this consultation process were: (i) the impact of the project on fishing and consequently on employment; (ii) the need to strengthen community organizations; (iii) the need to extend the consultation process through the implementation phase to continue providing information to address community concerns. These concerns were reflected in project design. The Environment and Social Component supports—among other activities—promoting the integration of community based groups, in particular to develop income-generating activities, construction of community centers, and a communications campaign to keep the population of Cartagena informed about progress on the project (see PAD, Annex 10).</p>
14.	<p><b>Benefits.</b> The Project Appraisal and EA are largely silent on the nature and location of the fishing activities of Punta Canoa and its neighbors. Had the project managers from the Bank and other entities properly recognized the communities as indigenous, they would have ... had to consider more carefully whether and how the project might benefit these communities. The compensatory supply of potable water and other token infrastructure improvements offered by ACUACAR surely do not meet the benefit standard of OD 4.20 (2), especially when weighed against the serious long-term harms the project is likely to inflict on these communities. Residents of Punta Canoa made this clear to ACUACAR by requiring the water company to sign a document stating that the village's acceptance of potable water did not mean that they approved the submarine outfall.</p>	4.20	23	<p><b>Comments.</b> The communities of Punta Canoa, Manzanillo and Arroyo de Piedra, as noted in Item 12, are not considered as indigenous peoples under either OD 4.20 or Colombian law, therefore the procedures of the OD do not apply.</p> <p>The area in the vicinity of the outfall has little marine life (see Item 10) and dilution modeling work (see Item 3) has shown there will be no effects on nearshore areas and beaches. Thus, fishing activity, to the extent it might occur in these areas, would not be affected.</p> <p>The SA also shows that the communities will not be adversely impacted by the proposed outfall and the Loan Agreement assures that specific benefits of the project will accrue to these populations. See Item 9 above. These actions are a response to the specific conditions of the North Zone communities to ensure they fully benefit from the project.</p>
<b>Financial Management</b>				
15.	<p><b>Risk of Default.</b> [One] area of harm involves the potential for the fiscal instability of the borrower, combined with the expected increase in the total cost of the outfall project, to result in a default on the loan.</p> <p>The City's fiscal disarray and increasingly strained resources indicate a high risk of default on the existing Bank loan</p>	10.02	7-8	<p><b>Comments.</b> Although OP 10.02 does not fully address financial analysis of the type cited in the Request, Management, nevertheless, concludes that the work carried out in project preparation and supervision is in line with good practice on financial analysis. This work entailed a financial assessment of the District of Cartagena and ACUACAR, financial structure of the operation, continued review of both the financial performance of ACUACAR and the District as well as financial management of the project. For these reasons, along with the successful outcome of the project financial structure to date, Management considers that the risk that the District of Cartagena would default on its debt service obligations for the project is small.</p>

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	<p>and/or on additional loans needed to cover anticipated retrofitting of the outfall system. A default would trigger the national government's obligation as the loan's guarantor but would undoubtedly hit hardest at home by sending the City into a cycle of restructuring that would extend the burden of the loan(s) far longer than anticipated, divert resources from other social projects, and generally injure the already fragile local economy. In addition, a default on this or a related loan would blemish the City in the eyes of other investors and prevent it from obtaining funding for municipal projects for years to come.</p>			<p>In particular, during project preparation, the District's level of commitment and the overall initial loan amount were reduced from USD 129 to USD 117 million and USD 100 to USD 85 million, respectively, as a result of a detailed analysis of the District's and ACUACAR's financial capacity. Assumptions and analysis results were discussed extensively with the District, the Government and ACUACAR, and the parties agreed on the viability and risk level of the revised financial structure.</p> <p>Three sources of District income were earmarked for the project and loan repayment, as follows: (i) IPU (Unified Property Tax, <i>Impuesto Predial Unificado</i>) – 18 percent of property tax collections;<sup>1</sup> (ii) ICN (Recurrent National Income, <i>Ingresos Corrientes de la Nacion</i>) – 20 percent of the income transferred by the Nation to Cartagena under Law 715; and (iii) Royalties (<i>Fondo de Regalia</i>) – 5 percent of the petroleum royalties transferred by the Nation to Cartagena, later increased to 10 percent to cover risks. Two separate trust funds were created with private fiduciary institutions to oversee these earmarked funds.</p> <p>The District was also required to: (i) obtain an operational surplus in order to reduce its unpaid debt of 12 billion Colombian Pesos to zero by 1999; and (ii) keep other infrastructure investments to a minimum. These steps were not followed by the administrations after the loan signing. By 2000, the District's unpaid debt had risen to 60 billion Colombian Pesos, diminishing the ability of the District to cover its operational costs. These results were reported in the first two annual reviews of District finances by the Bank as part of project supervision.</p> <p>To address these problems, the subsequent District administration implemented strict fiscal discipline. At the same time, Law 617, approved in October 2000, imposed further mechanisms to guarantee sound fiscal management by Colombian Municipalities, including severe fines and penalties on officers responsible for public accounts and intervention by the federal government as needed.</p> <p>The District obtained a line of credit guaranteed by the Government. In exchange, restrictions were imposed by the Government on capital and operation expenditures of the District, with the condition that an operational surplus be achieved and the previous years' unpaid debt be settled within two years. Each six months, the District is requested to review its financial action plan, adjustment measures and mechanisms with the Government, with a less detailed review undertaken monthly.</p> <p>The past two years have demonstrated that the financial mechanisms of the loan are robust, with the District reducing its cash debt from 62 billion Colombian Pesos to nearly zero by the end of 2003, while all the funds earmarked for project investment and loan repayment have been transferred to the trust funds. Based on the financial structure of the project and on the experience of the past years, Management considers that the risk of borrower default and related harm to Cartagena and its residents as a result of such default is minimal.</p>
16.	<b>Management Capacity and Project Cost.</b> Because the City	10.02	7, 26	<b>Comments.</b> Management considers the work carried out in project preparation and supervision to be sound, as stated above in Item 15.

<sup>1</sup> Page 7, footnote 5 of the Request states that, "The loan agreement requires the City to raise property taxes to help pay for the Loan." Management wishes to clarify that, as noted above, the Loan requires the District to dedicate a portion of certain tax revenues for project investment and loan repayment. It does not require a tax rate increase.

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	<p>of Cartagena has been plagued by fiscal mismanagement and corruption for decades and has only recently and slowly begun working to put its finances in order, it is not at all clear that it is currently equipped to take on a US\$85 million debt from the World Bank, especially where the actual cost of the outfall system is likely to be much higher due to the environmental and other uncertainties mentioned above.</p> <p>It is not clear that the Bank appropriately considered ... uncertainties about Cartagena's capacity either to responsibly manage public funds and partnerships with private companies like AGBAR or to take on the large loan and long-term capital commitment associated with the outfall project. This commitment apparently now includes, for example, the need to finance, within the next ten years, the construction of a US\$50 million primary treatment plant for Cartagena's wastewater in order to meet the terms of the environmental license granted to ACUACAR for the outfall system.</p>			<p>This includes the financial assessment of the District of Cartagena and ACUACAR, financial structure of the operation, and continued review of both the financial performance of ACUACAR and the District as well as financial management of the project.</p> <p>The Bank reviewed these issues during project preparation and considers that the District has the appropriate capacity with regard to the project. Financial analysis conducted by consultants and Bank staff during project preparation included sensitivity and risk analyses to measure the impact of changes in selected variables (project investment costs, as well as property tax collection rate improvements, administrative costs, and exchange rate devaluation) on the main financial indicators of the District (financial shortfall/surplus during project implementation, debt service coverage through life of loan, earmarked funds/debt service, interest/operation surplus, and debt balance/current revenue). Analysis indicated that the financial scheme is robust, with nearly 80 percent probability that there will be no financial shortfall, both in terms of counterpart provision and debt service (see pp. 65-68 of PAD).</p> <p>As to the possibility of cost overruns, project cost estimates for wastewater disposal have been prepared as part of the Hazen &amp; Sawyer FS and for all other project works by ACUACAR. To date, project costs have been lower than estimated. While it is possible that the outfall system might sustain cost overruns, there is no evidence to indicate that this is any more likely than an underrun, as has occurred in other project components. Related bid processes are only now underway.</p> <p>With regard to construction of the treatment plant, which is required under the terms of the environmental license to be undertaken within ten years, Management notes that implementation of the project has been divided into several phases, as is common for large urban infrastructure projects. The financial structure appropriate for that investment has not yet been developed, and will depend on the District of Cartagena's debt carrying capacity as well as financial contributions by other parties (e.g., ACUACAR, the National Government and others.)</p>
17.	<p><b>Financial and Accounting Statements.</b> [...] the Bank has violated the financial management standards of OP 10.02 by accepting inaccurate financial and accounting statements from the borrower, the City.</p>	10.02	25-26	<p><b>Comments.</b> Management takes the view that the project is in compliance with the financial management covenants in the Loan and Project Agreements. As required by OP 10.02, the Project Agreement requires preparation and submission of audited financial statements of the implementing agency (ACUACAR) and the project. In addition, the Loan Agreement requires that the borrower ensure that the required audits supporting loan withdrawals made under Project Management Reports (PMRs) are carried out in keeping with standards acceptable to the Bank. In accordance with OP 10.02, the Bank has required audited financial statements for both ACUACAR and the project to be submitted to the Bank on an annual basis (see Article IV, Section 4.01 of the Project Agreement), and ACUACAR has maintained financial management systems to assure accurate and timely information regarding project resources and expenditures. This is evidenced by the consistently unqualified<sup>2</sup> annual audits issued by independent auditors on the financial statements of ACUACAR and the project accounts, by the quarterly PMRs submitted by ACUACAR and reviewed by the Bank, which are audited as part of the overall</p>

<sup>2</sup> Per standard accounting usage, "unqualified" here refers to "without reserve."

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				<p>project audit, and finally by the findings of five Bank supervision missions to Cartagena that reviewed the financial management of the project.</p> <p>Some audit reports lacked information specifically required by the Bank, or have pointed to minor internal control deficiencies. These issues have been addressed as part of Bank financial management supervision and successfully resolved.</p> <p>The quarterly PMRs are the basis for loan disbursements. These reports require detailed and comprehensive information on financial, physical, and procurement processes, and ACUACAR's record in preparing them is excellent. In fact, although PMRs have been replaced by simpler, more flexible Financial Monitoring Reports (FMRs), ACUACAR and the Bank have agreed to continue using the more detailed PMRs. As with the audit reports, any questions raised have been answered satisfactorily in supervision missions.</p> <p>In addition, ACUACAR has been very prudent in requesting Bank disbursements, to minimize loan costs, and in fact the project has thus far been implemented with a higher proportion of counterpart funds (and a corresponding lower portion of loan funds) than originally planned.</p> <p>In sum, the project is up to date and in compliance with requirements for maintenance of financial management systems, submission of PMRs and auditing,. Management concludes, therefore, that the project is in compliance with OP 10.02.</p>
<b>Economic Evaluation</b>				
18.	<p><b>Economic Evaluation.</b> [...]he Bank violated OP 10.04 by failing to adequately and effectively scrutinize the economic investment and environmental risk evaluations of the outfall and alternative sanitation solutions. ... Cartagena Controller Simon Herrera reported to Mayor Carlos Diaz and the public in May and June 2001 that an audit of ACUACAR and evaluation of the outfall project yielded a number of concerning gaps in the feasibility studies that provided economic and environmental rationale for the outfall. The Controller's report concluded that the project, as designed, was not an appropriate investment for the City and recommended a reconsideration of alternative solutions to the City's sanitation problems, especially those that provide for water reuse.</p>	10.04	29-30	<p><b>Comment.</b> Management takes the view that the comprehensive economic analysis carried out during project preparation is in compliance with OP 10.04. (Environmental risk is addressed in earlier response items.) This included the cost efficiency analysis in the FS and the subsequent cost-benefit analysis carried out by the Bank team and consultants.</p> <p>As part of the FS carried out by Hazen &amp; Sawyer—a firm with long experience in many countries on these topics—six wastewater disposal alternatives combining different treatment levels and final disposal sites were analyzed based on cost efficiency (among other criteria, including technical, environmental and social criteria, as documented in the PAD, Annex 9). The study entailed detailed cost efficiency analysis of each alternative, considering investment costs, investment time and operation and maintenance. The analysis concluded that the net present value cost of the outfall was about USD 35 million less than the next best alternative, land application, and about USD 60 million less than lagoons. The least cost alternative – the submarine outfall – was then further analyzed to determine the optimum location, based on economic as well as environmental criteria.</p> <p>Based on the identified best solution for wastewater disposal in the FS and the proposed design for the other project components, additional economic and financial analysis was conducted during project preparation by the consulting firm, Soluciones Integrales, and Bank staff, in order to improve project design and eliminate investments for which the estimated return was negative (see PAD, Annex 4, Cost-Benefit Analysis Summary). This analysis included a discussion of non-monetary benefits, looked at the project from the financial, economic and distributional aspects, assessed the poverty impacts and</p>

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				<p>externalities, and included a sensitivity and risk analysis.</p> <p>The evaluation estimated the net fiscal impact and stated that the cost of the project for the District of Cartagena would be significant due to future large debt service payments. A risk analysis was carried out and subprojects with negative benefits were dropped or re-designed to improve project design, and increase both net economic benefits and sustainability.</p> <p>Regarding the sources and validity of data used in the economic analysis conducted by the Bank, ACUACAR was a primary source for data, in particular for the financial analysis – an analysis carried out from the perspective of the utility. ACUACAR data was subsequently complemented with additional research, including: (i) investment cost data from the FS; (ii) a willingness-to-pay study commissioned as part of project preparation, which entailed collecting data through a household survey to derive demand estimates independent from those provided by ACUACAR; and (iii) shadow prices reflecting market distortions that were derived by Soluciones Integrales. Project financing details were discussed and confirmed with the Ministry of Finance.</p> <p>In conclusion, Management maintains that the cost effectiveness analysis carried out by Hazen &amp; Sawyer and the subsequent cost-benefit analysis carried out by Bank staff and Soluciones Integrales entailed a comprehensive cost benefit analysis in compliance with OP 10.04.</p>
<b>Project Supervision</b>				
19.	<p><b>Privatization.</b> [A] number of potential conflicts of interest and signs of corruption have clouded the legitimacy of the outfall project and the economic and environmental evaluations on which it is based. These irregularities, some of which appear to be rooted in Bank actions that date back to the 1994 creation of ACUACAR, the executing agency for the outfall project, implicate the Bank's project supervision policy, OP 13.05. For example, ACUACAR's Project Engineer for the outfall project previously served as General Manager of Cartagena's public water utility and then as Deputy Mayor under Mayor Gabriel Garcia.</p> <p>As Deputy Mayor, he, along with Bank officials, pushed for and achieved privatization of the water system. The alliances and circumstances involved in the privatization do not support the success story, as told by the Bank, of a clean transfer of public resources to private man-</p>	13.05	27	<p><b>Comments.</b> Privatization of ACUACAR did not form part of the current loan and therefore OD/OP 13.05 is not applicable. However, Management would like to emphasize that reform of the institutional framework for water and sanitation service delivery has been crucial to sustainability of water and sanitation infrastructure investments and services and sector performance has improved since the creation of ACUACAR.</p> <p>In 1993, the water utility of Cartagena was in a state of disarray, the level of services provided was unacceptable and the Mayor asked for Bank advice regarding options for institutional reform of the utility. In the framework of sector dialogue, the Bank advised incorporation of a private operator to manage and supply water and sanitation services and provided information about a range of alternatives. While the Bank did not finance the process of incorporating the private operator and was not involved in selecting the institutional model or the associated bidding process, the Bank did discuss sector reform options with the National Government and the District of Cartagena, provided a framework for considering different private sector participation options, extended technical assistance in the context of sector dialogue, and acted as a catalyst to accelerate the reform process.</p> <p>Management considers ACUACAR to be one of the best performing utilities in Latin America. Compared to the level of service in any other city in Colombia (except for Barranquilla, which underwent a similar process to that of Cartagena), Cartagena's performance has been a success story. This success story is demonstrated by the performance indicators shown in Table 1 of the main text.</p>

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20.	<p><b>ACUACAR.</b> ACUACAR now operates almost beyond any external checks on its control over: designing and executing the City's Master Water and Sewerage Plan, of which the outfall project is now the major component; evaluating bids and awarding contracts; and managing project finances. The Project Appraisal explains, for example, that ACUACAR has been the primary source of all project data, including "data regarding market demand and supply, project specifics, comprehensive cost and investment data, project financing details, expected returns, and market distortions."</p>	13.05	27-28	<p><b>Comments.</b> The arrangements for project implementation responsibilities are in compliance with standard Bank practice and OD/OP 13.05. ACUACAR is the implementing agency of the project financed under the Bank Loan, in accordance with the provisions set forth in the Project Agreement. ACUACAR executes procurement processes, signs contracts and manages project funds as part of standard implementing agency responsibilities. It strictly complies with the provisions of the Project Agreement and needs a no objection from the Bank for nearly all activities related to project execution. The Bank closely supervises the performance of ACUACAR.</p> <p>ACUACAR falls under the national regulatory framework common to all water utilities in Colombia. This includes the <i>Comisión Reguladora de Agua</i> on tariff issues and the <i>Superintendencia de Servicios Públicos</i> on performance. The President of ACUACAR is the Mayor of Cartagena, an arrangement that also provides another measure of oversight. ACUACAR and the District have signed an operation contract and the District has hired an outside expert to review ACUACAR's performance in meeting the contract obligations. Finally, ACUACAR oversight is further bolstered through the provision of information to the general public via the following channels: (i) ACUACAR's audited financial statements and Annual Reports are displayed in the Cartagena Chamber of Commerce; (ii) audited financial statements, biannual financial statements (not-audited), and quarterly PMRs are registered with the District and available to the public upon request; (iii) all information system data is provided annually to the Superintendence of Public Services, and is then summarized in the Superintendence's public reports.</p> <p>Regarding the use of ACUACAR data in project preparation, ACUACAR data was complemented with additional research, as described in the response to item 18 above.</p> <p>Because ACUACAR performs standard tasks of a project implementing agency with oversight by the Bank, Management concludes that the Bank is in compliance with OD/OP 13.05 on this issue. Moreover, ACUACAR performance is subject to oversight and regulation through the Colombia sector regulatory entities and the District, as noted above.</p>
21.	<p><b>Conflicts of Interest (Environmental Specialist).</b> The Bank has also failed to adequately address the following possible conflicts of interest between Bank officials and both ACUACAR and the local environmental licensing agency. First...World Bank Senior Environmental specialist... is related to... a manager at ACUACAR, the executing agency. Two documents we have obtained indicate that, despite statements to the contrary by [the environmental specialist... the manager] did work on aspects of the Cartagena submarine outfall project,</p>	13.05	27-28	<p><b>Comments.</b> Management has found no evidence of conflict of interest involving the previous Environmental Specialist on the Bank's project team and, accordingly, takes the view that the Bank is in compliance with OD/OP 13.05. The Environmental Specialist during project preparation is not from Cartagena, but does have family living there. The Environmental Specialist had been requested to work on the project given his expertise in environmental management of infrastructure projects and his knowledge of Cartagena. The Environmental Specialist was not involved in any procurement decisions related to the project.</p> <p>A distant relative of the Environmental Specialist (second cousin of his father) is employed by ACUACAR. Though this relative made a general presentation on ACUACAR activities related to the project, he was never involved in project execution or directly in contact with the Bank regarding matters of project implementation. Another distant relative of the Environmental Specialist (daughter of a cousin of his mother) was the Director of CARDIQUE when the request for the environmental license for the submarine outfall was submitted. However,</p>

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	including ACUACAR's community consultation effort... [The environmental specialist]... is also the cousin of... the director of the local environmental licensing agency, CARDIQUE. These connections clearly had the potential to unduly advance the outfall project.			<p>the request was under review by CARDIQUE for several years, during which time the Director left CARDIQUE and was replaced by someone else. The environmental license was not issued during her tenure, but only after she was replaced.</p> <p>Despite the lack of any link between the distant relatives of the Environmental Specialist and the project, and in order to lay to rest any perception of conflict of interest, the Environmental Specialist was replaced on the project team in 2001.</p>
22.	<p><b>Conflict of Interest (Task Manager).</b> [...]he Bank's Task Manager for the outfall project... met with officials at CARDIQUE during the time that CARDIQUE was considering the environmental license application for the outfall and offered CARDIQUE financial support for other projects. Shortly after that meeting, CARDIQUE approved the license.</p>	13.05	28	<p><b>Comments.</b> Management considers that the Bank is in compliance with OD/OP 13.05 on Supervision with regard to this claim. The Task Manager met with CARDIQUE regularly as part of project preparation and supervision activities. Appropriate supervision requires that the Task Manager assess the progress of Bank-financed activities under the project. This includes all aspects related to the realization of project funded activities—permitting and consultation processes as well as bidding on and construction of works. Approximately four years elapsed between the date of submission of the request for the outfall environmental license to its approval. Over that time period, the Task Manager met with CARDIQUE officials to discuss the project and the related license as part of regular supervision missions. Management does not find this to be a conflict of interest; on the contrary, it considers this good practice for project supervision.</p> <p>While CARDIQUE did receive financial support through the project, the Task Manager asserts that financial support was never offered in exchange for approval of the licenses and Management has found no evidence to support this claim. In fact, Bank support for CARDIQUE's institutional strengthening was foreseen in both the PAD and Loan Agreement, and, accordingly, CARDIQUE has taken part in training activities financed by the loan. There is no Bank support to CARDIQUE outside of the activities specified in the PAD.</p> <p>Based on these facts, it is Management's conclusion that the Task Manager's contacts with CARDIQUE and project support for training for CARDIQUE are in compliance with OD/OP 13.05.</p>
23.	<p><b>Pacts of Integrity.</b> The Bank has also violated OP 13.05 by failing to follow up on a promise by its Task Manager to require the borrower and ACUACAR to promote or use Pacts of Integrity with bidders on contracts awarded under the outfall project.</p> <p>The Bank shifted the burden of improving Cartagena's bidding policies to the Colombian chapter of Transparency International (TICOL). TICOL's entreaties to ACUACAR and Cartagena's Mayor to consider making Pacts of Integrity a requirement for public bidding have been met with opposition.</p>	13.05	28-29	<p><b>Comments.</b> It is Management's judgment that, with regard to this claim, the Bank is in compliance with OD/OP 13.05 on Supervision, as well as OD/OP 11.00 on Procurement. Rules governing procurement are clearly laid out in the Bank's Procurement Guidelines and in the project legal agreements.</p> <p>In support of its fight against corruption, the Vice-Presidency of the Republic of Colombia requested that the Bank agree to the involvement of Transparency for Colombia (TICOL) in supporting the procurement processes undertaken by the project. The Bank considered TICOL involvement to be a positive step in the ongoing efforts of the Government of Colombia to combat corruption and voiced no objection to the use of loan funds to finance this activity. However, the Bank only agreed to finance services of TICOL to the project; neither the Task Manager nor the Bank promised to promote Pacts of Integrity or any other methodology used by TICOL. Nor was it necessary to use methodologies (such as Pacts) that are not mandated by the procurement rules for the project already included in the negotiated procurement schedule to the Project Agreement, which is based on the Bank's Procurement Guidelines.</p>
24.	<b>Response to NGOs.</b> The patent	13.05	29	<b>Comments.</b> Management considers that the thorough consultation

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	<p>unwillingness by [the] Task Manager... to address these and other concerns raised by CCH and other community watchdog groups has been especially disturbing. Numerous requests by CCH and other local NGOs for a community meeting with the Task Manager were ignored or rejected. Even in the face of clear public dissatisfaction with and confusion about the project after its 1999 approval, [the Task Manager] deliberately avoided public contact and met exclusively with ACUACAR and City representatives... [The Task Manager] met with a select group of citizens only after the World Bank's Institutional Integrity Department initiated an investigation in 2001. Even then, however, the Bank addressed community concerns by threatening to take its money elsewhere if groups like CCH continued to delay the outfall project by bringing complaints.</p>			<p>process carried out during project preparation and continued during supervision follows good practice for Bank projects and is in compliance with OD/OP 13.05. Between 1998 and 2003, the Task Manager conducted numerous meetings with community representatives and NGOs, and participated in workshops, seminars and community meetings, in addition to the program of dissemination and consultation (see Item 8 above). These meetings included discussions with representatives of Punta Canoa, Arroyo de Piedra and Manzanillo, SIAB, as well as representatives of the association of hotel owners in the vicinity of the submarine outfall. On one of his visits to Punta Canoa, the Task Manager arranged and attended a meeting between representatives of Punta Canoa and the management of ACUACAR, in the ACUACAR offices on the site of the El Bosque water treatment plant. From September 3 to 9, 2001, a group of 23 stakeholders—comprised of the official representatives of Punta Canoa, Manzanillo and Arroyo de Piedra, along with representatives of other areas of Cartagena, representatives of NGOs and other public officials—took part in a study tour to Chile and Uruguay, to see functioning outfalls similar to the one proposed for Cartagena, obtain relevant performance data, and discuss issues with the local authorities, citizens and fishermen.</p> <p>The Bank has a record of only one request from CCH, sent via e-mail, for a meeting with the Task Manager, in Washington, on May 25, 2000. At that time the Task Manager was out of Washington and could not attend. The Executive Director of CCH requested a meeting with the Bank's Country Manager stationed in Colombia. At this meeting, which took place on November 19, 2000, it was agreed that CCH would send any written evidence of alleged wrongdoing on the part of the Task Manager and any other complaints to the Country Manager. No such evidence was ever received by the Country Manager.</p> <p>Management further confirms that at no time did Bank staff "threaten to take [the Bank's] money elsewhere."</p>
25.	<p><b>Disbursements.</b> The Bank also appears to have violated its own policy to withhold loan disbursements until a project has obtained all required licenses: it authorized disbursements to Cartagena and ACUACAR more than one year before any environmental license was approved.</p>	13.05	29	<p><b>Comments.</b> Disbursements made for the project prior to environmental licensing do not constitute an infringement of Bank policy. Management notes that the Bank does not have a policy that requires all relevant licenses to be obtained prior to loan disbursements. Neither are there any conditions in the Loan Agreement for the project to this effect.</p> <p>In addition, Management notes that only three of the project's components (C, D and E) required an environmental license, whereas the disbursements in question were made for activities under Components A (Expansion of the Cartagena Water Supply System) and B (Expansion of the Sewerage System in the Cienaga Basin), for which permits were received from CARDIQUE during project preparation, in advance of disbursements.</p>
<b>Poverty Reduction</b>				
26.	<p><b>Impact on Poor Communities.</b> The Bank's failure to effectively scrutinize [reports from Cartagena's Controller, the City's Outfall Commission and SIAB] also implicates OD 4.15, its directive on poverty reduction. Although the project is intended</p>	4.15	31	<p><b>Comments.</b> Management takes the view that the project is in compliance with OD 4.15 on poverty. The EA, the POE review, and assessment by the Government of Colombia and the Bank all concluded that the risk of environmental damage from the outfall would be minimal. There is no evidence that the outfall will interrupt the economic activity of fishermen from Punta Canoa, Arroyo de Piedra and Manzanillo. Moreover, the three villages will benefit and economic activities in the larger also should benefit from the project for the following</p>

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	<p>to bring water and sanitation services and environmental benefits to some of the city's poorest communities, the deficient alternatives analysis and risk assessment fail to account for potential negative impacts on the poor both within and outside the district that will be served by the outfall... It is very unlikely that the submarine outfall project is the kind of "sustainable, high return project" that OD 4.15 indicates the Bank will support.</p>			<p>reasons: (i) the new wastewater disposal system will reduce contamination of Cartagena's beaches, Cartagena Bay and the Ciénaga de la Virgen; (ii) the project will provide water and most probably sanitation services to the three villages;<sup>3</sup> (iii) the project provides support for community development and organization; and (iv) the improvement in the environment due to better wastewater disposal will help bolster tourism in the area, creating jobs and economic opportunities.</p> <p>Both the technical design of the project and the monitoring program will ensure that fishing and tourism in the North Zone will not be impacted. Potential social impacts may result from increased land values and possible pressures on households that do not have title, which is less of an issue in the North Zone than in the southeast area of Cartagena. The Social Impact Mitigation and Community Development Program incorporates activities to strengthen community organizations and participation in a program of land regularization. A Community Leaders Network has been established to this purpose.</p> <p>The project will bring poverty reduction benefits to a large share of Cartagena's poor, with negligible negative impacts. In assessing the poverty impacts, Management wishes to emphasize the importance of considering beneficiaries throughout the project area, rather than solely the three communities referenced in the Request. Moreover, in terms of health and poverty impacts, the project is consistent with the approach laid out in the World Bank Environment Strategy for Latin America and the Caribbean (<a href="http://lnweb18.worldbank.org/ESSD/envext.nsf/41ByDocName/LatinAmericaandtheCaribbeanEnvironmentStrategy333KBPDF/\$FILE/LACEnvStrategy2001.pdf">http://lnweb18.worldbank.org/ESSD/envext.nsf/41ByDocName/LatinAmericaandtheCaribbeanEnvironmentStrategy333KBPDF/\$FILE/LACEnvStrategy2001.pdf</a>), which prioritizes access to safe water and improving collection and disposal of wastewater, in conjunction with future plans for wastewater treatment.</p> <p>As outlined in the PAD (section C3, page 9) the project aims to bring public health benefits in terms of sanitation services especially to the city's poor and marginal areas. In the city's poorest neighborhoods (San Jose de Los Campanos, El Pozón, Villa Estrella, La Boquilla, Paseo Bolívar, Zona Suroccidental and Zona Suroriental sub-basins, which currently discharge their sewage to the Ciénaga), approximately 80,000 people will directly benefit from project investments in increased sewerage and water supply coverage. The project will also improve overall standards of living in the city, especially in poor neighborhoods around the Ciénaga, and reduce urban pollution city-wide.</p> <p>As a result of high immigration to the city of poor population from other parts of Colombia, 84 percent of the fixed population of Cartagena, or 700,000 people, are of low and medium-low income, 31 percent of these people are extremely poor. Most of the investments undertaken by ACUACAR using loan proceeds and other financing sources have benefited the poor. The coverage of water and sewerage services went up from 88 percent and 70 percent to 95 percent and 75 percent, respectively, since the project started. Before the end of 2004, sewerage coverage will reach 95 percent. These service improvements have not been accompanied by water or</p>

<sup>3</sup> While water services to the North Zone were a condition in the project Legal Agreements, sanitation services were not due to lack of financing. However, to date bidding for project works and activities indicates the likelihood of considerable cost savings in Components C, D, and E. It is the intention of the project counterparts to use these additional project funds to extend sewerage services to the North Zone.

No.	Claim/Issue	OD/ OP/BP	Req. Page #	Response
				<p>sewerage tariff increases.</p> <p>The expansion of services to poor neighborhoods benefits the poor by significantly contributing to reducing family expenses for water. Monthly water expenses of the poor population not connected to the public water network are 10 to 50 times higher than those of the connected population. In addition, after paying a significant amount of their income to purchase water, the non-connected poor receive insufficient quantities of mostly contaminated water, which has a negative impact on their health.</p> <p>As to sewerage, in poor neighborhoods raw wastewater flows in open canals in the streets, even in many areas where sewerage networks have already been installed, because it is not possible to use these networks until the submarine outfall starts functioning. Once the sewerage systems begin to function, the standard of living of the residents of poor neighborhoods will significantly improve and upgrading of other neighborhood infrastructure is anticipated.</p> <p>These benefits will not come at the cost of poverty reduction and environmental impacts in the three villages near the outfall site as stated in the Request. To the contrary, based on analytical work prepared for the project, Management concludes that the risk of environmental damage to the three villages is minimal and the project contains targeted interventions that will clearly benefit these groups.</p>
<b>Other Issues</b>				
27.	<p><b>Previous Complaints.</b> We, Corporación Cartagena Honesta, and the residents we represent have complained to World Bank officials on numerous occasions over the past five years about the policy violations described above. We have consistently communicated and thoroughly documented our allegations of project irregularities and Bank wrongdoing and have requested that the Bank ensure more transparent and accountable management of Cartagena's financial and environmental resources... After bringing our concerns and detailed evidence directly to World Bank President James Wolfensohn in August 2001, the World Bank initiated an investigation through its Institutional Integrity Department and sent a two-person team to Cartagena. Although the Bank has refused to respond directly to our inquiries as to the status and outcome of this investigation, we believe it continued for nearly two years before being terminated with an official finding of no wrongdoing.</p>	n.a.	31-32	<p><b>Comments.</b> Management notes that CCH has written many times to the Bank over the past five years. These letters have been addressed to the Task Manager, to staff in other departments of the Bank and to the Bank's President. In reviewing the correspondence, Management notes that all letters were answered in a timely fashion.</p> <p>Management knows of only one letter in addition to those provided by the Requesters as Exhibits. This letter from CCH to the Bank (received on July 1, 1999) requested materials related to the project. The letter was promptly replied to on July 6, 1999 and materials available at that time were provided. The Bank has no evidence of further records in response to the information request (see Annex 14).</p> <p>With regard to allegations of irregularities, Management has reviewed this claim with Bank staff in the Department of Institutional Integrity (INT), which is responsible for handling allegations of misconduct against Bank staff. INT does not review allegations of violations of the Bank's operational policies but focuses only on whether individual staff members may have committed misconduct, as defined in the Bank's Staff Rules, Staff Rule 8.01. Because staff misconduct issues are personnel matters and not operational ones, they are wholly within the purview of INT and may be appealed ultimately to the World Bank Administrative Tribunal. Therefore, such matters are not within the scope of the investigation by the Panel.</p>

No.	Claim/Issue	OD/ OP/BP	Req. Page #	Response
	<p>We do know, however, that the project is currently moving towards the construction and implementation phases without any institutional or substantive corrective measures having been taken. We are emphatically not satisfied with the responses and explanations we have received from the Bank.</p>			
28.	<p><b>Investigation.</b></p> <ul style="list-style-type: none"> <li>- We ... request that the Bank stop disbursing funds to this project until an investigation [by the Inspection Panel] has been completed and an appropriate remedy adopted.</li> <li>- Additionally, we request the opportunity to submit recommendations on and otherwise actively participate in the formulation of any remedial measures taken by the Bank.</li> <li>- Finally, we ask that any proposals made by Bank management as a result of an investigation require full and honest consultation with all affected communities.</li> </ul>	n.a.	38	<p><b>Comments.</b> Management finds no grounds to stop loan disbursements at this point. Suspension of disbursements is covered by OP/BP 13.40. The Bank determines case by case whether to suspend disbursements for events that are unrelated to payment. Most, but not all, suspensions that are unrelated to payment occur because a borrower or other contracting party fails to carry out covenants under a Loan, Project, or other relevant Agreement. During the course of an Inspection Panel case, the Bank does not stop disbursing funds because of the case. The mere fact that a Request has been brought before the Panel in no way implies that there exists a proven violation of legal covenants by the borrower or the implementing agency that would merit consideration by Management of a disbursement suspension remedy.</p> <p>The Requesters will have the opportunity to discuss their recommendations with the Inspection Panel. During the eligibility phase of an Inspection Panel Request, the Panel usually visits the country and meets with the Requesters, as part of determining the eligibility of the Request. Should the case proceed to the investigation phase, the Requesters will have an additional opportunity to present their views to the Panel. In response to any findings of the Panel following its investigation, the Bank will consult with concerned parties in the preparation, if needed, of a management action plan.</p>

**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 2.**  
**Panel of Experts**  
**Summary of Qualifications**



**BRIEF BIOGRAPHICAL SUMMARIES  
OF THE MEMBERS OF THE  
PANEL OF EXPERTS**

I. **Prof. Daniel A. Okun:** Environmental Engineer (water supply and sanitation specialist)

Mr. Okun is one of the preeminent environmental engineers in the world. Currently the Kenan Professor of Environmental Engineering and Consultant in Environmental Engineering Emeritus at the University of North Carolina (1982-present), Mr. Okun has an extensive background in research, teaching and consulting on primarily water supply and sanitation issues. He holds over 43 honorary positions, has received nearly 40 honors or awards in his field, is a member of 22 professional societies, has consulted on over one hundred assignments all over the world in wastewater management and water supply, and has published several hundred papers and books on various related topics. Mr. Okun was a key member of the POE during the feasibility stage, tapping his extensive experience and technical expertise to advise on the selection of alternatives.

II. **Dr. Emanuel Idelovitch:** Sanitary/Environmental Engineer (water supply & wastewater management specialist)

Dr. Idelovitch has more than 30 years of world-wide experience in a variety of water and wastewater-related projects. Mr. Idelovitch was in charge or involved in all stages of project planning and implementation during his tenure at Tahal Consulting Engineers, Ltd. (1964-1986), The World Bank LAC region (Senior Sanitary Engineer, 1986-1994), and as an independent consultant to the Inter-American Development Bank, World Bank and many private companies (1995 to present, as well as other periods while at Tahal), including: country-wide and regional sector studies, master plans, feasibility studies, general planning, design, supervision of construction, operation and maintenance, rehabilitation, contract management, research, financing, institutional development and private sector participation in the provision of water supply and sewerage services. Mr. Idelovitch has also provided training and served as a professor in subjects related to wastewater treatment and reuse, as well as private sector participation in water supply and sewerage. For the POE, Mr. Idelovitch was asked to provide a wide view from his extensive wastewater management experience on the selection of alternatives during the feasibility stage.

III. **Dr. Phillip J. W. Roberts:** Civil/Environmental Engineer (outfall modeling specialist)

Dr. Roberts is currently a professor of civil and environmental engineering at Georgia Tech University, and is a recognized authority on the fluid mechanics of outfall diffuser mixing and the development and application of mathematical models of wastewater fate and transport. He has extensive international experience in marine waste disposal including the design of ocean outfalls, review of schemes, numerical modeling, and oceanographic fieldwork program design and data interpretation. His mathematical

models and methods have been adopted by the U.S. EPA and are widely used. He is a regular lecturer at the EPA Mixing Zone Workshops on the use of mathematical models and on outfall design for the Pan American Health Organization. He conducts research on diffuser mixing processes and has published extensively in this area. For this research he was awarded the Collingwood Prize of ASCE in 1980, and was UPS Foundation Visiting Professor at Stanford University in 1993-94. Dr. Roberts has also lectured widely on outfall design around the world and is presently Co-Chairman of the Specialist Group on Marine Wastewater Disposal, International Water Association, London. He was also responsible for the physical modeling of dilution for the Boston tunneled outfall diffuser. This outfall was commissioned in September 2000 and is the world's largest. For the purposes of the POE, Dr. Roberts reviewed and provided comments on the feasibility study and selection of alternatives, as well as technical inputs and expert advice on the design of the submarine outfall.

IV. **Dr. Fernando Troyano:** Civil Engineer (water supply and wastewater management specialist)

Dr. Troyano has forty years experience in field of water supply and wastewater management. Through his extensive experience as a public servant managing water supply and sanitation systems in his native Spain, as well as an international consultant for private companies and multilateral lending institutions, Dr. Troyano has developed an expertise in the design and operation of water supply and sanitation systems. Drawing on his extensive experience in designing and operating wastewater management systems in particular, Dr. Troyano served as a key member of the POE during the Feasibility stage, reviewing and providing comments on the set of alternatives.

V. **Mr. William Hirvela:** Construction Engineer (Nearshore and Offshore specialist)

Mr. Hirvela is a construction engineer with 45 years of engineering and supervisory experience in nearshore and offshore construction. He worked for 17 years for Morrison-Knudson Corporation (MK) as the Manager of Marine Engineering, where he was project manager for, among many other projects, a submarine pipe complex for Chevron Oil at Gaviata, California and a San Francisco Outfall Project. Previously, Mr. Hirvela worked for Santa Fe International, J.H. Pomeroy, Inc., and Ben C. Gerwick, Inc. on numerous outfall projects around the world. Among the many projects, Mr. Hirvela managed the construction of submarine pipelines in Alaska, Indonesia and Singapore, offshore facilities in the Java Sea, and the installation of four 56 inch submarine pipelines at Kharg Island, Iran. Retired from MK in 1995, Mr. Hirvela has continued to consult on major marine construction projects, including bridge construction in Canada, Sweden and Denmark. For the Panel of Experts (POE), Mr. Hirvela was relied upon to review and comment on the options identified in the feasibility study, as well as to provide technical input during the design stage of the marine outfall.

**VI. Mr. Joseph V. Perrone:** Civil Engineer (submarine outfall construction specialist)

For over 20 years, Mr. Perrone has worked extensively in the area of marine engineering, and specifically the planning and design of ocean outfall and seabed structures. He has been involved in all phases of ocean outfall development, including feasibility studies and design for outfall projects in several countries, including Australia, the United States, China (including Hong Kong), Singapore, Argentina and Colombia. Particular areas of expertise include: (i) planning, design and construction management of marine outfalls and subsea structures; (ii) development of testing procedures and performance specifications for corrosion, abrasion and biofouling resistant materials for the marine environment; (iii) development of design criteria and performance requirements for marine pipelines and subsea structures; (iv) hydraulics of ocean outfalls, diffusers and intakes; (v) marine investigations including interpretation of oceanographic and environmental data for engineering design; (vi) specifications for materials and workmanship for marine facilities; and (vii) construction management and inspection of marine engineering facilities. For the POE, Mr. Perrone was involved both in reviewing and commenting on the selection of alternatives during the feasibility stage, as well as in providing technical inputs and expert advice on the final design of the marine outfall.

**VII. Mr. James Thomson:** Construction Engineer

Mr. Thomson has worked professionally in the construction industry for over 40 years, and has held senior posts in North America, the U.K. and abroad. His experience has been mainly as a construction contractor, project management specialist and consulting engineer. Since 1979, Mr. Thomson has been the Chairman of Jason Consultants, a leading international consulting firm for underground infrastructure. Mr. Thomson is acknowledged as an authority on the design and installation both for new works and the rehabilitation of pipes, cables and underground structures. In particular, he is a recognized authority with specialist expertise in pipeline installation, tunneling and trenchless techniques (which he pioneered). Mr. Thomson has managed underground infrastructure projects ranging from research and development, through engineering and design, to analyzing the economic and marketing potential of various systems produced in the world. He has also written more than 80 technical papers and lectured to engineering groups and learned societies in many countries. For the POE, Mr. Thomson provided technical input and expert advice on the design of the outfall, focusing primarily on selection of pipes and installation.

**VIII. Mr. Alejandro Alberto Labbe:** Civil Engineer (submarine outfalls specialist)

Mr. Labbe has over 23 years experience as a civil engineer with a focus on wastewater management, and in particular, the design and construction of submarine outfalls. Dating back to Jan. 1986, Mr. Labbe has been the Engineering Manager for at least five outfall projects in Latin America. Most recently, as Engineering and Project Manager of CASCAL S.A., Mr. Labbe has provided special expertise in the elaboration of the following studies and pre-projects: (i) pre-project of preliminary treatment plants and

submarine outfalls of Lota, San Vicente, Mejillones and Tocopilla; (ii) Pre-project of the preliminary treatment plant and sea outfall of Puerto Montt; and (iii) preliminary treatment plant and sea outfall of Mar de Plata. Mr. Labbe joined the project's POE during the submarine outfall design phase, and provided technical oversight as to the design of the outfalls, and in particular the use of high density polyethylene pipes.

**IX. Dr. Calvin C. Patterson:** Sanitary/Environmental Engineer (wastewater treatment specialist)

Dr. Patterson has over thirty years experience working as managing or consulting engineers on a wide range of wastewater treatment plant and sewer system design and construction projects. He has project management experience in planning, design, treatability studies and construction of municipal and industrial water and wastewater treatment plants, collection, disposal and distribution systems. Over the course of his career, Dr. Patterson has served as project manager and design engineer for sixteen municipal wastewater plants, several of which included sludge processing and disposal facilities, in many areas throughout the United States, Chile and Peru. Dr. Patterson has also been a university associate professor in civil engineering, has multiple professional associations with prominent engineering and water works groups, and has been published in 13 journals or other publications. For the purposes of the POE, Dr. Patterson was asked to provide technical input and expert advice on the final design for the wastewater treatment facility to be constructed in conjunction with the outfall.

**COLOMBIA  
CARTAGENA WATER SUPPLY, SEWERAGE AND  
ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 3.  
“Dilution Modeling for the Cartagena Ocean Outfall”  
Philip J. Roberts, 2003  
and  
“Additional Water Quality Modeling for the Cartagena Ocean Outfall”  
Philip J. Roberts, 2004**



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**PHILIP J.W. ROBERTS, PhD, PE**  
**CONSULTING ENGINEER**  
**ATLANTA • GEORGIA • USA**

# Dilution Modeling for the Cartagena Ocean Outfall

Prepared for  
Aguas de Cartagena

October 31, 2003

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## EXECUTIVE SUMMARY

Mathematical modeling of the fate and transport of wastewater to be discharged from a proposed outfall at Cartagena, Colombia, is reported. The proposed outfall extends about 2.85 km from shore and discharges into water about 20 m deep. Extensive measurements of currents, temperature, salinity, waves, and tidal height have been made in the coastal waters around the proposed diffuser site. These data constitute an unusually extensive data set for an outfall project, including an almost continuous record of currents extending for nearly four years.

The data shows the proposed outfall location to be favorable to marine wastewater discharge. Currents are consistent and generally fast, which will result in efficient and rapid mixing near the diffuser with high initial dilutions. Because of the high dilutions, the plume should not be visible when it surfaces. Onshore currents are slow and more variable, resulting in little probability of the plume coming to shore.

Extensive mathematical modeling of the wastewater behavior was done using the measured oceanographic data. About 35,000 simulations of near field mixing and dilution and transport in the far field were done at one hour intervals for the data duration of almost four years.

Near field plume behavior was predicted by the mathematical model NRFIELD. The density stratification is generally weak, so the plume will surface most of the time. Because of the strong ocean currents and orientation of the diffuser perpendicular to the major current axis, initial dilutions will be high. The median predicted near field dilution is around 250, and maximum almost 1000. These dilutions are usually attained within 100 m from the diffuser. Although some minimum dilutions less than 100 were predicted, these are not significant as they occur only infrequently. Because of the high initial dilutions, adverse environmental effects, for example from toxics, near the diffuser will be minimal. Although the diffuser design and discharge depth could be modified to ensure minimum dilutions exceeding 100 at all times, this is not necessary as it would result in little improvements in water quality.

The far field simulations were done using the mathematical model FRFIELD. FRFIELD is coupled to the near field model and uses the current meter data to predict the spatial variations of the frequency of exceedence of various bacterial levels around the diffuser. The results were compared to the standards of the California Ocean Plan and local criteria. It was predicted that the bathing water standards will be met at least 2 km from shore, and so should be met at the beaches with a large margin of safety. Transport of the plume to shore is highly unlikely. Should it occur, the combination of high initial dilution, oceanic diffusion, and bacterial decay will reduce the bacteria to low levels.

While the outfall could, in theory, be lengthened so that the probability of onshore transport is zero, this would require an unrealistically long outfall with a considerable

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increase in cost. Any improvement in shoreline water quality would be negligible. The outfall design would then be based on isolated extreme events. This is not the usual design method, and is not recommended.

The modeling limitations were discussed. Because of modeling uncertainties and limitations in the oceanographic data, it was recommended that a monitoring program be initiated to confirm the outfall performance and to monitor any environmental changes, especially at the shoreline. The monitoring program should begin before discharge commences and continue afterwards.

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## 1. INTRODUCTION

### 1.1 Background

An ocean outfall has been proposed as the best option for discharge of wastewater from the City of Cartagena, Colombia. A sketch of the proposed outfall and sewerage system is shown in Figure 1. Based on mathematical modeling and analyses carried out by the engineering consultant, Hazen and Sawyer, it was recommended that the outfall should be situated near Punta Canoa. The outfall is about 2.85 km long and terminates in a diffuser that discharges the wastewater at a depth of about 20 m. The objective of the diffuser is to cause rapid and efficient mixing of the wastewater so that the concentrations of any pollutants are quickly reduced to very low levels with minimal environmental impact. The outfall and diffuser are positioned so that the probability of effluent being transported to shore is very small. Should any transport of effluent to shore occur, the combination of initial dilution, turbulent diffusion in the ocean, and bacterial mortality will reduce concentrations of bacteria to low levels, ensuring compliance with water quality and bathing water requirements. The environmental criteria include requirements for initial dilution and shoreline bacteria levels. To ensure that these requirements would be met, extensive oceanographic data were gathered and used in mathematical modeling of the fate and transport of the discharged wastewater. The oceanographic data, the mathematical models, and the modeling results are described in this report.



Figure 1. Cartagena Outfall and Sewerage System

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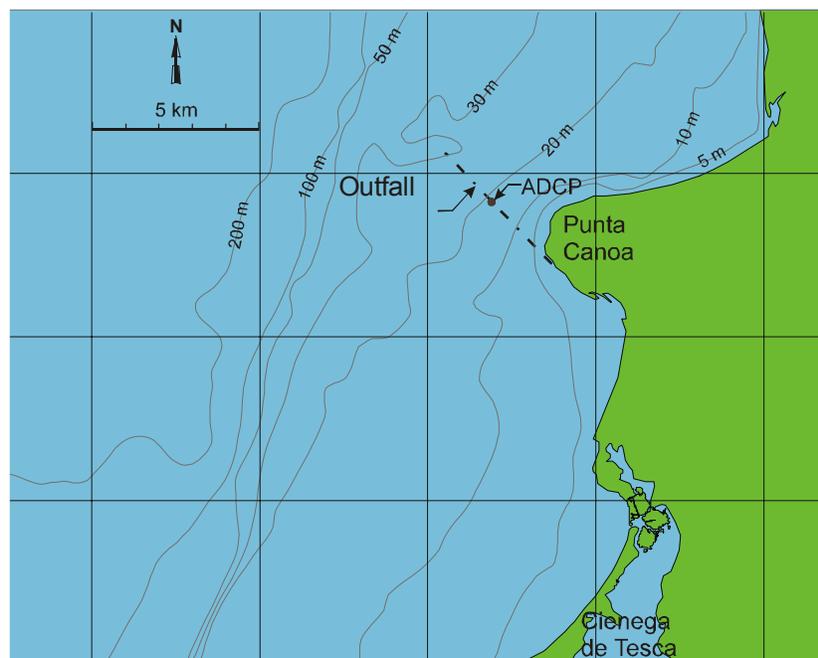
## 2. OCEANOGRAPHIC CONDITIONS

### 2.1 Introduction

Extensive measurements of currents, temperature, salinity, waves, and tidal height have been made in the coastal waters around the proposed diffuser site by the engineering consultant. The data, which were obtained by moored instruments and by boat, are described in Hazen and Sawyer (2003). The most important oceanographic parameters that determine the wastewater mixing and transport are current speed and direction and variation of seawater density through the water column. The measurements of these parameters and their implications are discussed below.

### 2.2 Currents

Currents were measured from January 1998 to August 2002 by an Acoustic Doppler Current Profiler (ADCP) moored at the site shown in Figure 2. The mooring site was located in 17.7 m water depth, about 2.5 km from Punta Cana. The ADCP, an RDI 1200 kHz, measured the speed and direction of currents in six bins of 3 m height through the water column; the bins ranged from heights of 5.3 to 23.7 m above the seabed. The top bins were often above the water surface and were not judged to be reliable, so only the bottom four bins, ranging from heights of 5.3 to 14.3 m (depths of 3.4 to 12.4 m) were used. The ADCP took measurements every 20 seconds which were averaged over 15 minute intervals for a total of approximately 135,000 current profiles.



**Figure 2. Bathymetry and ADCP Mooring Location**

The ADCP was deployed on three occasions for a total duration of almost four years, as indicated in Table 1. Deployment 3 is a remarkably long continuous record of more than two years. For the purpose of discussing the data in approximately one-year long segments, Deployment 3 is subdivided into two parts, labeled 3a and 3b.

**Table 1. ADCP Deployment Periods**

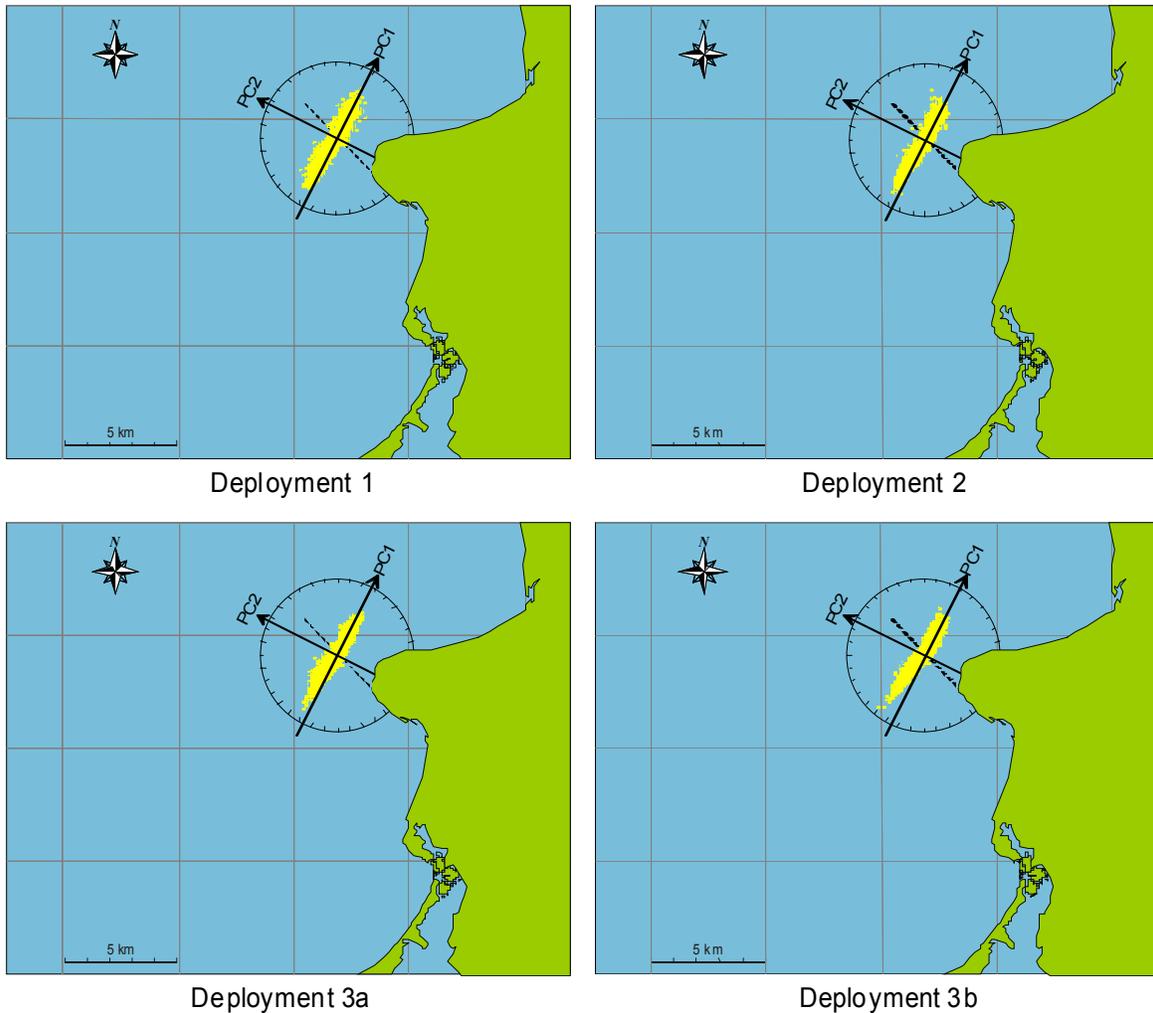
Deployment number	Start date	End date	Duration (days)
1	January 1, 1998	February 12, 1999	407
2	November 8, 1999	August 1, 2000	267
3	August 15, 2000	August 17, 2002	732
3a	August 15, 2000	August 15, 2001	365
3b	August 15, 2001	August 17, 2002	367
Total number of days			1,406

Polar scatter diagrams of the currents for the four deployments are shown in Figure 3. The currents have a strongly preferred direction along an axis running approximately NNE/SSW. In order to investigate this further, the principal axes of the currents were computed. These are the axes that maximize and minimize the kinetic energy, or variance, of the currents when projected onto them. The axis that maximizes the energy is the first principal axis, and the component of the currents along this axis is the first principal component; the axis that minimizes the energy is the second principal axis, and the component of the currents along this axis is the second principal component. The first and second principal axes are orthogonal. These axes are shown and labeled as PC1 and PC2 in Figure 3. The average direction of PC1 is 26.5°N. A summary of the current statistics is given in Table 2

**Table 2. Summary of Current Speed Statistics**

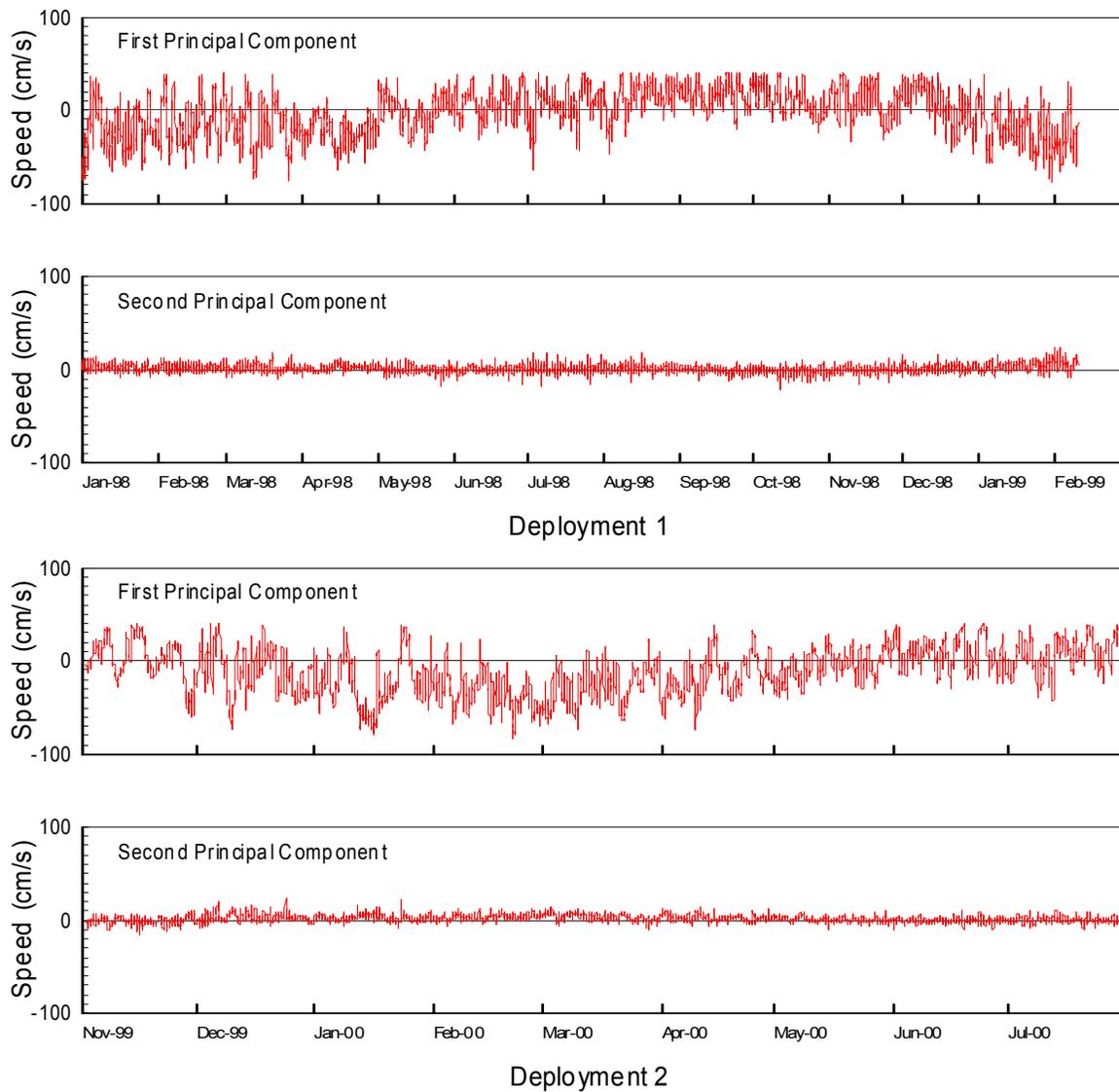
	Deployment			
	1	2	3a	3b
Minimum:	0.1	0.1	0.0	0.0
Maximum:	78.1	88.8	89.7	97.6
Average:	20.0	22.5	20.2	21.0
10th Percentile:	4.2	4.9	4.3	4.4
50th Percentile:	17.3	18.5	17.5	18.4
90th Percentile:	39.8	46.0	40.3	41.2

\*All speeds in cm/s



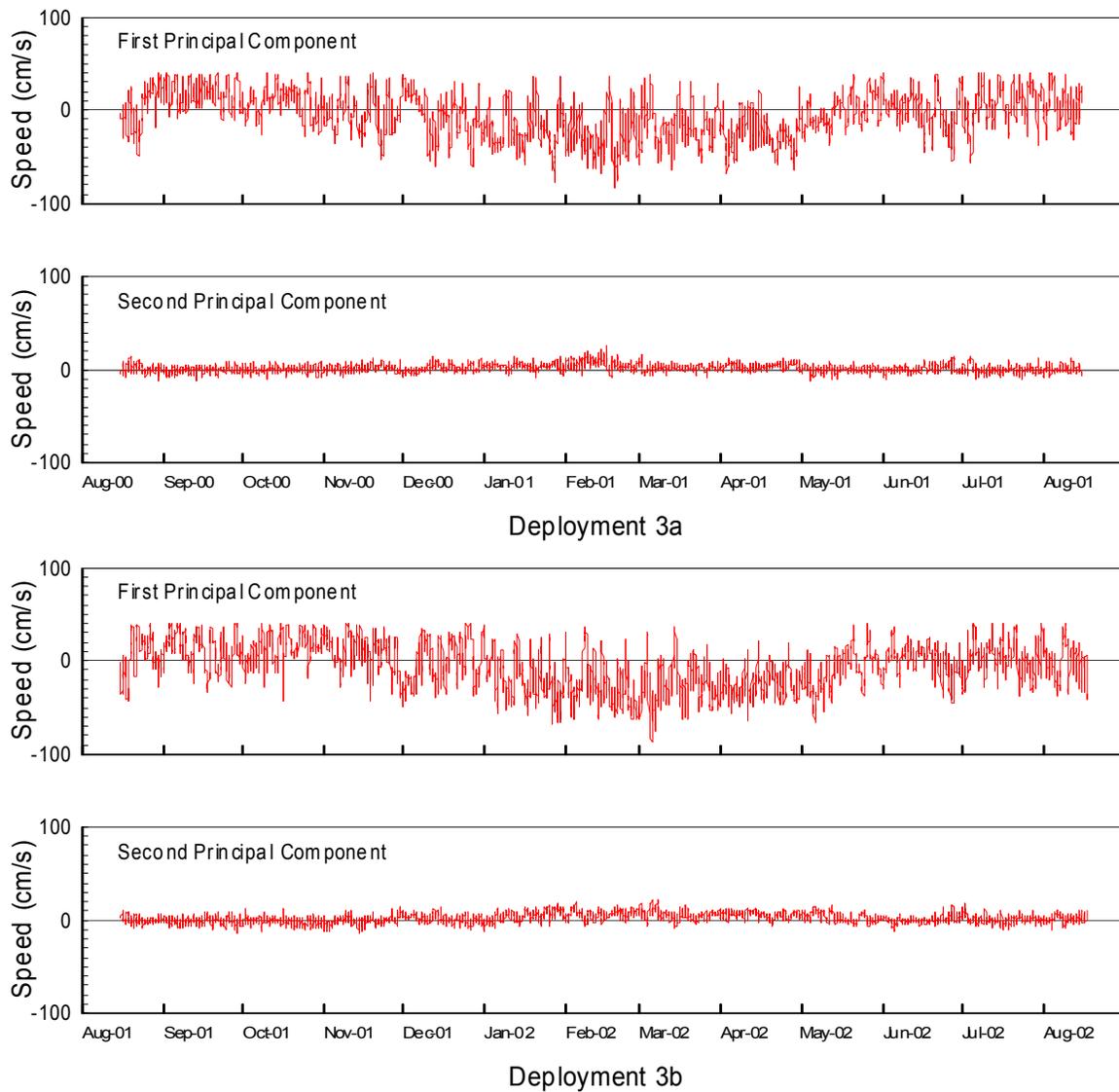
**Figure 3. Polar Scatter Diagrams for the Four Deployment Periods**

Time series of the first and second principal components are shown in Figures 4 and 5. As indicated on Figure 3, the positive direction of PC1 is towards  $26.5^{\circ}\text{N}$  and of PC2 is towards  $296.5^{\circ}\text{N}$ . The currents have a strongly preferred direction along the first principal axis. The second principal component is much weaker than the first, and has a more randomly variable direction. The variation of current properties with depth is discussed in Hazen and Sawyer (2003). The currents flow in predominantly the same direction over the depth, especially the deeper currents which are very uniform in direction. Nearer to the surface, the Northerly flowing currents are shifted somewhat counterclockwise. Speeds decrease slightly with depth from peaks of around 85 cm/s near the surface to about 65 cm/s near the bottom.



**Figure 4. Principal Components of Currents for Deployments 3a and 3b**

There is little difference between the four deployments although the currents show a reasonable variability. Average speeds for each deployment are about 20 cm/s, with median values around 18 cm/s, and the 10 and 90 percentile values are about 5 cm/s and 40 cm/s respectively. Speeds are generally high throughout the year with monthly averages ranging from about 14 cm/s in June up to 33 cm/s in February. From January to early May, the currents are strong and flow predominantly towards the SES with occasional flows to the NWN. Around early May, the current regime switches, and the direction becomes more Northerly, with oscillations to the SES. The average velocity vector during January - May is about 15 cm/s to the SES at  $210^{\circ}\text{N}$ , and during June to December about 11 cm/s to the NWN at  $26^{\circ}\text{N}$ . On an annual basis, these two currents almost cancel each other out, leading to a net average velocity close to zero. Maximum



**Figure 5. Principal Components of Currents for Deployments 3a and 3b**

speeds varied from 60 cm/s in October up to almost 100 cm/s in March. The months of December to April have speeds faster than average and May to November slower than average.

Energy spectra of the currents show peaks at semidiurnal, diurnal, and sub-inertial frequencies. Their relative magnitudes vary with depth as well as time through the year. The semidiurnal peak, caused by semidiurnal tide components, was the least important, although close to the bottom its magnitude is comparable to the diurnal peak. The semidiurnal peak remained relatively constant through the year. The diurnal peak varied through the year. Although the diurnal astronomic tide compounds the tidal oscillation at this location, this variable behavior seems to be also influenced by the sea-breeze

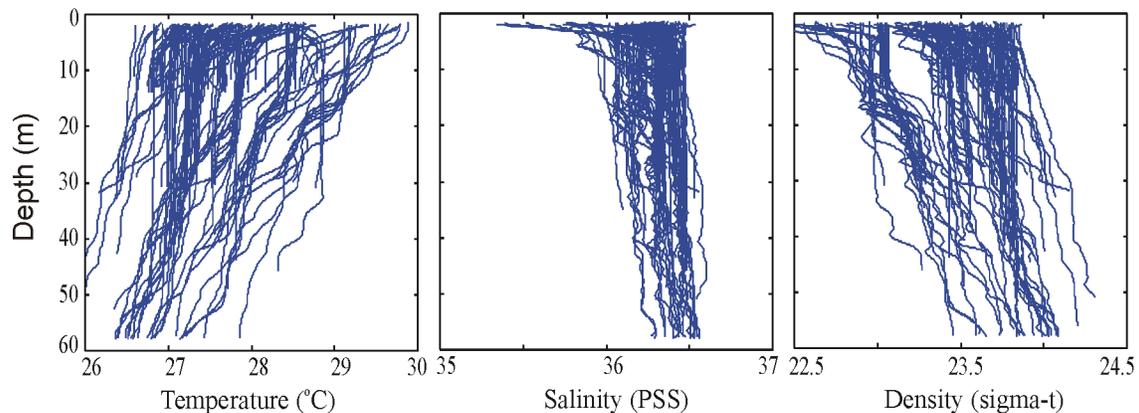
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component of the winds as the rotary cross spectrum between wind and currents showed good correlation at the diurnal frequency. The sub-inertial period energy decreased with depth for the whole year. Tidal height measurements are given in the Final Report of the Oceanographic Program, Hazen and Sawyer, October 199. The fluctuations are small, generally less than 45 cm, and so do not contribute significantly to the currents.

### 2.3 Density Stratification

Density stratification, the variation of seawater density with depth, is very important to wastewater plume behavior. A strong stratification can trap the plume below the water surface, and can limit initial mixing and dilution.

Density stratification was measured with a profiling instrument deployed from a boat at various locations off the Cartagena coast. The sampling was concentrated around Punta Canoa and at the proposed outfall site. The instrument consisted of STD (salinity, density, depth) probes lowered repeatedly through the water column. Readings were taken continuously from surface to bottom. Profiles were obtained at depths up to 60 m, and distances up to 13 km from the coast. 188 profiles were obtained from 23 January 1998 to 25 June 1998. The profiles are presented in the Final Report of the Oceanographic Program, Hazen and Sawyer, October 1998 and are shown in Figure 6.



**Figure 6. Temperature, Salinity, and Density Profiles**

The stratification is generally weak. Density differences over the water column (up to 60 m deep) typically vary from zero (i.e. homogeneous or well-mixed) up to 1  $\sigma_t$ -units (a  $\sigma_t$ -unit is a density difference of 1 g/cm<sup>3</sup> or 1 kg/m<sup>3</sup>). The density stratification is mainly due to temperature variations although a thin layer of lower salinity water was often observed near the surface. Stratification is weaker in winter (0.3  $\sigma_t$ -units) and somewhat stronger in summer (1.8  $\sigma_t$ -units) during June, August, and September.

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In order to obtain additional, continuous stratification measurements, a thermistor string was installed near the diffuser site on November 1, 1999. The string consisted of a series of thermistors mounted on a stainless steel cable with a concrete anchor and a buoy. The string was installed in 20 m water depth. Five thermistors were mounted at intervals of about 3 meters. The instruments were Seabird SBE that have an accuracy of 0.002°C and a resolution of 0.0001°C; readings were obtained at 15-minute intervals. The string was deployed twice, from November 1999 to August 2002. Data was obtained from November 1, 1999 to August 2, 2000, and from August 3, 2000 until the buoy was damaged on June 22, 2001. Also, during the second period, only three probes were operational.

The temperature data are shown in Figure 7. The traces are so close as to be often indistinguishable as there are only small temperature differences between the surface (5 m) and the bottom (17 m). Because it is the temperature difference over the water column that most affects plume behavior, the temperature difference between the top (5 m) and bottom (17 m) probes are shown in Figure 8. The data shows a relatively constant temperature through the water column during most of the year. The water column is frequently homogeneous, i.e. well-mixed over depth. Nevertheless the temperature data confirms that the potential for stratification exists during the summer months of May to September. During this period, the temperature differences vary up to a maximum of two degrees Celsius but are usually much less.

## **2.4 Discussion**

The oceanography of the proposed outfall site is favorable for marine wastewater discharge. Currents in the vicinity of the proposed diffuser are generally quite fast, which should result in efficient and rapid mixing near the diffuser and high initial dilutions. Density stratifications are generally weak, indicating that the plume will usually reach the surface. These implications are explored further below. The extensive data base shows that the design criteria used during the feasibility study were conservative and the impacts to the marine environment associated with the discharge smaller than previously assumed. These impacts are the subject of detailed modeling in the following sections.

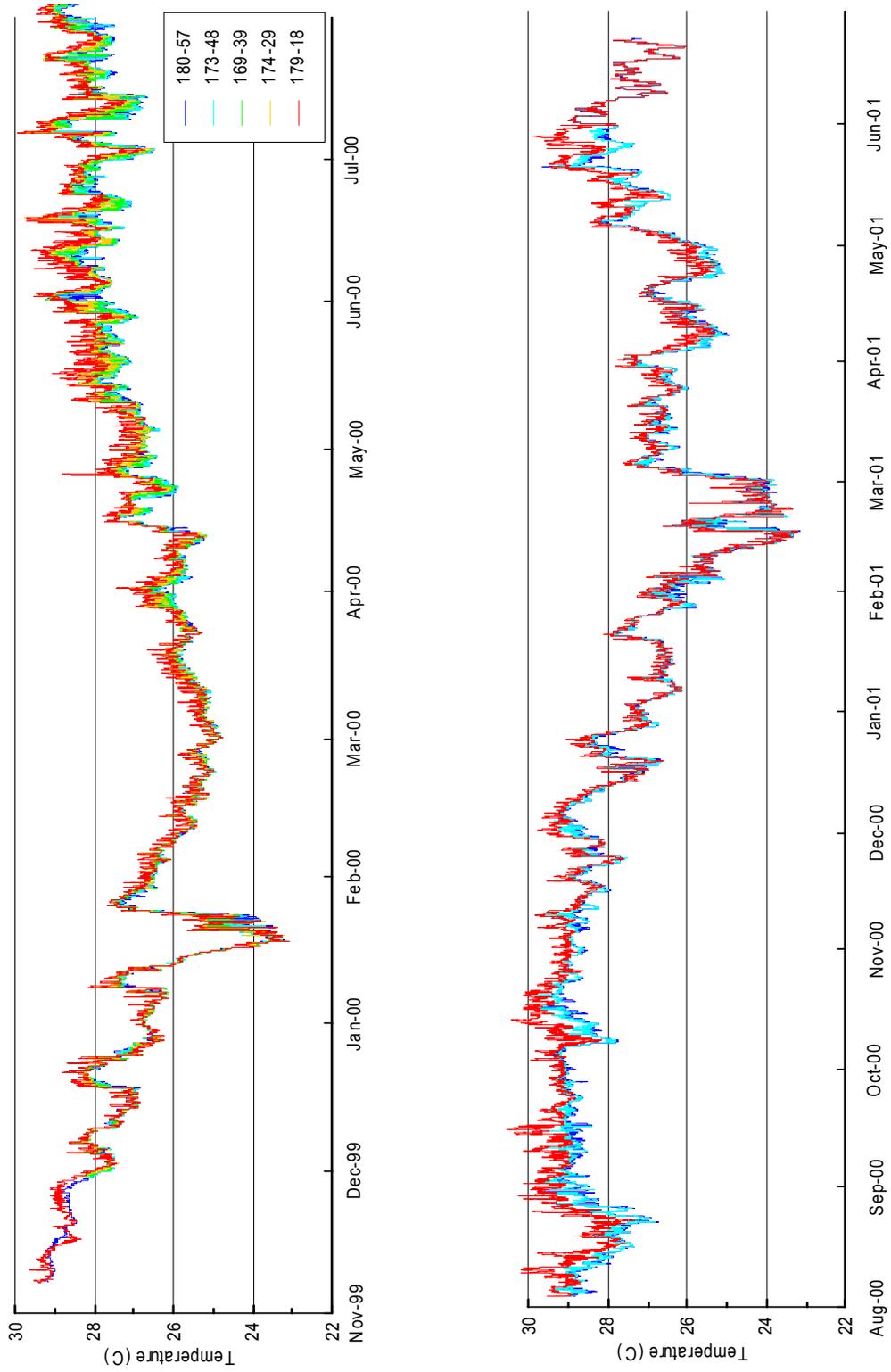
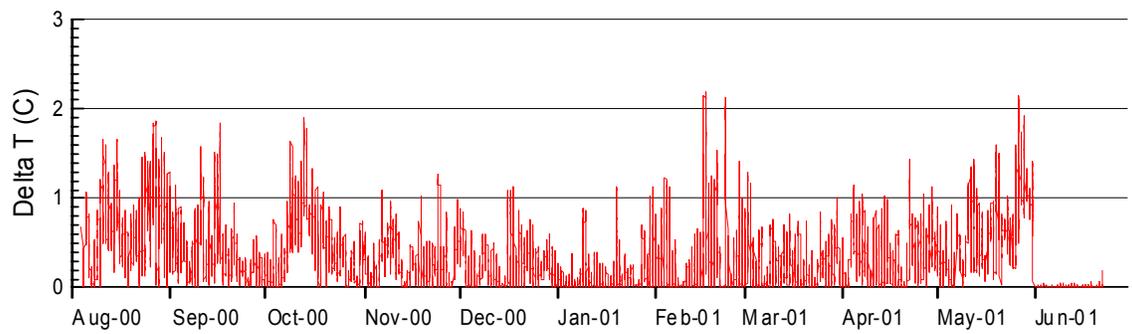
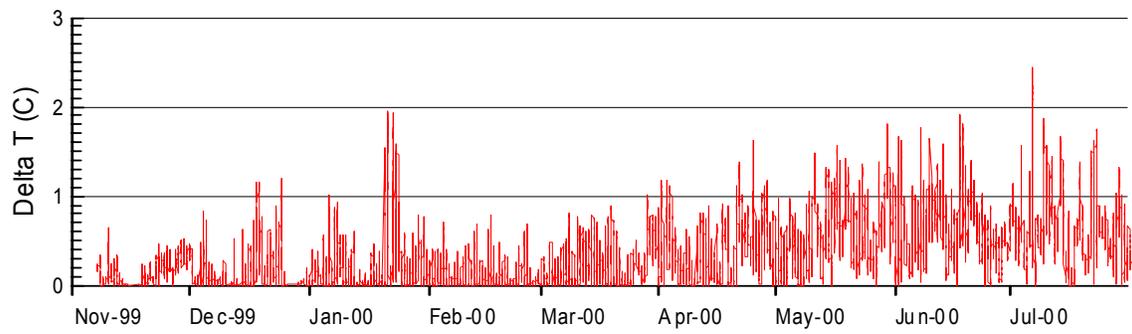


Figure 7. Temperatures Measured by the Thermistor String.



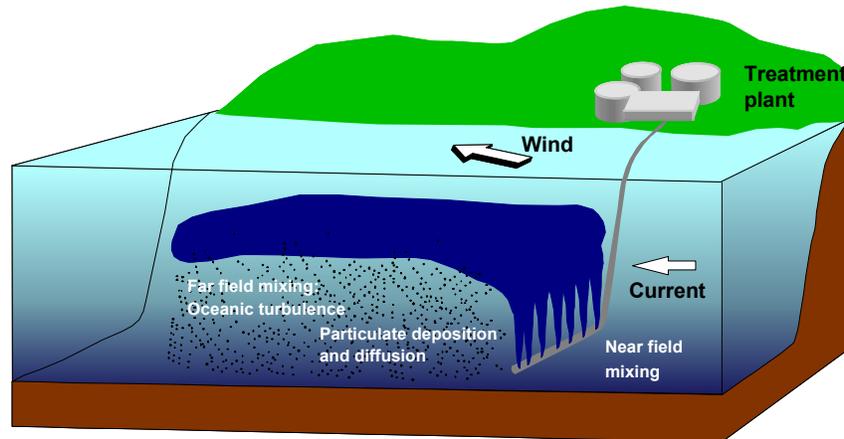
**Figure 8. Temperature Difference over Water Column Measured by Thermistor String**

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### 3. MATHEMATICAL MODELING OF WASTEWATER TRANSPORT

#### 3.1 Introduction

A schematic depiction of the processes involved in mixing and dispersing of wastewater discharged from an outfall with a long multiport diffuser is shown in Figure 9.



**Figure 9. Schematic Depiction of a Marine Wastewater Discharge.**

The processes are complex, and are described in many papers, for example Roberts (1996) and Wood et al. (1993). The wastewater is discharged as a series of horizontal, round, high velocity jets that cause turbulence and mixing. The density of domestic sewage is close to fresh water, around  $998 \text{ kg/m}^3$ , so because seawater is typically more dense, with densities around  $1025 \text{ kg/m}^3$ , the sewage is very buoyant. The jets therefore begin rising as a turbulent plume. As they rise, the plumes entrain seawater that rapidly mixes with the wastewater, and individual plumes may merge. If the density stratification in the water column is strong, the plumes may become trapped below the water surface; if the density stratification is weak, the plumes will reach the surface. In either case, the turbulence induced by the discharge then decays and the rate of mixing slows considerably. This typically occurs within distances of tens to hundreds of meters from the diffuser. Dilutions achieved within this region, sometimes known as initial dilution, are typically of the order of hundreds to even thousands. The concentrations of contaminants in the wastewater are therefore very rapidly and substantially reduced. The region in which these processes occur is known as the near field.

Beyond the near field, the plume drifts with the ocean currents and is diffused by oceanic turbulence. The rate of mixing in this region, known as the far field, is much slower than in the near field. Another important process in the far field is bacterial reduction due to mortality and decay. In the far field, the plume wanders with the ocean currents, so that

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distant locations are only intermittently impacted. The far field typically extends distances of kilometers to tens of kilometers from the diffuser.

Because of the widely varying length and time scales of these hydrodynamic processes, it is not possible to simulate them with one overall mathematical model. Separate models are used in the near field and far field, and the models are linked together. The models used and the results obtained are described below.

### **3.2 Near Field Modeling**

Mixing in the near field depends on the diffuser configuration and oceanic conditions. The main diffuser variables are the diffuser length, the port size and spacing, and the effluent flowrate. Because diffusers are often designed so that the individual plumes merge, the most important diffuser variable is the diffuser length, and the port details, i.e. the port diameter and spacing, are less important. The main oceanographic variables are the current speed and direction, and the density stratification.

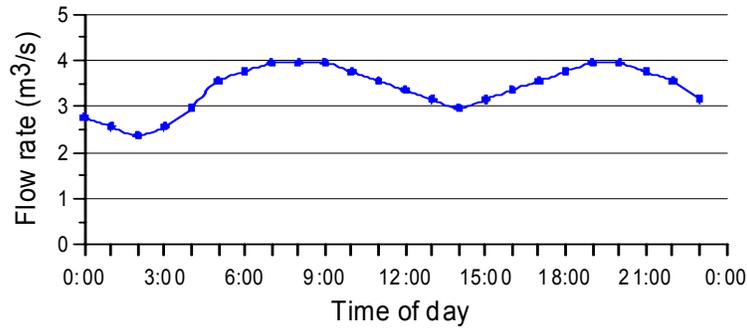
Plume behavior in the near field was modeled with NRFIELD (previously known as RSB). This model is based on the extensive experiments of Roberts et al. (1989) on line multiport diffusers in stratified flows of arbitrary direction. The model is described in Baumgartner et al. (1994). The model predicts the near field plume behavior, including dilution, plume rise height, plume thickness, and the length of the near field. The model was run with the oceanographic data to produce time series of predicted plume characteristics. This is similar to the procedure used in modeling the Mamala Bay, Hawaii, outfalls (Roberts, 1999a).

Long time series of predicted plume characteristics were generated by running the model at one hour time steps through the one year modeling period. The inputs to the model at each time step are the diffuser parameters, wastewater flowrates, current speed and direction, and density stratification. These input data and parameters were generated and chosen as follows.

The fixed diffuser parameters are those proposed by the engineering consultants. The diffuser length is 520 m, consisting of 27 Tee-shaped risers spaced 20 m apart. Each riser contains two ports of nominal diameter 200 mm. The diffuser depth is 20 m. The diffuser orientation is 115°. This orientation was chosen to be approximately perpendicular to the first principal current component (see Figure 3) as this results in the maximum initial dilution (see Roberts, et al., 1989).

The peak future flowrate was assumed to be 3.9 m<sup>3</sup>/s (90 MGD), which is the projected future flowrate for the years 2015 to 2025. The assumed diurnal flow variation is shown

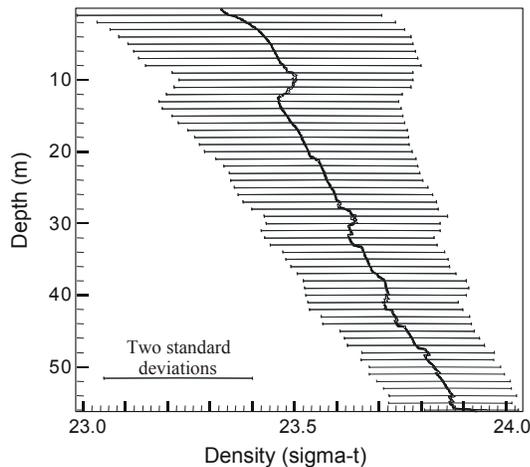
in Figure 10. This variation was repeated through the modeling period. The effluent density was taken to be  $998 \text{ kg/m}^3$ .



**Figure 10. Assumed Diurnal Wastewater Flow Variation**

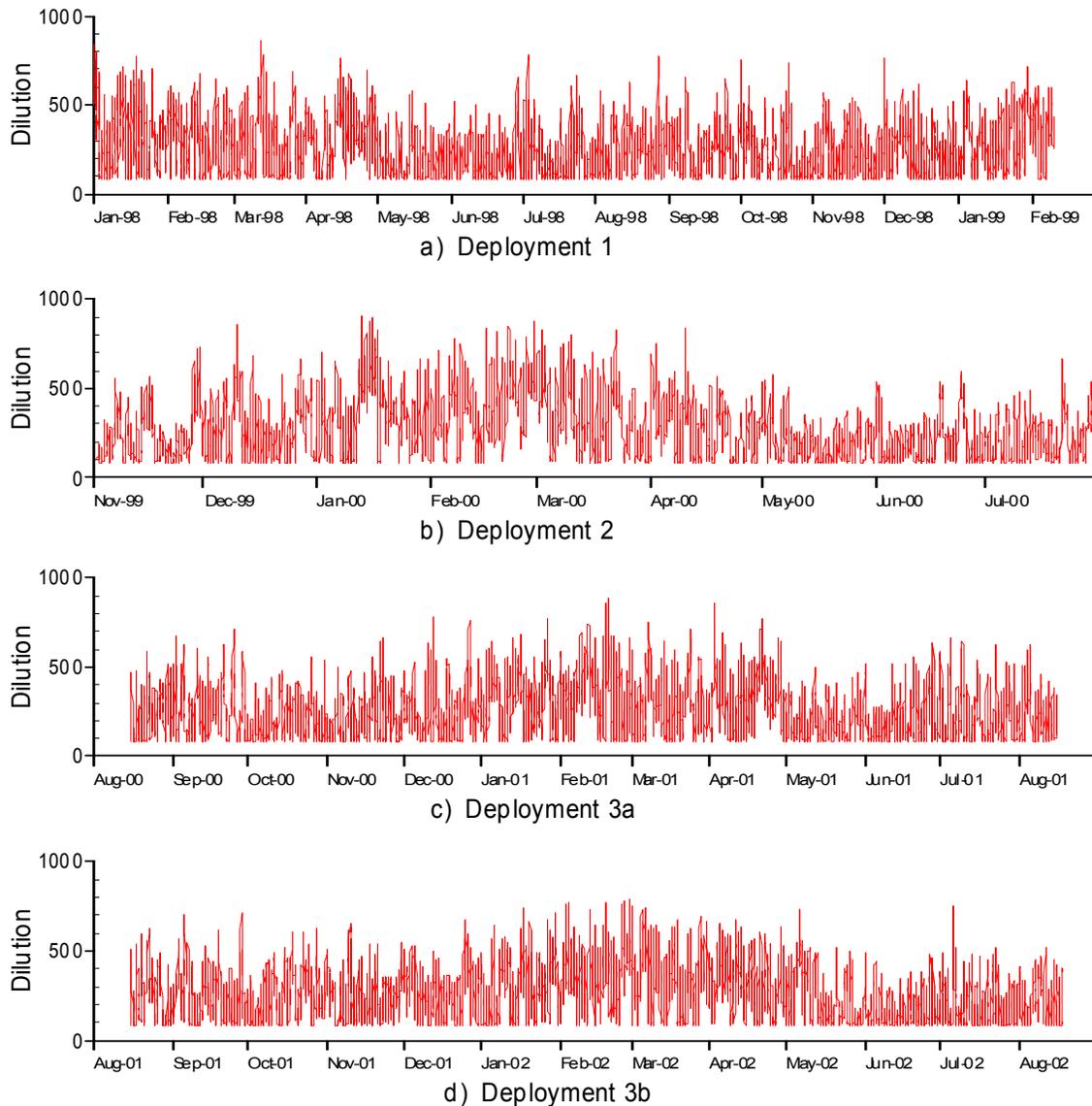
The currents were those measured by the ADCP for each deployment, as shown in Figures 3, 4, and 5. The 15-minute data were depth-averaged and then averaged to one reading per hour.

Density stratification at every hour is also needed. As salinity was not measured by the thermistor strings, it was not possible to calculate hourly density profiles. Therefore, synthetic density profiles were generated as follows. The mean and standard deviation of the density at each depth measured by the profiling instrument (Figure 6) was first computed from all the profiles; the results are shown in Figure 11. A linear regression line was fit to each density profile down to 20 meters depth. The histogram of the slopes of these lines showed a near log-normal distribution. The slope of the density profile at each time step was then obtained by a log-normal random number generator routine. The stratifications obtained in this way are weak, and are consistent with the data obtained from the thermistor string.



**Figure 11. Means and Standard Deviations of Measured Density Profiles**

NRFIELD was run with these data at one hour increments for the modeling period of almost four years, a total of about 35,000 simulations. The predicted time series of near field dilutions are shown in Figure 12, and their corresponding frequency distributions in Figure 13.

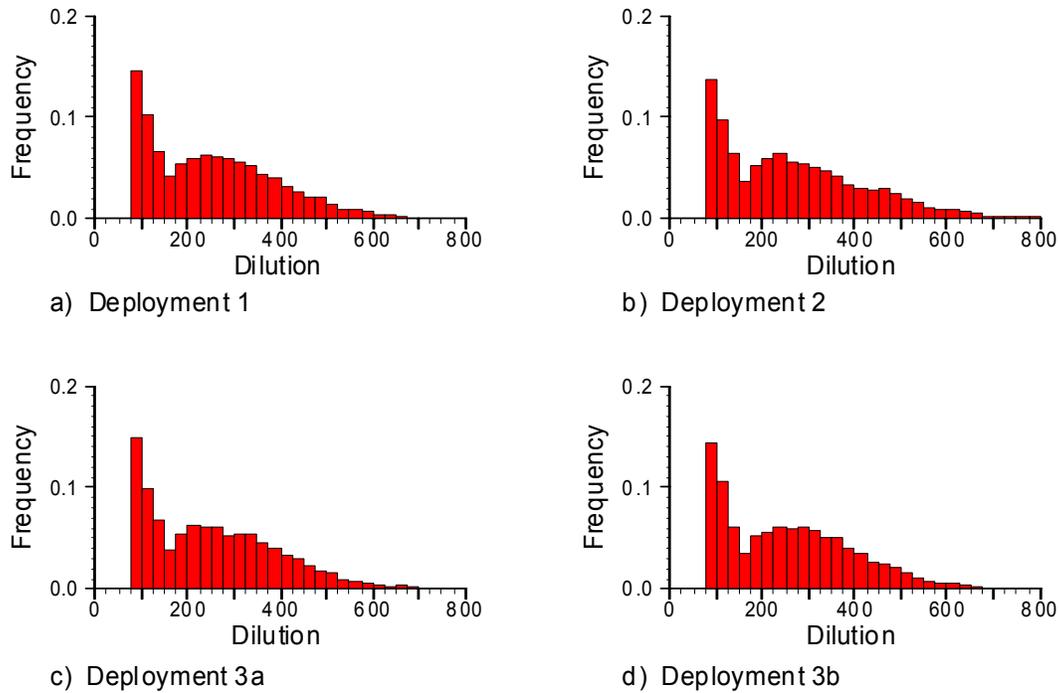


**Figure 12. Predicted Near Field Dilutions for the Four Deployment Periods**

The predicted dilutions are always high and their pattern does not vary significantly between the four deployment periods. Dilutions range from 85 to 900 with median values between 230 to 250. The low dilutions were infrequent; the minimum dilution was greater than 100 for 85% of the time. These low dilutions (less than 100:1) are not significant as they only occur during high flowrates; they could also be artifacts of the

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manner in which the density profiles were generated. The length of the near field mixing zone depends mainly on the current speed. It ranges from 11 to 450 m, with a median value of 80 m.



**Figure 13. Frequency Distributions of Predicted Near Field Dilutions**

Because of the weak stratification, the plume almost always surfaces. For the assumed stratifications, the plume reaches the surface more than 99% of the time. When the plume surfaces, the minimum dilution is always greater than 85:1.

### 3.3 Far Field Modeling

In the far field, the plume wanders with the ocean currents and is diffused by oceanic turbulence. The rate of mixing for a long diffuser is relatively slow. For example, the far field dilution for a diffuser of about 500 m long is about 5:1 for a travel time of ten hours. Reduction of bacterial concentrations by mortality in this time can be quite high, however. Because of variable current speed and direction, including random current fluctuations, transport of the plume to any particular location is highly intermittent. Bacterial concentrations at any fixed location then consist of moderately high values separated by long periods of zero or very low levels. Because of this intermittency and the random nature of individual plume trajectories, a statistical approach to this problem is often used. In the following, we use the approach of Roberts (1999b) in modeling the Mamala Bay, Hawaii, plumes. In particular, the probability of transport due to advection by currents to any location is computed. As the plume travels, it is diffused by oceanic turbulence, and

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bacterial concentrations decrease due to mortality. The model used, FRFIELD, is summarized in Appendix A.

Oceanic diffusion is computed according to Brooks (1960) solution to the diffusion equation assuming the “4/3 power law” where the lateral diffusion coefficient varies with the 4/3 power of the field width. The initial value of the horizontal diffusion coefficient,  $\varepsilon_o$  is given by:

$$\varepsilon_o = \alpha L^{4/3} \quad (1)$$

where  $\alpha$  is a constant and  $L$  the initial field size, assumed equal to the diffuser length,  $L$ . Following Fischer et al. (1979), the value of  $\alpha$  was assumed to be  $0.006 \text{ cm}^{2/3}/\text{s}$ . This value is midway in the range given for coastal waters by Fischer et al. (1979).

Bacterial mortality is assumed to follow a first order decay process so that the bacterial concentration  $c$  after travel time  $t$  is given by:

$$\frac{c}{c_o} = 10^{-\frac{t}{T_{90}}} \quad (2)$$

where  $c_o$  is the bacterial concentration at the end of the near field and  $T_{90}$  is the time for 90% reduction in bacteria due to mortality.  $T_{90}$  is allowed to vary diurnally. In the following,  $T_{90}$  was assumed to vary sinusoidally through the day according to the equation assumed by the consultants:

$$T_{90} = 10.75 + 9.25 \cos\left(\frac{\pi}{12} \tau\right) \quad (3)$$

where  $\tau$  is the time in hours after midnight. Therefore,  $T_{90}$  ranges from 1.5 to 20 hours through the day. This is discussed below and in Appendix B. The initial total coliform concentration in the effluent was assumed to be  $10^7$  per 100 ml, and the fecal coliform concentration assumed to be  $2 \times 10^6$  per 100 ml.

Transport was simulated by the mathematical model FRFIELD (Roberts, 1999b). This model is coupled to the near field model NRFIELD discussed previously. The inputs to FRFIELD are the plume characteristics predicted at the end of the near field NRFIELD and the depth-averaged currents. The actual oceanographic data and assumed effluent flowrates are used in these simulations. In other words, the measured currents, stratification, and flowrate are first used by NRFIELD to predict the near-field wastefield

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behavior. FRFIELD then uses the measured currents to predict the subsequent advection of the plume in the far field. The maximum travel time is taken as the semi-diurnal tidal period, approximately 12 hours, as these travel times result in maximum bacterial impact.

In order to place the results in context, they are compared with the Water Contact (bathing water) Standards in the California Ocean Plan (SWRCB, 1990). These standards are written in terms of total and fecal coliform levels. For example, the plan states in part that:

- a. Samples of water from each sampling station shall have a density of total coliform organisms less than 1,000 per 100 ml; provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 ml, and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml.*
- b. The fecal coliform density based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200 per 100 ml nor shall more than 10 percent of the total samples during any 60-day period exceed 400 per 100 ml.*

These standards must be met at a distance of 1,000 ft (305 m) from the shoreline or the 30 ft (9.1 m) depth contour, whichever is farthest offshore.

The frequencies with which the level of total coliforms exceeds 1,000 per 100 ml are shown in Figure 14 for the four deployment periods. The area in which the California standard is exceeded (20%) is shown in red. (This is the same as a fecal coliform level of 200 per 100 ml). The results are very similar for all four deployment periods. The contours elongate considerably along the first principal current axis due to the predominance of currents in this direction. Little elongation, or transport, towards shore is predicted due to the slow speeds and random directions of the onshore currents. Because these onshore currents are slow, of short duration, and infrequent, the frequency of exceedence decreases rapidly in the shoreward direction. The standards are reached within a few hundred meters from the diffuser, i.e. more than 2 km from the nearest shoreline.

Although these simulations include all of the measured current conditions, including any potential “worst-case” conditions, the averaged exceedence frequencies do not address short duration events that may bring the plume to shore. The maximum incursions of the plume during periods of sustained onshore flow were therefore investigated further. Plume trajectories simulated from the current meter records were shown in Roberts (2002b) for travel times up to twelve hours. (Longer travel times do not affect the results as they afford more opportunity for bacterial reduction due to oceanic diffusion and

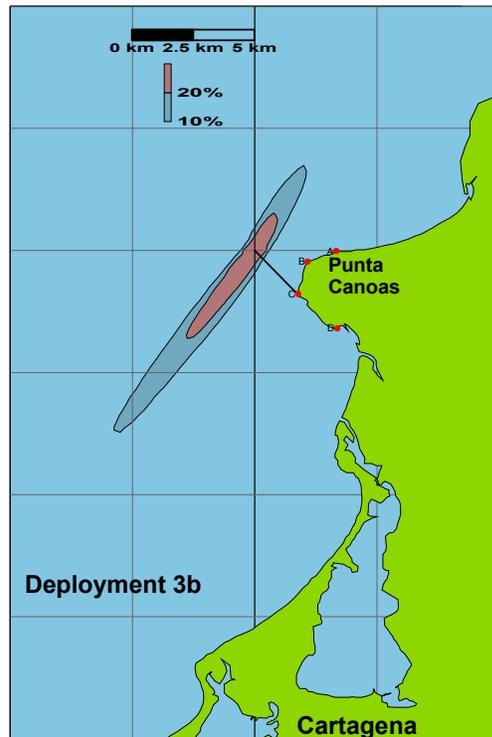
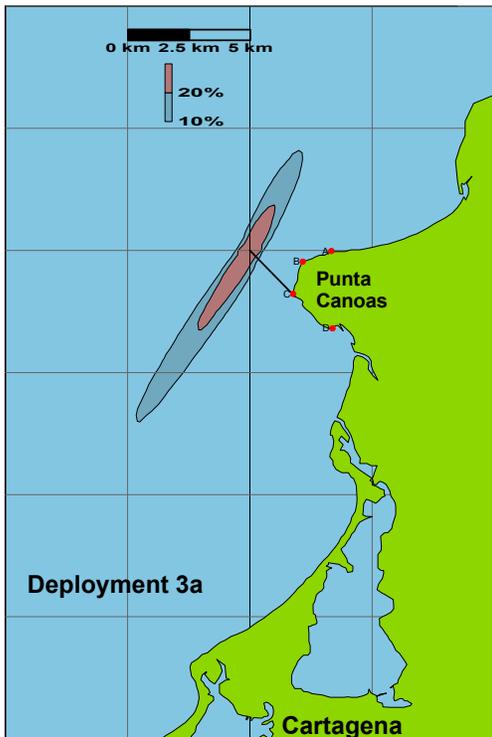
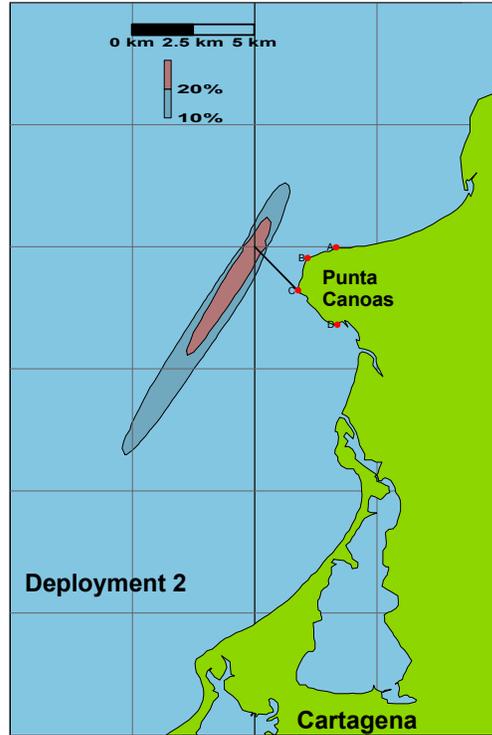
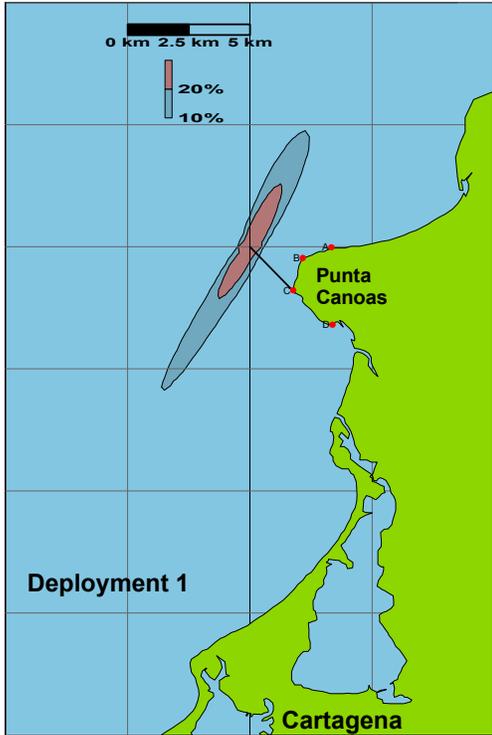


Figure 14. Frequency of Total Coliforms Exceeding 1,000 per 100 ml

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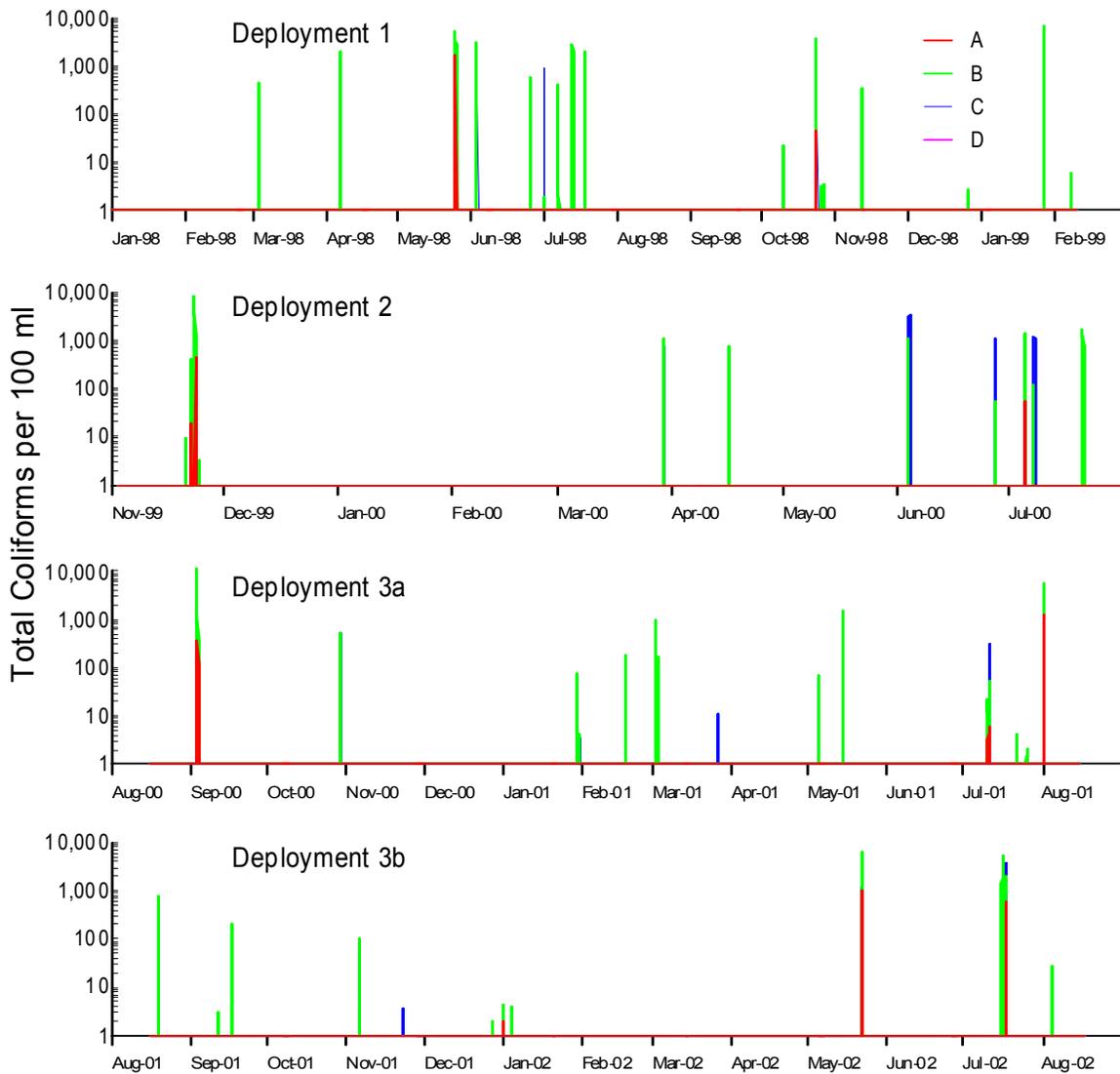
mortality. The great majority of bacterial impacts at any location result from plume elements that have traveled for less than twelve hours). Although the results should not be interpreted as predictions of actual trajectories, but only indications of the travel that can occur within twelve hours, they did imply that some travel to the shore near Punta Canoa may occasionally occur.

To investigate this further, the predicted time series of total coliform at four locations, labeled A, B, C, and D on Figure 14, were computed. This time records are shown in Figure 15. It can be seen that the record consists almost entirely of zeroes, with brief periods of slightly elevated levels. For the four locations, A, B, C, and D, the predicted coliform levels are zero for 99.9, 99.3, 99.7, and 100.0 percent of the time respectively. The highest level predicted is 5430 per 100 ml on 5 July 2000; the levels never exceeded 10,000 per 100 ml.

It is emphasized that even these “worst-case” predictions are probably overestimated by the model as it assumes the currents continue to travel shoreward without turning, as they ultimately must. Even with these assumptions, the requirements of the California Ocean plan are met. To put these results into context, if the coliform levels are zero for 99.3% of the time, they are above zero for 0.7% of the time, which is about five hours per month.

The currents that result in these incursions were very infrequent. For example, for the second deployment they occurred on four days in November, two days in June, and three days in July. This is a total of nine days out of the 274 days. They appear to occur during periods of current direction reverse and last for only a few hours. They occur less than 1% of the time.

In this report, it was assumed that the bacterial decay rate  $T_{90}$  varied sinusoidally through the day according to Equation 3. In order to assess the sensitivity of the results to the value of  $T_{90}$ , other functions were tried. This included a step function in which  $T_{90}$  was equal to 1.5 hours from 6 am to 6 pm, and infinite (i.e. no decay) from 6 pm to 6 am. Also tested was a constant  $T_{90}$  equal to 1.5 hours throughout the day and night. It was found that, although the areal extent of the impact was affected by the assumed variation of  $T_{90}$ , the shoreline impact was not affected, due to the lack of onshore transport. The constant value of  $T_{90}$  equal to 1.5 hours resulted in significant reduction of the area affected. This indicates that the much longer regions of affected area for other assumptions are due to transport at night, when decay rates are small. Even setting  $T_{90}$  equal to infinity did not result in significant shoreline impacts. It is concluded that shoreline bacterial impacts are not sensitive to the assumed values of  $T_{90}$ .



**Figure 15. Predicted Time-series of Total Coliforms at Four Points Near Punta Canoas**

The assumptions and limitations of this modeling must be kept in mind. As discussed in Roberts (1999b), far field modeling in coastal waters has many uncertainties. The approach used here cannot predict actual plume trajectories because of random current fluctuations and because the assumption of spatial current homogeneity eventually breaks down at some distance from the source. The method can only estimate the variations of statistical quantities in the vicinity of the diffuser, for example, Figure 14.

Even with the above provisos, it is clear that beach water quality standards should be met by a large margin. The standards will be met several kilometers from shore, and transport to shore is highly unlikely. Nevertheless, other shoreward transport mechanisms, such as wind-blown movement of floatables, cannot be ruled out. It is therefore desirable to

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remove floatables, as much as feasible, by treatment. Also, because of the modeling uncertainty, a monitoring program around the outfall and at local beaches should be instituted to monitor the outfall performance. The monitoring program should begin before the outfall commences discharge and continue afterwards to confirm the outfall performance and to monitor any changes at the beaches.

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#### 4. DISCUSSION AND CONCLUSIONS

The oceanographic data base to support the mathematical modeling of the plume behavior is very extensive. The data shows the proposed outfall location to be favorable to marine wastewater discharge. Currents in the vicinity of the proposed diffuser are consistent and generally fast, which will result in efficient and rapid mixing near the diffuser with high initial dilutions. Onshore currents are weak. Density stratifications are weak, so the plume will usually reach the surface. Because of the high dilutions it will not generally be visible, however.

Near field dilutions will generally be much greater than 100, with a median value around 250, and maximum values of almost 1000. These dilutions are usually attained within 100 m from the diffuser. Although some minimum dilutions of less than 100 were predicted, these are not significant as they occur only infrequently.

All bacterial bathing water standards will be met at least 2 km from the shoreline. Transport of the plume to shore is highly unlikely. Should it occur, the combination of high initial dilution, oceanic diffusion, and bacterial decay will reduce the bacteria to low levels. Greater distances offshore and deeper discharge are not necessary to meet shoreline water quality standards.

While the outfall could, in theory, be lengthened so that the probability of onshore transport is zero, this would require an unrealistically long outfall with a considerable increase in cost. There would probably be no improvement in shoreline water quality, as shoreline impacts are already negligible. The outfall design would then be based on isolated extreme events; this is not the usual design method for outfalls, and is not recommended.

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**APPENDIX A:  
FAR FIELD MODEL (FROM ROBERTS, 1999B)**

The visitation frequency  $\gamma$  at a point  $\vec{x}$  is defined as the fraction of time for which the plume center is within vector  $\vec{w}/2$  of  $\vec{x}$ , where  $|\vec{w}|$  is the expected width of the plume (Csanady, 1983b). This is the same as the probability of finding the plume within  $\pm \vec{w}/2$  of  $\vec{x}$ . Consider a puff released at  $\vec{x} = 0$  at time  $t = 0$ . The probability distribution function for the puff center at a later time  $t$  is  $P(\vec{x}, t)$  such that the probability of the puff center being between  $\vec{x}$  and  $\vec{x} + d\vec{x}$  is  $P(\vec{x}, t)d\vec{x}$ . The probability that the puff is overlapping a point  $\vec{x}$  is given by:

$$p(\vec{x}, t) = \int_A P(\vec{x}, t) d\vec{x} \quad (\text{A1})$$

where the area of integration  $A$  is the area of the puff at time  $t$ . For a continuous source, the probability of impaction, or visitation frequency, of the plume for all prior releases is obtained by integrating over release time  $t'$ . For stationary conditions:

$$\gamma = \int_{-\infty}^t \int_A P(\vec{x}, t - t') d\vec{x} dt' = \int_0^{\infty} \int_A P(\vec{x}, t) d\vec{x} dt \quad (\text{A2})$$

Csanady defines a dividing time  $t_d$  to distinguish between young and old puffs. In a tidal environment, it would be expected that  $t_d$  is of the order of the tidal period. Eq. 2 then becomes:

$$\gamma(\vec{x}, t_d) = \int_0^{t_d} \int_A P(\vec{x}, t) d\vec{x} dt \quad (\text{A3})$$

which is the visitation frequency of all the ‘‘young’’ puffs of age less than or equal to  $t_d$ . Eq. 3 is analogous to Eq. 26 of Csanady (1983a).

The displacement probability,  $P(\vec{x}, t)$ , of the puffs can be computed from their trajectories, if known. The location of the puff center at various times  $t$ ,  $\vec{x}_c(t)$  is given by:

$$\vec{x}_c(t) = \int_0^t u_L(t') dt' \quad (\text{A4})$$

where  $u_L$  is the Lagrangian velocity of the puff center. Csanady (1983a) discusses how

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$P(\bar{x}, t)$ , i.e. the statistics of  $\bar{x}_c(t)$ , can be computed from the statistics of  $u_L$ , and Koh (1988) discusses similar computations from simulated currents. The fundamental problem in air and water pollution, however, is that these Lagrangian velocities are not generally known. Instead, what are usually available are Eulerian velocity measurements at a fixed point such as from a current meter. The usual assumption, often applied in air pollution (Pasquill, 1974), is to infer Lagrangian displacement from an Eulerian record by the approximation:

$$x_c(t) \approx \int_0^t u_E(t') dt' \quad (\text{A5})$$

where  $u_E$  is the fixed point (Eulerian) record of velocity. The trajectory computed for various travel times  $t$  by Eq. 4 is a path line; the trajectory computed by Eq. 5 is known as a progressive vector diagram in oceanography. Clearly, the displacement predicted by Eq. 5 becomes increasingly unreliable as the distance from the source increases. Furthermore, Zimmerman (1986) has pointed out that regularly varying tidal flows over irregular topography can produce “Lagrangian chaos,” that is, unpredictable and non-repeatable trajectories. Therefore, even if we had perfect Lagrangian information for an individual release, we could not use this to predict future trajectories even under identical forcing functions. For these reasons individual plume trajectories should not be inferred by these methods, but it is usually assumed that statistical inferences of the pattern and scale of the dispersion can be made. Support for this assumption is provided by List et al. (1990) who found good general agreement between diffusivities in coastal waters computed from drogues and from fixed current meters. Because of the complexity of the dispersion process and the relatively poor spatial resolution of coastal measurements, it is clearly not possible to pretend for great accuracy in any predictive method. The statistical approach is of particular value in assessing the probability of exceedence of some threshold concentration at particular locations such as at the edge of a mixing zone or along the coastline.

For outfall studies we usually have current meter records that consist of discrete measurements at a fixed point with a fixed sampling interval  $\Delta t$ . To use these data, we discretize the plume as a series of puffs released at a rate equal to the sampling frequency  $(\Delta t)^{-1}$ . The location of a puff released at time  $t_0 = n\Delta t$  after travel time  $T = m\Delta t$  is then assumed to be given by the discrete form of Eq. 5:

$$\bar{x}(t_0 | T) = \sum_{i=n}^{i=n+m} \bar{u}_i \Delta t \quad (\text{A6})$$

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where  $\bar{u}_i(t)$  is the local measured velocity at time  $t = i\Delta t$ . This computation is repeated for all releases during the whole data record, and each puff is followed up to the maximum travel time or “time horizon,”  $t_d$ . This procedure would typically include thousands of releases, each release being tracked at each time step as it travels. The area around the diffuser is overlain with a grid, and if a puff is within  $\pm \bar{w}/2$  of a grid node, this is counted as a “visit.” The number of visits by a puff of age younger than  $t_d$  is summed and divided by the total number of releases to obtain the visitation frequency at that location. Koh (1988) and Noda & Associates (1992) present similar computations in which the probability of travel of the plume centerline into a grid square is computed.

As the plume travels it is diffused and grows due to oceanic turbulence. We use a gradient diffusion model for this process rather than a particle tracking model due to its computational simplicity and the difficulties of keeping track of the huge number of particles that would be necessary for an extended simulation over many months. It is assumed that the diffusion coefficient is proportional to the 4/3 power of the plume size. List et al. (1990) observed good general agreement with this relationship for Southern California coastal waters. The decay of peak concentration is assumed to be given by Brooks (1960) solution to the diffusion equation which can be expressed in terms of travel time  $t$  from the source as:

$$S_f = \frac{c_0}{c_m} = \left( \operatorname{erf} \left[ \frac{\frac{3}{2}}{\left(1 + \frac{8\varepsilon_0 t}{L^2}\right)^3 - 1} \right]^{1/2} \right)^{-1} \quad (\text{A7})$$

where  $S_f$  is the far-field dilution,  $c_0$  the contaminant concentration after completion of near field mixing, and  $c_m$  the centerline concentration.  $\varepsilon_0$  is the initial value of the horizontal diffusion coefficient:

$$\varepsilon_0 = \alpha L^{4/3} \quad (\text{A8})$$

where  $\alpha$  is a constant and  $L$  the initial puff size (see Figure 1 of Part I). Eq. 7 applies to a continuous line source whose concentration is reduced by lateral diffusion only. For an isolated puff growing in three-dimensions the diffusion rate will be greater and the plume dilution will increase away from the puff center. We neglect these effects and use the conservative assumptions that the dilution in the puff is given by the continuous solution and is constant across the puff.

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The puff size  $w$  is allowed to grow by diffusion as it travels. It is defined by:

$$w = L \sqrt{1 + 12 \left( \frac{s_y}{L} \right)^2} \quad (\text{A9})$$

where  $s_y$  is the standard deviation:

$$s_y = \frac{L}{\sqrt{12}} \sqrt{\left( 1 + \frac{8\mathcal{E}_0 t}{L^2} \right)^3 - 1} \quad (\text{A10})$$

The actual dilution  $S$  at any location when the plume is present is the product of the near field dilution  $S_n$  and the far-field dilution  $S_f$ :

$$S = S_n \times S_f \quad (\text{A11})$$

where  $S_n$  is assumed to be the dilution predicted at the end of the near field by the model NRFIELD (see Part I). The corresponding contaminant concentration is then given by:

$$c = \frac{c_{00}}{S} \quad (\text{A12})$$

where  $c_{00}$  is the contaminant concentration in the effluent leaving the treatment plant. The concentration estimated by Eq. 12 is the maximum that might be expected at any location. It may occur very infrequently, however, and time-average concentrations will be much lower.

Bacteria are assumed to decay according to a first order decay process so that the bacterial concentration after travel time  $t$  is given by:

$$\frac{c}{c_o} = 10^{-\frac{t}{T_{90}}} \quad (\text{A13})$$

where  $c_o$  is the bacterial concentration at the end of the near field and  $T_{90}$  is the time for 90% reduction in bacteria due to mortality.  $T_{90}$  is allowed to vary diurnally.

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**Additional Water Quality Modeling for the  
Cartagena Ocean Outfall**

**Prepared for the World Bank**  
**Washington, DC**

**19 May 2004**

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## EXECUTIVE SUMMARY

Mathematical water quality modeling to supplement that in the previous report (Roberts, 2003) is presented. In particular, the effects of effluent chlorination on the spatial distribution of total and fecal coliforms resulting from the discharge are presented. In addition, simulations of intestinal enterococci are presented and compared with guidelines recently proposed by the World Health Organization. Simulations for a one year (365 days) period are reported. The results are consistent with those in the previous report and show the proposed outfall location to be favorable to marine wastewater discharge. Currents in the vicinity of the proposed diffuser are generally fast, resulting in efficient and rapid mixing near the diffuser with high initial dilutions. Onshore currents are weak and irregular so transport of wastewater to shore is unlikely. Density stratifications are weak, so the plume will usually reach the surface. Because of the high dilutions it will not generally be visible, however.

Near field dilutions will generally be much greater than 100, with a median value around 230, and maximum values of almost 1000. These dilutions are usually attained within 100 m from the diffuser. Although some minimum dilutions of less than 100 were predicted, these are not significant as they occur only infrequently.

The behaviors of total and faecal coliforms were simulated and the results compared to various bathing water standards. The water contact standards of the California Ocean Plan are met close to the diffuser, and far from the shoreline. The primary and secondary contact standards of Colombia, under law 1594 of 1984, will also be met.

Chlorination was assumed to reduce total and fecal coliforms in the raw effluent by two orders of magnitude. For this effluent, the standards were met right over the diffuser, as the high near field dilutions reduced coliform concentrations below the standards immediately.

The transport of intestinal enterococci was also simulated. Initial values in the raw effluent were based on a recent measurement of raw effluent in Cartagena. The highest grade water level was attained within about 650 m (in the shoreward direction) from the diffuser. Again, bathing water standards were achieved far from shore.

The simulations contained in this and the previous reports are based on an unusually extensive oceanographic data set. Although there are many uncertainties and approximations involved in the simulations, the very wide margin by which shoreline bacterial standards are met show there is very little chance of any violations there. Chlorination of the effluent or higher levels of treatment should not be required to meet bathing water standards.

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## 1. INTRODUCTION

An ocean outfall has been proposed to discharge wastewater from the City of Cartagena, Colombia. A sketch of the proposed outfall and sewerage system is shown in Figure 1. The outfall is about 2.85 km long and terminates in a diffuser that discharges the wastewater at a depth of about 20 m. The objective of the diffuser is to cause rapid and efficient mixing of the wastewater so that the concentrations of any pollutants are quickly reduced to very low levels with minimal environmental impact. The outfall and diffuser are positioned to minimize the probability of effluent being transported to shore. In the unlikely event that this occurs, the combination of initial dilution, turbulent diffusion in the ocean, and bacterial mortality will reduce concentrations of bacteria to low levels, ensuring compliance with bathing water requirements. The environmental design criteria for the outfall included requirements for initial dilution and shoreline bacteria levels.



**Figure 1. Proposed Cartagena Outfall and Sewerage System.**

Extensive mathematical modeling to ensure compliance with these criteria was reported in Roberts (2003). It was concluded that initial (near field) dilutions are high, usually between 100 to almost 1000. It was concluded that the California bathing water standards for total and fecal coliforms would be met far from shore. Since that report, questions have been raised about the effects of chlorination of the effluent on bacterial impacts and new guidelines for recreational bathing water protection have been published by the World Health Organization (WHO). These guidelines are based on levels of intestinal enterococci. The purpose of this report is to investigate the effects of chlorinating the effluent, and to present the results of enterococci simulations and compare them with the WHO guidelines.

## **2. BACTERIAL MODELING FOR BATHING WATER QUALITY COMPLIANCE**

### **2.1 Introduction**

Receiving water quality standards to ensure protection of the environment and public health have been established by various authorities around the world. Bathing water standards, whose objective is to protect public health, are based on levels of indicator bacteria (that indicate the presence of sewage). Examples include the California State Water Resources Control Board (SWCRB, 2001), the California Department of Health Services (DHS, 2000), the World Health Organization (WHO, 2003), the European Union (EU, 2002), and the US Environmental Protection Agency (USEPA, 1986). These standards are based on some combination of limits on total coliforms, fecal coliforms, and intestinal enterococci/fecal streptococcus. For wastewater disposal through a long outfall, bacteria are usually the main parameter of concern because all other wastewater constituents are subject to rapid dilution and dispersion resulting in low concentrations in the receiving waters.

The most important of these criteria that are commonly applied to marine waters are summarized below along with the Colombian standards. The modeling results are compared with these standards in Section 4.

### **2.2 World Health Organization Guidelines**

Protection of recreational water quality at beaches has traditionally been by microbiological sampling. This is now shifting to a combined approach of sampling plus a sanitary inspection to classify recreational waters in order to manage them. The World Health Organization (WHO) has recently published guidelines for recreational water quality protection (WHO, 2003) that follow these principles.

The WHO approach proposes that water safety and quality are best managed by a combination of sanitary inspection and microbiological water quality assessment. The sanitary inspection category is based on the risk to human health from contact or exposure to sewage under “normal” conditions with respect to the operation of sewage treatment works and oceanographic conditions. The results of the sanitary inspection and microbial water quality assessment are combined to give a five-level classification for water environments - very good, good, fair, poor, and very poor.

The risks from exposure to sewage discharged from outfalls are shown in Table 1. Note that lagoon treatment with discharge to the beach or from a short outfall is rated as high risk. Indeed, most disposal practices that result in direct impingement of sewage effluent on recreational waters will result in high risk, even with advanced levels of treatment.

**Table 1. Relative Risk Potential to Human Health Through Exposure to Sewage Through Outfalls (From WHO, 2003).**

Treatment	Discharge type		
	Directly on beach	Short outfall	Effective outfall
None	Very high	High	NA
Preliminary	Very high	High	Low
Primary (including septic tanks)	Very high	High	Low
Secondary	High	High	Low
Secondary plus disinfection	—	—	—
Tertiary	Moderate	Moderate	Very low
Tertiary plus disinfection	—	—	—
Lagoons	High	High	Low

The WHO microbial guideline values are based on only one measure: the 95th percentile level (i.e. 95% of the values are below this level) of intestinal enterococci (faecal streptococci). Epidemiological investigations have shown that this shows the best relationship with disease incidence compared to total and faecal coliforms, and it also has more ability to survive in salt water. Depending on the value, the waters are classified as A (no expected health effect), B, C, or D (significant health risk).

The recreational waters are then classified according to the sanitary inspection (Table 1) and the microbiological classification. An example is shown in Table 2.

**Table 2. Example of a Classification Matrix for Faecal Pollution of Recreational Water Environments<sup>3,4</sup> (From WHO, 2003).**

Sanitary Inspection Category (susceptibility to faecal influence)	Microbial Water Quality Assessment Category (95th percentile intestinal enterococci/100 ml)				
	A ≤40	B 41–200	C 201–500	D >500	Exceptional circumstances
Very low	Very good	Very good	Follow up <sup>1</sup>	Follow up <sup>1</sup>	Action
Low	Very good	Good	Fair	Follow up <sup>1</sup>	
Moderate	Good <sup>2</sup>	Good	Fair	Poor	
High	Good <sup>2</sup>	Fair <sup>2</sup>	Poor	Very poor	
Very high	Follow up <sup>2</sup>	Fair <sup>2</sup>	Poor	Very poor	
Exceptional circumstances	Action				

<sup>1</sup> Implies non-sewage sources of faecal indicators (e.g. livestock).

<sup>2</sup> Indicates possible discontinuous/sporadic contamination (driven by events such as rainfall). This is most commonly associated with Combined Sewer Overflow (CSO) presence.

<sup>3</sup> The human health risk depends greatly upon specific (often local) circumstances. Public health authorities should be engaged in the identification and interpretation of such conditions.

<sup>4</sup> There may be periods of higher risk, such as during an outbreak with a waterborne pathogen, or a sewer rupture. Under such circumstances, the matrix may not properly represent risk/safety.

### **2.3 California Ocean Plan**

The Water Contact (bathing water) Standards in the California Ocean Plan (SWRCB, 2001) have been widely adopted around the world. These standards are written in terms of limits on total and fecal coliform levels. The plan states that:

- a. Samples of water from each sampling station shall have a density of total coliform organisms less than 1,000 per 100 ml; provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 ml, and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml.*
- b. The fecal coliform density based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200 per 100 ml nor shall more than 10 percent of the total samples during any 60-day period exceed 400 per 100 ml.*

These standards must be met within a zone bounded by the shoreline and a distance of 1,000 feet (305 m) from the shoreline or the 30-foot (9.1 m) depth contour, whichever is further from the shoreline.

### **2.4 Colombian and Brazilian Standards**

The Colombian standards, under law 1594 of 1984, state that in primary contact areas, total coliforms shall be less than 1000 per 100 ml and fecal coliforms less than 200 per 100 ml. In secondary contact areas, total coliforms shall be less than 5000 per 100 ml and fecal coliforms less than 1000 per 100 ml. The primary contact standard is the same as the California standard for total coliforms; the secondary contact standard is the same as the Brazilian standard. No frequencies are specified for the Colombian or Brazilian standards.

### 3. OCEANOGRAPHIC CONDITIONS

#### 3.1 Introduction

Extensive measurements of currents, temperature, salinity, waves, and tidal height have been made in the coastal waters around the proposed diffuser site by the engineering consultant. The data, which were obtained by moored instruments and by boat, are described in Hazen and Sawyer (2003) and their implications for marine wastewater disposal are discussed in Roberts (2003). The most important observations are summarized below, along with the data used in the present simulations.

#### 3.2 Currents

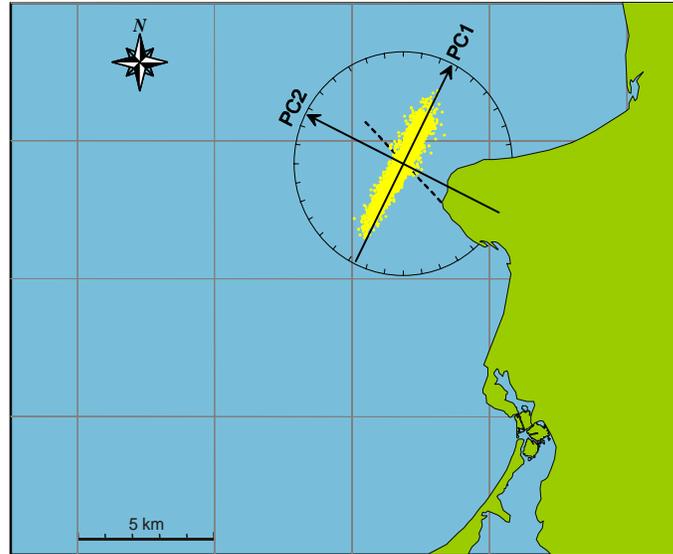
Currents were measured from January 1998 to August 2002 by an Acoustic Doppler Current Profiler (ADCP) moored near the proposed outfall diffuser. The ADCP measured the speed and direction of currents in six bins of 3 m height through the water column; the bins ranged from heights of 5.3 to 23.7 m above the seabed. The top bins were often above the water surface and were not judged to be reliable, so only the bottom four bins, ranging from heights of 5.3 to 14.3 m (depths of 3.4 to 12.4 m) were used. The ADCP took measurements every 20 seconds which were averaged over 15 minute intervals for a total of approximately 135,000 current profiles.

Mathematical modeling of wastefield behavior and bacterial water quality using all of these data were reported in Roberts (2003). It was found that there were no significant yearly differences in the results. Therefore, the simulations reported here use a one year data period from January 1, 1998 at 01:00 to January 1, 1999, at 0:00. Exactly one year of data (365 days) were used to ensure that there was no seasonal bias in the results.

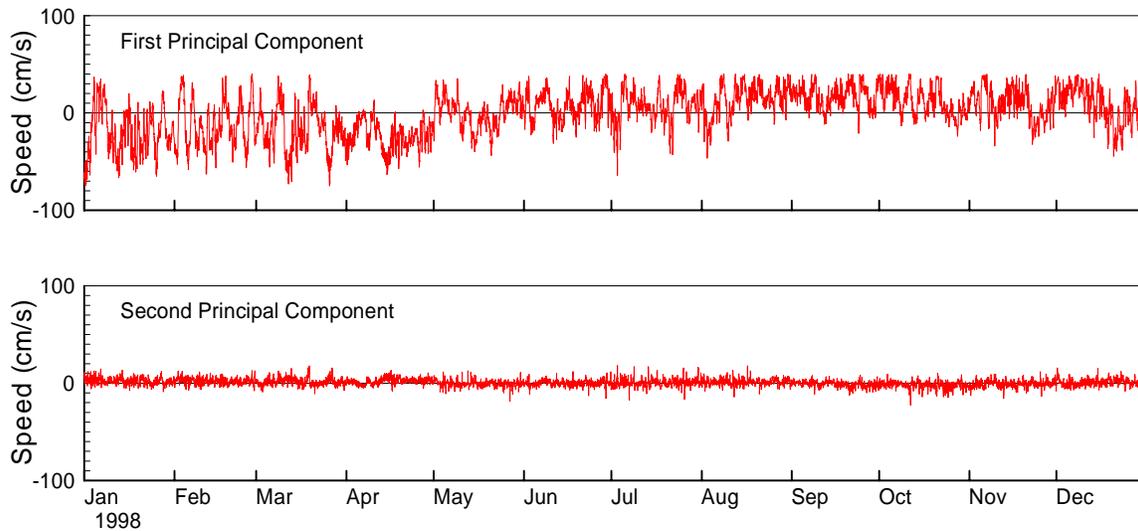
A polar scatter diagram of the currents is shown in Figure 2a. It can be seen that the currents have a strongly preferred direction along an axis running approximately NNE/SSW. In order to investigate this further, the principal axes of the currents were computed. These are the axes that maximize and minimize the kinetic energy, or variance, of the currents when projected onto them. The axis that maximizes the energy is the first principal axis, and the component of the currents along this axis is the first principal component; the axis that minimizes the energy is the second principal axis, and the component of the currents along this axis is the second principal component. The first and second principal axes are orthogonal. These axes are marked on Figure 2a, labeled PC1 and PC2.

Time series of the first and second principal components are shown in Figure 2b. The positive directions are shown in Figure 2a; the positive direction of PC1 is towards 26.5°N and of PC2 is towards 296.5°N. The currents have a strongly preferred direction along the first principal axis. The second principal component is much weaker than the first, and has a more randomly variable direction. The variation of current properties with depth is discussed in Hazen and Sawyer (2003). The currents flow in predominantly the same direction over the depth, especially the deeper currents which are very uniform

in direction. Nearer to the surface, the Northerly flowing currents are shifted somewhat counterclockwise. Speeds decrease slightly with depth from peaks of around 85 cm/s near the surface to about 65 cm/s near the bottom. Depth-averaged speeds range up to about 80 cm/s with an average value around 20 cm/s.



a) Polar Scatter Diagram.



b) Time Series of Principal Components

**Figure 2. Currents Used in Simulations.**

The currents show a seasonable variability. Speeds are generally high throughout the year with monthly averages ranging from about 14 cm/s in June up to 33 cm/s in February. From January to early May, the currents are strong and flow predominantly towards the SES with occasional flows to the NWN. Around early May, the current

regime switches, and the direction becomes more Northerly, with oscillations to the SES. The average velocity vector during January - May is about 15 cm/s to the SES at 210°N, and during June to December about 11 cm/s to the NWN at 26°N. On an annual basis, these two currents almost cancel each other out, leading to a net average velocity close to zero. Maximum speeds varied from 60 cm/s in October up to almost 100 cm/s in March.

Energy spectra of the currents show peaks at semidiurnal, diurnal, and sub-inertial frequencies. The relative magnitudes of these peaks vary with depth as well as time through the year. The semidiurnal tidal component was the least important, although close to the bottom its magnitude is comparable to the diurnal peak. The semidiurnal peak remained relatively constant through the year but the diurnal peak varied. Although the diurnal astronomic tide compounds the tidal oscillation at this location, this variable behavior seems to be also influenced by the sea-breeze component of the winds as the rotary cross spectrum between wind and currents showed good correlation at the diurnal frequency. The sub-inertial period energy decreased with depth for the whole year. Tidal height measurements are given in the Final Report of the Oceanographic Program, Hazen and Sawyer, October 1998. The fluctuations are small, generally less than 45 cm, and so do not contribute significantly to the currents.

### **3.3 Density Stratification**

Density stratification, the variation of seawater density with depth, is very important to wastewater plume behavior. A strong stratification can trap the plume below the water surface, and can limit initial mixing and dilution.

Density stratification was measured with a profiling instrument deployed from a boat at various locations off the Cartagena coast. The sampling was concentrated around Punta Canoa and at the proposed outfall site. 188 profiles were obtained from 23 January 1998 to 25 June 1998. The profiles are presented in the Final Report of the Oceanographic Program, Hazen and Sawyer (October 1998) and in Roberts (2003).

In addition, continuous stratification measurements were obtained by a thermistor string moored near the diffuser site. The string consisted of five thermistors spaced about 3 m apart along a stainless steel cable with a concrete anchor and a buoy in 20 m water depth. Data were obtained from November 1, 1999 to August 2, 2000, and from August 3, 2000 to June 22, 2001. The data are presented in Roberts (2003).

The profiles and the thermistor data show the stratification to be generally weak. Density differences over the water column (up to 60 m deep) typically vary from zero (i.e. homogeneous or well-mixed) up to 1  $\sigma_t$ -units (a density difference of 1 g/cm<sup>3</sup> or 1 kg/m<sup>3</sup>). The water column is frequently well-mixed over depth. The density stratification is mainly due to temperature variations, although a thin layer of lower salinity water was often observed near the surface. Stratification is weaker in winter (0.3  $\sigma_t$ -units) and somewhat stronger in summer (1.8  $\sigma_t$ -units). During the summer months,

May to September, temperature differences over the water column vary up to a maximum of two degrees Celsius but are usually much less.

### **3.4 Discussion**

The oceanographic data and mathematical plume modeling using this data has been previously discussed in Roberts (2003). The proposed site is quite favorable for marine wastewater discharge. Currents are generally fast, resulting in efficient and rapid mixing near the diffuser with high initial dilutions. Density stratifications are generally weak, so the plume will usually reach the surface. Transport of the wastewater to the shore is highly unlikely. Potential bacterial impacts are discussed further below.

## 4. MATHEMATICAL MODELING

### 4.1 Introduction

The mechanisms of wastewater mixing in the ocean are discussed in Roberts (2003). Because of the very wide range of time and length scales involved, it is not possible to simulate all the processes in one model. They are usually divided into “near field” and “far field” processes. In the near field, turbulent mixing is extremely energetic, resulting in rapid dilution. In the far field the plume is transported by ocean currents and mixed by oceanic turbulence. The near field typically extends up to a few hundred meters from the diffuser; the far field extends up to several kilometers. The near and far field modeling and results are presented below.

### 4.2 Near Field Modeling

Plume behavior in the near field was simulated with the mathematical model NRFIELD. The model is described in Baumgartner et al. (1994). It predicts the near field plume behavior, including dilution, rise height, thickness, and the length of the near field. The model was run with the oceanographic data to produce long time series of predicted plume characteristics, similar to the procedure used in modeling the Mamala Bay, Hawaii, outfalls (Roberts, 1999a).

The model was run at one hour time steps through the one year modeling period. The inputs to the model at each time step, in addition to the fixed diffuser parameters, are the wastewater flowrate, current speed and direction, and density stratification. The input data and parameters were generated or chosen as follows.

The diffuser parameters are those proposed by the engineering consultants. The diffuser length is 520 m, consisting of 27 Tee-shaped risers spaced 20 m apart. Each riser contains two ports of nominal diameter 200 mm. The diffuser depth is 20 m and the diffuser orientation is 115°. This orientation was chosen to be approximately perpendicular to the first principal current component (see Figure 2) in order to maximize the near field dilution (see Roberts, et al., 1989).

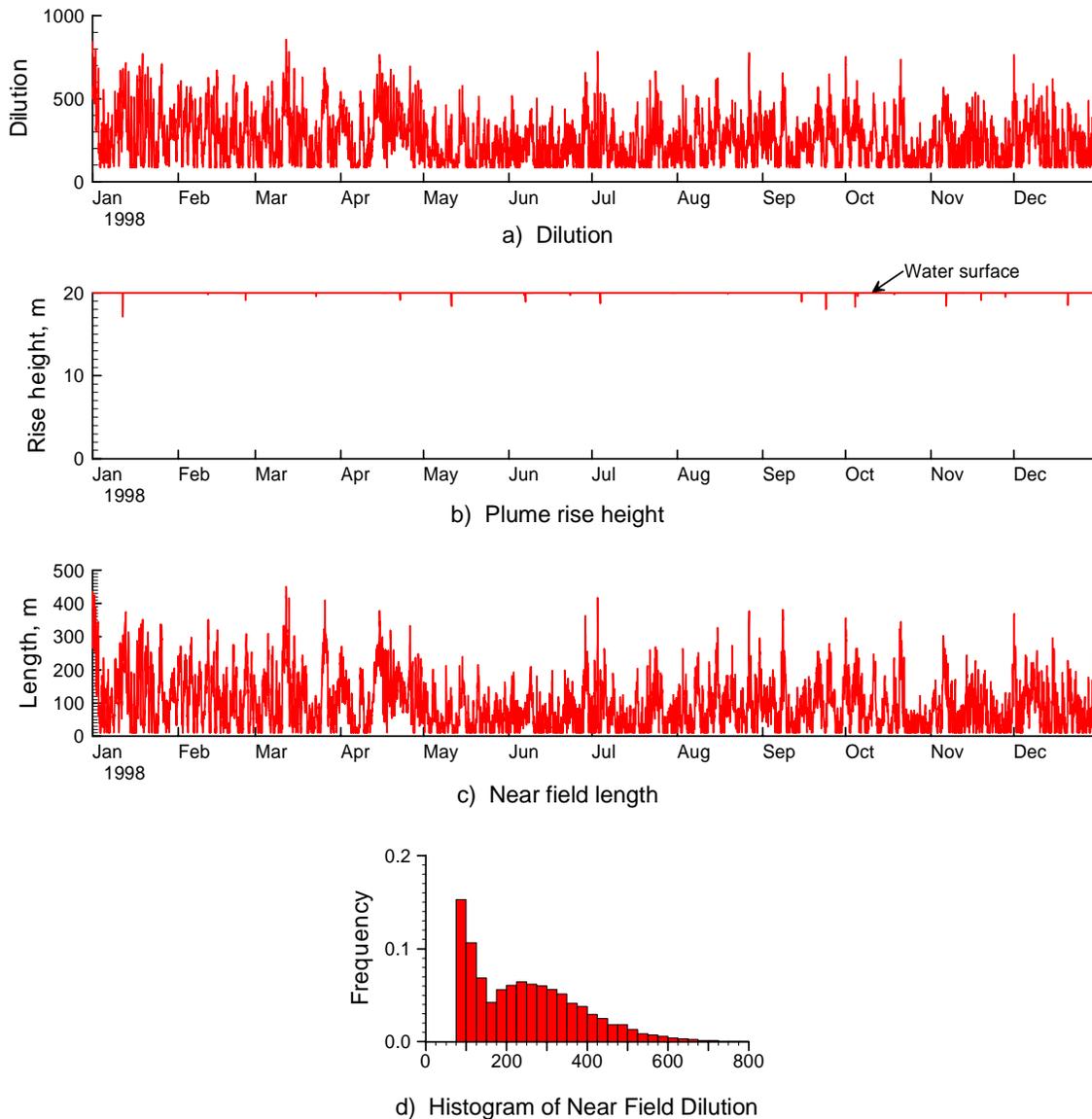
The peak flowrate was assumed to be 3.9 m<sup>3</sup>/s (90 mgd), which is the projected future flowrate for the years 2015 to 2025. A diurnal flow variation was assumed (Roberts, 2003) that was repeated through the modeling period. The effluent density was taken to be 998 kg/m<sup>3</sup>.

The currents were those measured by the ADCP and shown in Figure 2. The 15-minute data were depth-averaged and then averaged to one reading per hour.

The density stratification over the water column at every hour is also needed. As salinity was not measured by the thermistor strings, it was not possible to calculate hourly density profiles. Therefore, synthetic density profiles were generated as discussed in Roberts (2003). The mean and standard deviation of the density at each depth was first computed from all the profiles and a linear regression line was fit to each profile. The histogram of

the slopes of these lines showed a near log-normal distribution. The slope of the density profile at each time step was then obtained by a log-normal random number generator routine. The stratifications obtained are consistent with the data obtained from the thermistor string.

NRFIELD was run with these data for the period of one year, a total of almost 9,000 simulations. The predicted time series of near field dilution, plume rise height, and near field length, and the frequency distribution of near field dilution are shown in Figure 3.



**Figure 3. Near Field Simulation Results.**

The predicted dilutions (Figure 2a) are always high. Dilutions range from 84 to 860 with a median value of 230. Dilutions were greater than 100:1 for 85% of the time. Dilutions less than 100:1 are not significant as they only occur during high flowrate, and they could be artifacts of the manner in which the density profiles were generated. The length of the

near field (Figure 2c) depends mainly on the current speed. It ranges from 11 to 450 m, with a median value of 80 m. Because of the weak stratification, the plume almost always surfaces (Figure 2b). For the assumed stratifications, the plume reaches the surface more than 99% of the time; when the plume surfaces, the dilution is always greater than 85:1.

### 4.3 Far Field Modeling for Bacterial Compliance

In the far field, the plume wanders with the ocean currents and is diffused by oceanic turbulence. The rate of diffusion is much slower than in the near field, although reduction of bacterial concentrations by mortality can be quite high. Because the current speed and direction are quite variable and partially random, transport of the plume to any particular location is highly intermittent. Bacterial concentrations at any particular location will consist of moderately high values separated by long periods of zero or very low levels. Because of this intermittency and the random nature of plume trajectories, a statistical approach to this problem is often used. In the following, we use the approach of Roberts (1999b) in modeling the Mamala Bay, Hawaii, plumes. The probability of transport due to advection by currents to any location is computed, and the reduction in bacterial concentrations due to oceanic turbulence and mortality are computed.

The modeling assumptions are the same as used in Roberts (2003). Oceanic diffusion is computed according to Brooks (1960) solution to the diffusion equation assuming the “4/3 power law” where the lateral diffusion coefficient varies with the 4/3 power of the field width. The initial value of the horizontal diffusion coefficient,  $\varepsilon_o$  is given by:

$$\varepsilon_o = \alpha L^{4/3}$$

where  $\alpha$  is a constant and  $L$  the initial field size, assumed equal to the diffuser length,  $L$ . Following Fischer et al. (1979), the value of  $\alpha$  was assumed to be  $0.006 \text{ cm}^{2/3}/\text{s}$ . This value is midway in the range given for coastal waters by Fischer et al. (1979).

Bacterial mortality is assumed to follow a first order decay process so that the bacterial concentration  $c$  after travel time  $t$  is given by:

$$\frac{c}{c_o} = 10^{-\frac{t}{T_{90}}}$$

where  $c_o$  is the bacterial concentration following near field mixing and  $T_{90}$  is the time for 90% reduction in bacteria due to mortality.  $T_{90}$  is allowed to vary diurnally according to the equation assumed by the consultants:

$$T_{90} = 10.75 + 9.25 \cos\left(\frac{\pi}{12} \tau\right)$$

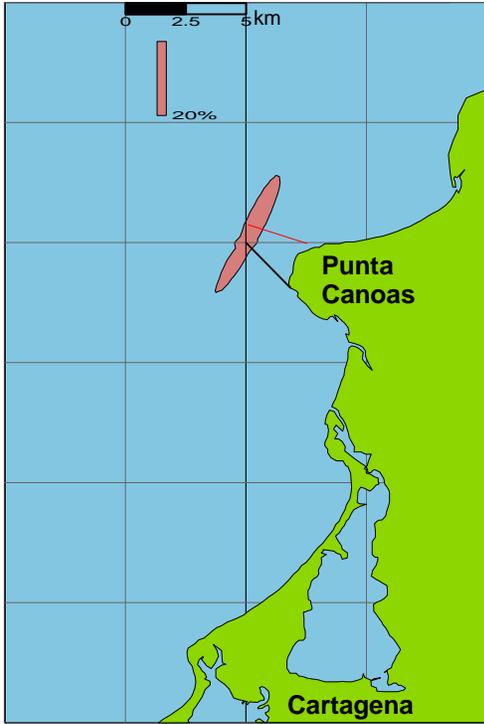
where  $\tau$  is the time in hours after midnight. Therefore,  $T_{90}$  ranges from 1.5 to 20 hours through the day. The initial total coliform concentration in unchlorinated effluent was

assumed to be  $10^7$  per 100 ml, and the fecal coliform concentration assumed to be  $2 \times 10^6$  per 100 ml. In chlorinated effluent the initial total coliform concentration was assumed to be  $10^5$  per 100 ml, and the fecal coliform concentration assumed to be  $2 \times 10^4$  per 100 ml. Intestinal enterococci were measured in raw effluent in Cartagena in May 2004. The value obtained was  $2.4 \times 10^5$  per 100 ml. This was assumed to be reduced by 50% by treatment, so a value of  $1.2 \times 10^5$  per 100 ml of intestinal enterococci in the wastewater was assumed for the model runs.

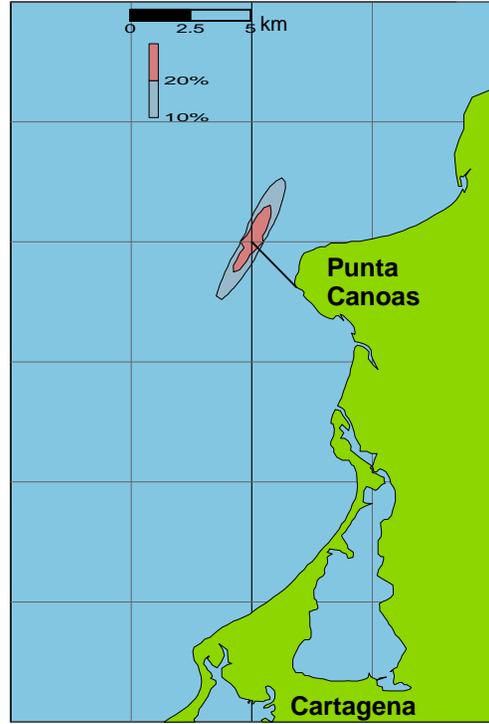
Transport was simulated by the mathematical model FRFIELD (Roberts, 1999b). This model is coupled to the near field model NRFIELD that was discussed previously. The inputs to FRFIELD are the plume characteristics predicted at the end of the near field by NRFIELD and the depth-averaged currents. In other words, the currents, stratification, and flowrate are first used by NRFIELD to predict the near-field wastefield behavior, and then FRFIELD uses the measured currents to predict the subsequent advection and diffusion of the plume in the far field. The maximum travel time is taken as the semi-diurnal tidal period, approximately 12 hours, as these travel times result in maximum bacterial impact.

The coliform predictions for unchlorinated affluent are shown in Figure 4. The results are shown as the frequencies, in percent, with which certain coliform levels are exceeded. Regions where the California standards may be exceeded are shown in red. The California faecal coliform standard (Figure 4c) is more stringent than the total coliform standard (Figure 2a). The contours elongate considerably along the first principal current axis due to the predominance of currents in this direction. Little elongation, or transport, towards shore is predicted due to the slow speeds and random directions of the onshore currents. Because these onshore currents are slow, of short duration, and infrequent, the frequency of exceedance decreases rapidly in the shoreward direction. The standards are reached within a few hundred meters from the diffuser as discussed further below. The bacteria level in Figure 4a is the same as the Colombian primary contact standard. The bacteria level in Figure 4b is the Colombian secondary standard (and the Brazilian standard). Neither the Colombian primary nor secondary contact standards should be violated at the shore.

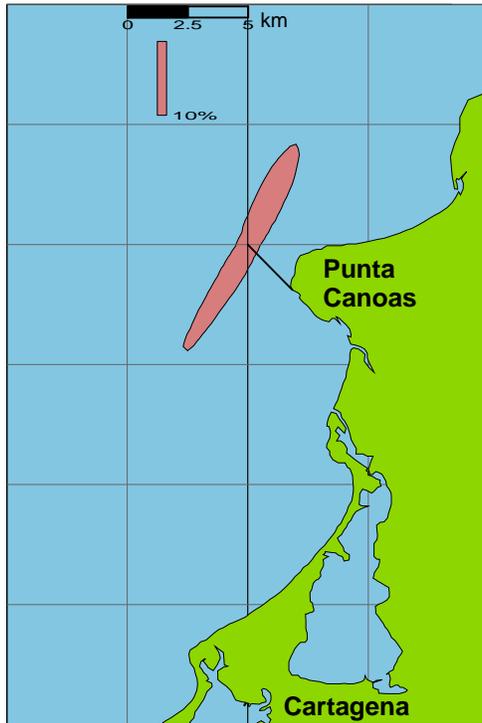
The coliform predictions for chlorinated affluent are shown in Figure 5. Chlorination is assumed to reduce the coliforms in the effluent by two orders of magnitude. As can be seen, there are no contours on these maps, i.e. the standards should be met everywhere. This is primarily because of the high near field dilution, whose median value is 230; (Section 4.2). This reduces the total coliform level of  $10^5$  per 100 ml to less than  $10^3$  per 100 ml right away, so this level is never exceeded in the ocean.



a) Total coliforms, 1,000 per 100 ml

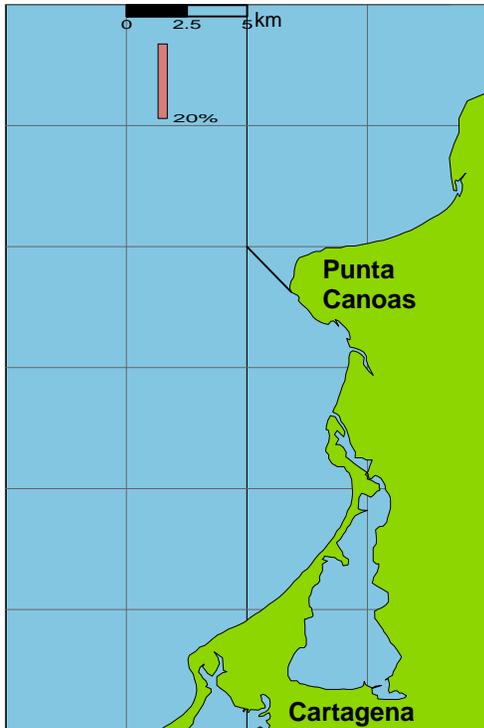


b) Total coliforms, 5,000 per 100 ml

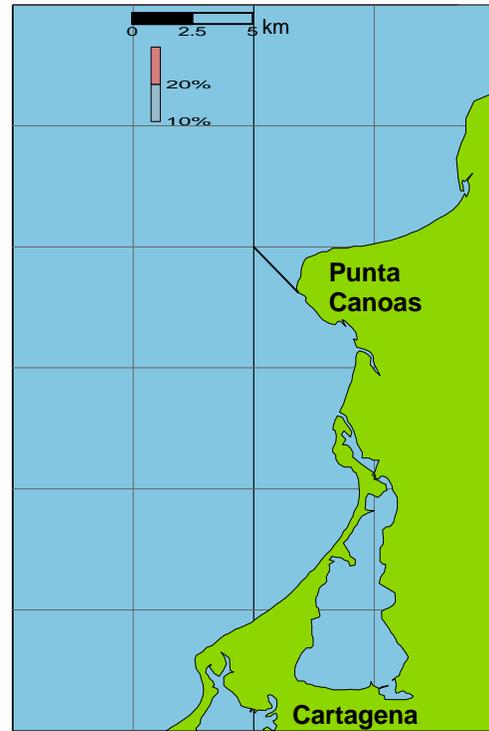


c) Fecal coliforms, 400 per 100 ml

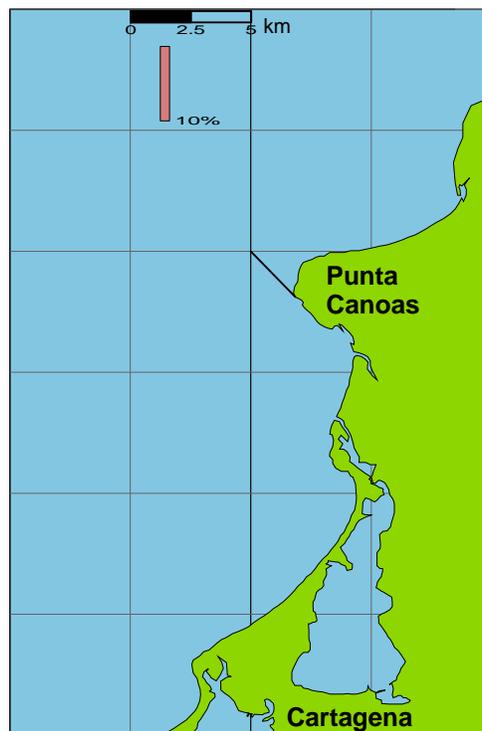
**Figure 4. Frequency of Exceedance of Various Levels of Total and Faecal Coliforms for Unchlorinated Effluent. Areas in Which California Standards May Be Exceeded Are Shown in Red.**



a) Total coliforms, 1,000 per 100 ml



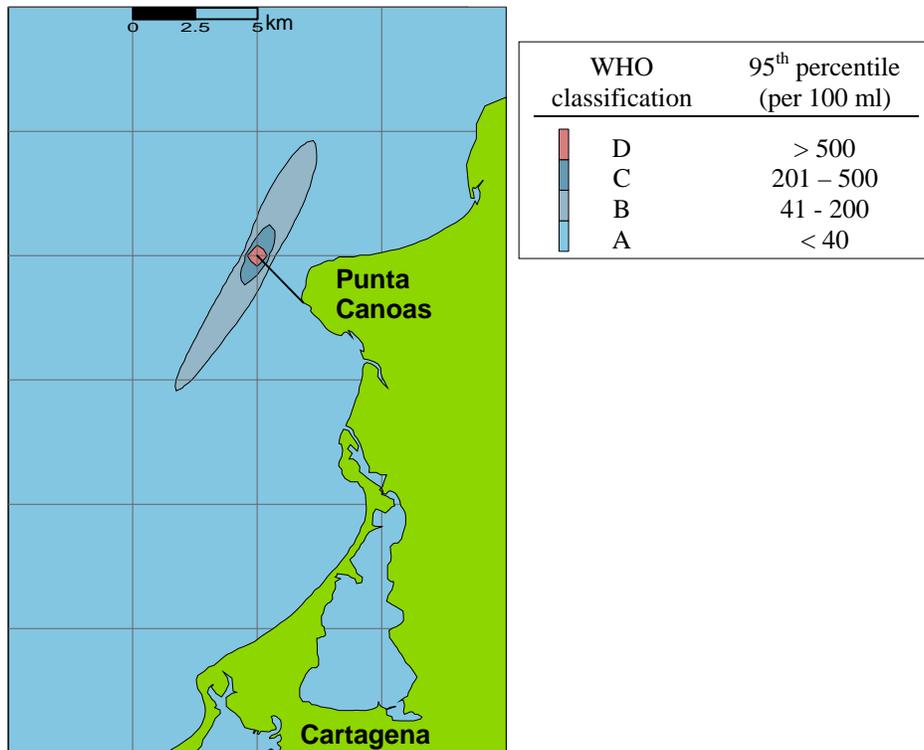
b) Total coliforms, 5,000 per 100 ml



c) Fecal coliforms, 400 per 100 ml

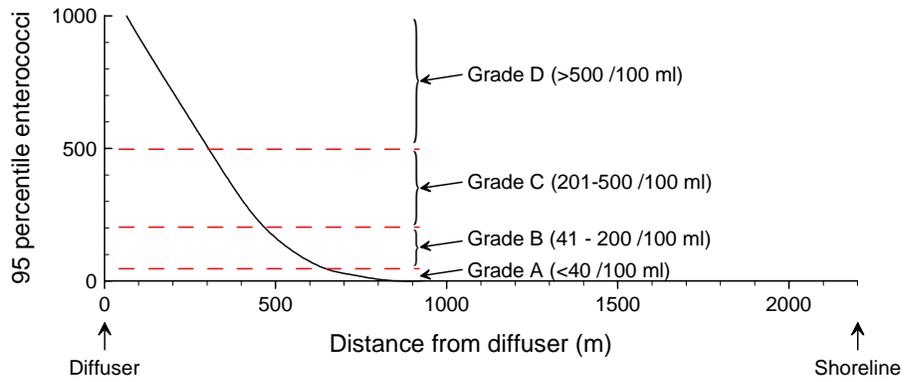
**Figure 5. Frequency of Exceedance of Various Levels of Total and Faecal Coliforms for Chlorinated Effluent.**

Comparisons of intestinal enterococci levels for unchlorinated effluent to the WHO guideline values are shown in Figure 6. This figure shows contours of the 95 percentile values (i.e. 95% of the values are below this value) for the various enterococci classification levels used by WHO. Again, the worst area is confined to a small region near the diffuser. Water quality improves rapidly towards shore, and meets the highest grade of A at a distance of about 600 m from the diffuser. It should be noted that Grade A is a quite stringent requirement, even Grade B water is considered fairly low risk (See Tables 1 and 2).



**Figure 6. 95 percentile Values of Intestinal Enterococci for Unchlorinated Effluent and Comparisons to WHO Guideline Values.**

To illustrate the rapid improvement in water quality in the shoreward direction, enterococci levels were computed along a line from the diffuser to shore. The line is from the diffuser to the closest shoreline point near Punta Canoas, a distance of about 2.2 km. The results are shown in Figure 7. The steep decline in bacterial levels with distance is apparent. The water improves to Grade C at a distance of about 300 m, to Grade B at about 450 m, and Grade A at about 650 m. In other words, the water quality reaches the highest grade level at about 1.6 km from the shore. Water quality at the shore should be even better.



**Figure 7. Variation of 95 percentile Enterococci Levels along a Line from the Diffuser to Shore and Comparisons to WHO Guideline Values.**

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**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 4.**  
**Letter of Support for the Project from Community Leaders of**  
**Southeast Cartagena to the District House of Representatives**



**FOUNDATION OF UNITED LEADERS  
FOR DEVELOPMENT OF THE SOUTHEASTERN ZONE**

Cartagena de Indias, September 11, 2001

Members of the House of Representatives  
Committee 1a  
Santa Fe de Bogotá D.C.  
Cartagena

Greetings:

The city of Cartagena, and particularly its southeastern zone, is suffering serious environmental degradation as a result of its lack of sewage disposal facilities, with drastic effects on its quality of life. Due to the lack of sewage disposal, it has become normal to find sewage running through the city's avenues, streets, gutters and canals. This sewage is dumped untreated into the city's internal bodies of water such as the wetland known as La Ciénaga de la Virgen, which receives 60 percent and the Bay, 40 percent. This situation leads to pollution, infant mortality and [*destruction of*] the ecosystem of the marsh and the bay.

The most alarming thing is that pollution has been found to lead to high indexes of morbidity and mortality, and based only on statistical data supplied by the District Administrative Health Department (DADIS) and the State Social Enterprise (ESE) of Esperanza *neighborhood*, which have to do with health in the southeastern zone, the statistics for the year 2000 [*are as follows for*] illnesses caused by sewage: acute laryngitis: 10,037 cases; acute respiratory tract infections: 8,580 cases; intestinal parasitoses: 4,806 cases; influenza: 4,695 cases; indeterminate intestinal infections: 4,197 cases, and diarrhea of presumed infectious origin: 2,516 cases. Giving a grand total of 34,831 cases and a mortality rate way above the average for cities in Third World countries, without taking into account the other statistics from the ARS, IPS and ESES in the rest of the city.

We may add to this the fact that Cartagena, being a city with a rich historical past, with beaches and bodies of natural water (Ciénaga de la Virgen, the Bay and Canal del Dique) is socioeconomically very dependent on tourism, which has gradually been declining because no solution has been found to the sewage problem. Thus we do not understand why, now that there is a solution available that is technically, socially, economically and ecologically feasible, some people are opposing it with theoretical arguments concerning its technical and financial aspects, heightening the risk that the World Bank, through exhaustion of its funds and the injustice [*of those arguments*], will withdraw its financial support and we, the citizens of Cartagena, will have to wait for another 30 years while more studies are carried out that will once again come to the conclusion that the best alternative of all the solutions that were, without exception, considered in the Hanzer & Sawyer study (one million three hundred dollars), is the submarine outfall.

Proof of this, which cannot be overlooked, is that the Water Supply and Sewage Master Plan, and its final component, the submarine outfall, is the only project that is endorsed in its entirety by the national government, approved by the District, and accepted for financing by the multilaterals (World Bank and Inter-American Development Bank).

I put it to you, members of the House, that failure to carry out the Water Supply and Sewage Master Plan and its final component, the submarine outfall, will result in the following situations:

1. Perpetuate the poor image of Cartagena at the national and international levels.
2. Continue to hold up industrial and tourism development.
3. Prevent the cleaning up of the city's bodies of water, affecting fishing, ecological recovery and the development of ecotourism.
4. Cause the city to continue to incur serious economic losses through its efforts to combat diseases resulting from pollution, so that it is unable to invest in works of major importance such as development of the old city, El Corralito de Piedra.

The city's poor image, the negative impact on its socioeconomic status, the high mortality and morbidity rates resulting from the environmental pollution that fouls the city (Cartagena stinks from one end of the city to the other): all these issues could be solved through implementation of this project in the same way as other coastal cities throughout the world [*which*] have seen their development take off by using the submarine outfall solution to solve their wastewater disposal problems. One example is the city of Viña Del Mar in Chile, which hosts Latin America's largest music festival and which has started to receive new inflows of foreign exchange and investment, enabling it to solve its problems of unemployment, tourism, and infrastructure, with a submarine outfall off its inland beaches 1,800 meters from the shore at a depth of 18 meters, with pretreatment; this is similar to the design for Cartagena, which is actually longer, deeper, and in the open sea.

Last of all, the majority of those of us who are involved in civil management and those who live in the zone are wondering, given that most of the world's coastal cities have submarine outfalls that are working without causing any pollution, *why is Cartagena the only exception?*

Very truly yours,

FUNDACIÓN FLUDEZSO

(signed)  
Ángel Palacio S.  
President

(signed)  
Alvaro Venecia C.  
Secretary

Copy: Senators and representatives of Bolivar, the spoken and written press.

Attached are the signatures of community leaders from the various *barrios* of the city of Cartagena.

**FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL**

PERSONERIA JURIDICA No. 2635 MAYO 2001  
NIT. 906-909-769 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. Victoria Gomez	Sr. Progreso	45426414	<i>[Signature]</i>
2. CELINA GOMEZ		33141499	
3. JAIRO PUCHE	Sector Progreso	8.272.989	Medellin Jaero B. Puchet.
4. Lucia Fineres Y.	Puntilla	33158.643	Lucia J. Fineres P.
5. Elena Martinez	puntilla	22.860.300	Elena Martinez
6. Sandra Torres	Puntilla	45467473	<i>[Signature]</i>
7. Silvana Atencia	Puntilla	73103719	<i>[Signature]</i>
8. Yabli P. Ramirez Torres	Playa Blanca	33.124.557	Yabli Ramirez
9. Ofelia Ortiz Fuentes	PROGRESO	22.948.027	Ofelia Ortiz
10. Antonia Placer	Playa Blanca	45.47452	<i>[Signature]</i>
11. Karon Duran H.	Playa Blanca	9.082.695	Karon Duran
12. Inma Ingrid Julia Alvarez	Playa Blanca	45524659	Inma Ingrid
13. Lisbeth Ramirez	Playa Blanca	1.581.969	Lisbeth Ramirez
14. Betta Polo	Puntilla	22.753.945	Betta Polo
15. Norma Sanchez	Puntilla	33.153.324	Norma Sanchez
16. Elenys Patino	Progreso	45502882	Elenys Patino
17. Gustavo Melendez	Playa Blanca	9.082.593	<i>[Signature]</i>
18. Eder Romero P.	la Puntilla	9.079.077	<i>[Signature]</i>
19. Patricia	Playa Blanca	45.435.414	
20. Norma Diaz	Playa Blanca	22.797.402	
21. Simona Ortega	La Magdalena	26134428	
22. José Manuel	PUNTIJA	73078103	<i>[Signature]</i>
23. Carlos Sierra Sanchez		3977597	Sierra
24. Miriam Silgado	Sababanda	45524876	Miriam Silgado
25. Ermelinda Velazquez	Sababanda	32.953.913	Ermelinda V
26. Fidel Emilio	Arribo	9.048.092	<i>[Signature]</i>
27. Javier Villalba	Sector Puntilla	73141347	Javier Villalba
28. Juan Alfonso	PUNTIJA	73099005	<i>[Signature]</i>
29. Antonio Cecilia	Duc	33.136.832	Antonio Cecilia
30.			

FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL

PERSONERIA JURIDICA No. 2636 MAYO 2001  
NT.806-009-700 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. Mirena Mendez	NVO Porvenir	45.498900	Mirena Mendez
2. ROSEL E FERNANDEZ	NVO porvenir	73.143.350	ROSEL FERNANDEZ
3. Miguel castilla B.	N.V. Porvenir	73162644	Miguel
4. Margarita Perez J	N.V. Porvenir	45511449	Margarita
5. Osvaldo MARTINEZ E	SAN JOSE	43.136.161	Osvaldo
6. Nancy Alfonso	N.V. Porvenir	45.760.510	Nancy
7. Edileina M.M.	Nuevo porvenir	45166220	Edileina
8. KATY TATIANA	NVO porvenir	22121430	KATY
9. Ruth Maria	mediano	45424935	Ruth Maria
10. Erida Mendez	N.V.O. Porvenir	45.537485	Erida Mendez
11. Guineira Vela	NVO Porvenir	22800913	Guineira
12. HORACIO	HERRERA	73196934	HORACIO
13. WALTER	SONIO	8.703226	WALTER
14. Diana Torres	Nuevo porvenir	73.576691	Diana
15. Suselchatis	n. porvenir	45.452485	Suselchatis
16. Gella Serrano	n. porvenir	20037134	Gella Serrano
17. Sergio Roldán	n. porvenir	70.767.199	Sergio
18. Allagalis Alarín	45467	4546794	Allagalis Alarín
19. Noris Torres B.	Nuevo porvenir	45487420	Noris Torres B.
20. Martha Suarez B.	Nuevo Porvenir	45423364	Martha Suarez
21. ALEXIVIS CONTRA	NUEVO PORVENIR	45752177	ALEXIVIS CONTRA
22. Luis Roberto	NUEVO PORVENIR L.M.15		Luis Roberto
23. Raymond Zetien	NVO Porvenir	73.568391	Raymond
24. Betilda Zambo	NVS Porvenir	45.542.692	Betilda Z.
25. Alejandrina Cardales	NVO Porvenir	33'106.402	Alejandrina Cardales
26. William Cabalcos	NVO Porvenir	73.574460	WILLIAM CABALCOS
27. Edileina DZ	NVO porvenir	45537966	Edileina DZ
28. Lurmeis Sierra	NVO Porvenir	45256251	Lurmeis Sierra
29. Mariana Torres	NVO porvenir	45-487m	Mariana
30. Quinto	PROSUM	7308208	ORGANISAO PADRE DEF

**FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL**

PERSONERIA JURIDICA No. 2836 MAYO 2001  
NT.306-009-768 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. Libardo Martínez	Nuevo Porvenir	73.105.999	Libardo Martínez
2. Rosa A. Matorana S.	NB. Chaparral	45.430.861	Rosa A. Matorana S.
3. Martha S. Matorana	Nuevo Porvenir	33.335.204	Martha Matorana
4. Neila Enríque	Nuevo Porvenir	22712330	Neila Enríque
5. Georgina Olguín A.	Nuevo Porvenir	45.517.466	Georgina Olguín A.
6. Elizabeth Arango Pérez	Nuevo Porvenir	45.686.760	Elizabeth Arango Pérez
7. Esther M. Olguín de B.	Nuevo Porvenir	45.428.624	Esther M. Olguín de B.
Selva S. F.	Nuevo Porvenir	45.513.756	Selva S. F.
8. Hilda Tenorio	Nuevo Porvenir	45.487.575	Hilda Tenorio
10. Vilma Reyes	Nuevo Porvenir	36.557.390	Vilma Reyes
11. Elied Velásquez	NVO. Porvenir	42.134.829	Elied Velásquez
12. EIKIN DE ARCO	NVO. Porvenir	73.181.131	EIKIN DE ARCO
13. ANUAR Velásquez B	NVO Porvenir	73.162.427	ANUAR Velásquez B
14. Wilmer Pedrosa G	NVO Porvenir	73.124.153	Wilmer Pedrosa G
15. Gustavo Pedrosa G	NVO Porvenir	73.006.608	Gustavo Pedrosa G
16. Wilson Muñoz Ortiz	NVO Porvenir	73.187.607	Wilson Muñoz Ortiz
17. Luis Díaz Garrido	NVO Porvenir	45.518.054	Luis Díaz Garrido
18. William Gómez	NVO Porvenir	73.107.332	William Gómez
19. Chenis Pavilla J.	NVO Porvenir	22.804.926	Chenis Pavilla J.
20. Aura Fernanda	NVO Porvenir	45.487.225	Aura Fernanda
21. Luis Yunque	San José	33.155.720	Luis Yunque
22. LEZMA DE LOS DELGADO	Nuevo Porvenir		LEZMA DE LOS DELGADO
23. Eduardo Velásquez B	NVO Porvenir	73.115.492	Eduardo Velásquez B
24. Darlys Velásquez B	Nuevo Porvenir	33.332.303	Darlys Velásquez B
25. Hernán Cortés	Nuevo Porvenir	59.611.119	Hernán Cortés
26. Tania Pedrosa P	Nuevo Porvenir	45.525.025	Tania Pedrosa P
27. Magdalena L	Nuevo Porvenir	45.537.323	Magdalena L
28. Leonor Muñoz O	Nuevo Porvenir	45.500.409	Leonor Muñoz O
29. Carmen Muñoz O	Nuevo Porvenir	45.537.953	Carmen Muñoz O
30. Rosmarí Agaméz B	Nuevo Porvenir	45.759.194	Rosmarí Agaméz B

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**FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL**

PERSONERIA JURIDICA No. 2636 MAYO 2001  
NT. 998-998-760 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. Tania Burgos V.	Puntilla	45.760.320	Tania Burgos V.
2. GILBERTO S M	Puntilla	880296	GILBERTO S M
3. HESTOR GOMEZ	Puntilla	3.583.230	Hestor Gomez
4. Carriera Lopez M.	Puntilla	45.486.830	Carriera Lopez M.
5. Martin's Samuente	Puntilla	22.808198	Martin's Samuente
6. Jesu Samuente		72.84306	Jesu Samuente
7. Arina Lopez Barro	Progreso	9064824	Arina Lopez Barro
8. ROMON	FRATRE	73100934	
9. JUDIAN IRIARTE	EL CAYO BLANCO	933.763	
10. Felicit Paredo	Torres	6583510	Felicit Paredo
11. Juan de la Cruz de la Cruz		33.017124	Juan de la Cruz
12. Clara Bolivar	Torre	45.463.571	
14. Gabriel A. Nista		3.981.014	Gab. A. Nista
15. Piedad Dujes		9065267	Piedad Dujes
16. Juarez Alton		7356860	Juarez Alton
17. Yameth Samuente	Puntilla	22.785.536	Yameth Samuente
18. Edira S. ILO		33.737608	Edira S. ILO
19. Maria Herrera		33.152.165	Cartagena
20. Juan Pardo		73.87952	Cartagena
21. Miguel Angel de la Cruz		3.789.854	Miguel Angel de la Cruz
22. Lilia Suarez	MM	33.157120	Cartagena
23. Luis E. Diaz	Abadía	43.722	Cartagena
24. Maria Simanca	C.O.R. 3 Edad	33.159.262	Maria Simanca
25. Harby Marrugo Cabarcas		73.40.997	Harby Marrugo Cabarcas
26. Heriberto Ramallo		9061883	Heriberto Ramallo
27. Samuel Talar		988265	Samuel Talar
28. Juan Hugo		45.45.889	Cartagena
29. Josefa Ramirez		45.526.144	Josefa Ramirez
30. Trilina Perez M.		45.459.764	Trilina Perez M.
31. Leonardo Lopez Torres		33.73.650	(L)
32. Maria A. Martinez		92.503.000	S/O
33. Neber FLP Maldon	Polo	3.499.203	neber
34. Antonia Geli Torre	Torre	45.446.342	Antonia Geli Torre
35. Claudia Barrin		30.767.953	
36. Caspar Flores	Progreso	9074746	
37. WILSAI C. FLORES	PIERO	72.140.571	
38. Royal Diaz M.	Monter	7307994	
39.			
40.			

**FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL**

PERSONERIA JURIDICA No. 2835 MAYO 2001  
NIT. 896-008-788 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. <del>Emmanuel Pardo</del>		5696805	<del>Emmanuel Pardo</del>
2. José C. Niverthillo	FUNDACION FLUDERCO	90609910	<del>Niverthillo</del>
3. Maria T. Ortiz M.	Chapocua	33.157.974	Maria T. Ortiz M.
4. Glicerio Nuyez M.	Chapocua	73.152.333	Glicerio Nuyez M.
5. Marco Guzman HZ	Chapocua	23.146.057	Marco G.
6. Maria Tasso	Chapocua	9066426	Maria Tasso
7. Ysenia Nuyez	Chapocua	45595285	Ysenia Nuyez
8. Teodoro Paternina	Chapocua	9.104.066	T.P.
9. Lola Salas Benavides	Chapocua	45593.548	Lola Salas Benavides
10. GUSTAVO ALEXO	CHAPACUA	7.921.077	GUSTAVO ALEXO
11. Esteban Soria	Chapocua	34471300	Esteban S.
12. Erickson Paternina Dey	Chapocua	43.188.025	Erickson Paternina Dey
13. Pascual Paternina R.	Chapocua	6863234	Pascual Paternina R.
14. KATHIA COCKER	Chapocua	6611409	KATHIA COCKER
15. Leonor Vega	Chapocua	6611405	Leonor Vega
16. Juan B. Pacheco	Chapocua	45459863	Juan B. Pacheco
17. Nelly Olascoaga	Chapocua	33180.068	Nelly Olascoaga
18. Alfonso B. Rojas	Chapocua	M2844	Alfonso B. Rojas
19. Elmer Negrete	Chapocua	M1123	Elmer Negrete
20. Esteban Soria	Chapocua	115.419.849	Esteban S.
21. Marydella Bell	Chapocua	33129656	Marydella Bell
22. Debra Gomez	Chapocua		Debra Gomez
23. Maria Esteban	Chapocua	2289790	Maria Esteban
24. Maria Navarro P.	Chapocua	33133.962	Maria Navarro P.
25. Naura Rosalbo	Pd. Jimeno	26924983	Naura Rosalbo
26. Patricia Suarez	Chapocua	2290132	Patricia Suarez
27. <del>Ant. Caldera</del>		36499.945	<del>Ant. Caldera</del>
28. DIGNO JUAN	Barro	6.148989	DIGNO JUAN
29. Felix Leon Jimeno	Chapocua	45.956.320	Felix Leon Jimeno
30. RICARDO CARMELLO Gonzalez	CHAPACUA	73.574.724	Ricardo Carmello G.

FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL

PERSONERIA JURIDICA No. 2636 MAYO 2001  
NT.906-006-788 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. Yvelis Osuna	Chapaca Sector el 10 de Mayo	45.530.318	Yvelis Osuna
2. Fabian Hernandez	Chapaca MLL16	22.805.542	Fabian
3. Maria N. Palacios	Chapaca MLL130	82.391.762	Maria N. Palacios
4. Maryly Hernandez	Chapaca H. H. 1.19	45.540.086	Maryly
5. Isabel Coronado	La O	9065162	Isabel
6. Rubi Languez	Chapaca	45499686	Rubi Languez
7. Belkis Violeto	Sonso	33103472	Belkis
8. Silvia Nodalto	Palmar	15763030	Silvia Nodalto
9. Sonia Pardo	Estela	20226611	Sonia Pardo
10. Sebastian Brito	Chapaca	73080909	Sebastian
11. Hugo Berruti	Chapaca	73074158	Hugo Berruti
12. Mary Sierra	Chapaca	9148007	Mary Sierra
13. Miguel Hernandez	JAC. Chapaca	9.085.473	Miguel
14. Esbelina Rojas	Chapaca	33.141.400	Esbelina
15. Brigidal Bastia	Chapaca	45.512.905	Brigidal
16. Joel Hernandez J.	Chapaca	73.577.487	Joel Hernandez
17. Glorica Castillo	Chapaca	33153358	Glorica Castillo
18. Julio Suarez	Chapaca	73093118	Julio Suarez
19. Yuddy Hernandez	Chapaca	21808789	Yuddy
20. Cecilia Languez	Esperanza	45036387	Cecilia Languez
21. TELMO RODRIGUEZ	Esperanza	893879	Telmo Rodriguez
22. Mercedes Cortes	Chapaca	25837113	Mercedes Cortes
23. Luis Padilla	Chapaca	73156688	Luis Padilla
24. Flor Rincón	Chapaca	23227591	Flor Rincón
25. Gilberto Hernandez	Chapaca	956332	Gilberto Hernandez
26. Beatriz Sierra	Chapaca	45453290	Beatriz Sierra
27. Mariela Nodalto	Chapaca	4816785	Mariela Nodalto
28. Antonio Pardo	Estela	9290875	Antonio Pardo
29. Abel Cordoba	Estela	5096848	Abel Cordoba
30.			

**FUNDACIÓN DE LIDERES UNIDOS PARA EL DESARROLLO  
DE LA ZONA SUR ORIENTAL**  
PERSONERIA JURIDICA No. 2636 MAYO 2001  
NT.806-006-700 DV-4  
CARTAGENA - BOLIVAR

NOMBRES Y APELLIDOS	ORGANIZACIÓN, COMUNA, BARRIO	CEDULA DE CIUDADANIA	FIRMA
1. José Hernández	S.O.P. Popoye	9.060.890	[Firma]
2. Víctor J. J. J.	JAL	82311440	[Firma]
3. Manuel Hernández	La Campesina	9065162	[Firma]
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6. AURELIO TAPIAS ESPAÑA	FUND. COLOMBIA VIVE	9087230	[Firma]
7. JOAQUÍN HERNÁNDEZ	EDIL C # 6	72085162	[Firma]
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12. Lina Martínez P.	J.A.C. Progreso	9082136	[Firma]
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25. DEYANIRO BARRIOS	Playa Blanca	45.501.156	[Firma]
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27. Víctor Angulo	" " "	9.196.586	[Firma]
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31. Haroldo Hernández	Electoral	73.159.282	[Firma]
32. Gladys Rojas	Puente	33153.716	[Firma]
33. Jacquelin Jara	Puente	45.574.260	[Firma]
34. Mariacelly Palacio		40.789.406	[Firma]
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37. Gladys Jelis	Puente	8424.246	[Firma]
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**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 5.**  
**Terms of Reference for**  
**Rapid Environmental Assessment of the**  
**Water-Supply Projects**  
(works which form part of the Project, excluding wastewater)



# RAPID ENVIRONMENTAL ASSESSMENT OF THE WATER-SUPPLY PROJECTS – ACUACAR

## TERMS OF REFERENCE

### Purpose

The purpose of the study shall be to make a rapid analysis of the possible environmental and social conflicts entailed by the construction and operation of different water-supply projects to be implemented in the city of Cartagena, and to provide specific environmental management recommendations to be incorporated in the designs of the works or in the construction phases.

### Works to be analyzed

The works to be analyzed are summarized below:

### CATCHMENT AND PUMPING

- \* **Expansion of Albornoz reservoir:** Consisting in the construction of a 96,000-m<sup>3</sup> capacity reservoir alongside of the existing reservoir in the Albornoz pumping station, with the appropriate connection structures. This project would increase the raw-water storage capacity in this station, which would serve to lessen the vulnerability of the present raw-water conveyance system.
- \* **Alternate electrical connection for the Albornoz station:** Comprising installation of a three-phase 13,200-V power line from the Ternera substation to the Albornoz pumping station, using AAAC No. 4/0 cable with insulation at 34.4 kV and 12.00-m concrete poles. This connection will provide an alternative supply source for the Albornoz Pumping Station, thereby reducing the vulnerability of the present production system.
- **Conveyance lines and distribution systems**
- \* **Splitting of Dolores – Piedrecitas – Albornoz (Stage II):** This project comprises continuation of the new raw-water conveyance line between the Dolores, Piedrecitas and Albornoz stations, which will involve: supply and installation of 4,526 m of 1,000-mm pipe, broken down as follows: 1,100 m between the Dolores station and the point where a previously laid line begins that ends in the Piedrecitas station; and 3,426 m of line to be laid between the Piedrecitas station and a section of line installed earlier that ends near the Albornoz station. Completion of this project will create increased raw-water conveyance capacity and reduce the vulnerability of the present line, which frequently suffers damage.
- \* **El Pozón Neighborhood Water-Supply Systems:** This project comprises the supply and laying of 21,400 m of 110-mm PEAD line and installation of 3,500 house connections. It will provide secondary water systems to 60% of the El Pozón neighborhood, with which 100% water-supply coverage will be obtained if one takes into account the investment in water-supply systems already planned by the District of Cartagena for this neighborhood.
- \* **La Popa Hillside Zone Water-Supply Systems:** This project comprises the installation of main and secondary networks and solution of the drinking-water supply problem by means of a pressure system connected to the public network for the neighborhoods

located on the upper slope of the La Popa hill. The work will include laying of 2.6 km of H.D. line in diameters between 200 mm and 400 mm plus 28 km of PEAD line in diameters between 63 mm and 250 mm, by means of which a water-supply coverage in excess of 90% would be achieved for the above-mentioned neighborhoods.

- \* **Water-Supply Systems Lacking in the Southeast Zone:** The works involved include the supply and installation of 1,280 m of 200-mm PEAD pipe and 7,445 m of 110-mm pipe to complete the water systems for the La María, San Francisco and Paraíso neighborhoods located in the far right of the city's southeast zone. Together with the investment currently being made by Aguas de Cartagena, these works would bring water-supply coverage in the zone up to 95%.
- \* **Water-conveyance and distribution in the Membrillal neighborhood:** This project comprises the supply and installation of the drinking-water conveyance line from the Alcalis treatment plant to the road intersection at the Colclinker quarry with the Gambote – Mamonal alternative route, using a 2,000-m long 300-mm PEAD line, plus the supply and installation of 4,430 m of 110-mm PEAD line and 860 m of 63-mm line, together with installation of 11 valves. This project will bring water service to the Membrillal neighborhood and adjoining areas which have not been able to obtain service for a number of decades due to their distance from the treatment plant.
- \* **Water supply for squatter neighborhoods:** The project envisions the installation of 1,735 m of 110-mm PEAD pipe and 1,050 m of 63-mm pipe. The aim is to provide partial and controlled water service to the La Estrellita, La María, and La Sierrita No. 2 neighborhoods and the back part of San José de Los Campanos, all of which are neighborhoods now in process of consolidation that were the product of unplanned subdivisions and squatter settlements and which are now generating strong pressure to obtain basic public services.
- \* **Relocation of 30" line in the Amberes neighborhood.** Supply and laying of 1,100 m of H.D. 800-mm line in Calle Madrid in the Amberes neighborhood, with the aim of relocating an existing line section on which some 20 homes were built 25 years ago and which now represents a greater hazard for the community living there with every day that passes.
- \* **Interconnection of Colinas Tank and Alcalis System:** This involves the supply and laying of 1,900 m of H.D. 600-mm pipe from the Colinas tank then following the Henequén road and passing through the Antonio José de Sucre, 20 de Julio and Villa Barraza neighborhoods until connecting with the 24" line by the road to Mamonal. The object of this project is to supply drinking water to the Mamonal industrial zone by means of the Colinas tank, thereby increasing system reliability for the industrial zone and reducing operating costs.
- \* **Partial replacement of filling line for the Colinas tank:** The project comprises installation of 1,530 m of H.D. 800-mm line. The intention is to replace the section of the tank-filling line located under substandard dwellings along the road running behind the treatment plant; these homes were part of unplanned urban growth in previous years. The project will greatly lessen the risk represented by any line break on these locations.
- \* **Replacement of Water-Supply Line to Paseo Bolívar Neighborhood:** This project will involve the laying of 2,350 m of H.D. 400-mm line and 1,021 m of PEAD 110-mm line.

The aim here is to replace the 16" line in the Cra. 17 in Paseo Bolivar, where frequent breaks occur leading to repeated suspensions of service; in addition, this opportunity will be used to separate the upper part of Torices, which will be supplied from the Nariño tank, from the lower part, which will continue to be supplied from the 30" line. The route of this conveyance line will start in the El Espinal neighborhood and will pass through the Torices, San Pedro y Libertad, Canapote Daniel Lemaitre and Santa María neighborhoods.

- \* **Barrios Plan:** This project envisions the laying of 2,000 m of 300-mm PEAD pipe, 4,430 m of 110-mm pipe and 860 m of 63-mm pipe, the object being to resolve and improve the hydraulic functioning of the present water lines in neighborhoods such as El Prado, Lower San Isidro, Cartagenita, Altos del Nuevo Bosque and Villa Estrella, which will bring about a significant improvement in the system's performance.

## **TREATMENT AND STORAGE**

- \* **Construction of Stage I of the Albornoz treatment plant and pumping station.** Construction of the first 60,000 m<sup>3</sup>/day module of the Albornoz treatment plant, which includes dosing structures, flocculation, parallel-plate sedimentation, filter battery and dosing tank for chlorine plus storage, plus in addition the pumping station for moving water from Albornoz to the Colinas tank with an installed power of 600 kW. This project would increase the water-treatment capacity by 60,000 m<sup>3</sup>/day, thereby reducing the cost of pumping raw water and lessening the vulnerability of the present water-treatment facility.
- \* **La Loma Tank (Stage II):** Construction of the tank in concrete, with capacity of 5,000 m<sup>3</sup>. Supply and installation of pipes and accessories for connection and protection of slopes with stone riprap and a containing wall. This project will make it possible to increase the system's storage capacity by 5,000 m<sup>3</sup>/day and to expand continuity of service to 24 hours in the high zones around the El Bosque treatment plant.
- \* **Sludge Treatment El Bosque Treatment Plan (Stage I):** Construction of two sludge-thickening tanks of 35 m diameter and 3.5 m useful height, supply and installation of the decanted-water pumping system (installed power 50 kW), sludge pumping station (installed power 45 kW), upgrading of the existing sedimentation ponds and construction of concrete drying areas with their respective handling areas (total area approximately 2,500 m<sup>2</sup>). The intention here is to enable more appropriate handling of 9 tons/day of sludge resulting from water treatment, thereby improving the environmental condition of the plant's surroundings and of the discharge channel for the water used in washing filters and sedimentation equipment that empties into the Bay of Cartagena.

## **Legal framework**

The environmental impact assessment (EIA) must be performed in accordance with the requirements laid down in the following:

- World Bank Operational Directive 4.01, Annex A: "Environmental Assessment and other operational directives, in particular the policy on involuntary resettlement of population; operating manuals, notes on operational policies and pertinent guidelines. Any additional information can be found in the Environmental Assessment Manual, Volumes I and II, of the World Bank.

- National legislation and/or regulations on environmental studies and impact assessments and environmental licensing requirements for projects.
- Regulations governing urban infrastructure and sanitation projects at regional, departmental and local level.
- Pertinent international agreements and conventions signed by Colombia.

### **Methodology of the Assessment**

The rapid environmental assessment of these components shall be based on a quick office study and a detailed visit to each worksite. In general the steps listed below shall be followed:

- location of the works in updated urban plans; these plans shall be updated during the field visits that will be described further on; succinct description of each component.
- preparation of a check list of environmental impacts; based on existing check lists for projects of this type. In particular, the list or lists shall include: (i) the need to relocate families because of the location or expansion of the infrastructure; (ii) the impact on sensitive ecosystems (wetlands, native vegetation, etc.); (iii) the impact on sensitive urban infrastructure such as green zones, parks, playing fields, etc.; (iv) the impact on structures of a certain historical or cultural heritage value; and (v) communities or centers or urban infrastructure particularly sensitive to nuisances (dust, noise, traffic) during the construction or operation of the components, such as hospitals, schools, community centers, etc.
- detailed field visit to each of the works and application of the check lists and taking of relevant photographs.
- location of the key check list items on the location maps of the components.
- identification of environmental recommendations for design and construction; these measures will include: (i) relocation of families, in accordance with the World Bank resettlement policies; (ii) landscaping of the works; (iii) control of construction activities (need for an environmental manual for water-supply works contractors) and in particular management of construction waste and pedestrian safety during construction; (iv) specific measures to be taken into account in the designs and operation; (v) rehabilitation or compensation program for impacted infrastructure; (vi) arrangements for managing contingencies; and (vii) the need for information programs and consultation with affected communities. These measures shall be spelled out as regards: (i) detailing or terms of reference for their preparation (manuals for example); (ii) execution schedule; (iii) institutional responsibility (ACUACAR, consultant, contractor, supervising authority, other district entities); and (iv) costs.
- preparation of an Environmental Record Sheet for each worksite that shall contain as a minimum: (i) location of sensitive areas; (ii) the environmental management measures to be implemented for each component; (iii) photographs of the site; and (iv) format for the environmental monitoring of each project.

### **Products expected**

The products expected are the following: (i) Environmental Record Sheet for each component; and (ii) general and specific environmental recommendations for each worksite.

**Time allowed for the Consultancy**

The estimated time required is 45 days, including the field work.

**Profile of Consultant**

Environmental specialist with experience in environmental assessments, 1.5 man-months. The main consultant can also quote for: (i) one assistant engineer, 1.5 man-months; and (ii) one assistant, a draftsman or computer expert, 1.5 man-months.

**Logistic support**

The consultant shall include in his proposal the cost of air travel for his personnel, the cost of land transportation to the worksite and the cost of publishing reports.



**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 6.**  
**Terms of Reference for the**  
**Environmental Impact Assessment**  
**Cartagena Wastewater Management Project**



## TERMS OF REFERENCE

### ENVIRONMENTAL IMPACT ASSESSMENT

#### CARTAGENA WASTEWATER MANAGEMENT PROJECT

1. **Introduction.** Prior to the appraisal by the World Bank of the Cartagena Wastewater Management Project (hereinafter “the Project”), the District of Cartagena-ACUACAR will have to produce an Environmental Impact Assessment (EIA). This requirement is laid down in the World Bank’s Operational Directive on Environmental Assessment (OD 4.01).

2. **Background.** The Cartagena Wastewater Management Project covers primarily the infrastructure for managing Cartagena’s wastewater, such as sewer systems in marginal zones, interceptors, pumping stations, possible wastewater treatment plants (pretreatment, primary treatment) and a possible underwater outfall.

3. ACUACAR is carrying out studies and research designed to determine at feasibility level the wastewater treatment and disposal systems for Cartagena. On a preliminary basis the following options have been identified: (i) construction of a pretreatment plant, with an additional treatment program in the medium term to the extent that it is called for, and (ii) discharge into the sea of 100% of the wastewater by means of an underwater outfall into the Caribbean Sea. The EIA requested shall take into account the findings and progress of these studies and of any others that ACUACAR and the Municipality of Cartagena or other entities may have made or may be making in parallel with the EIA. However, the Consultant will be responsible for the acquisition and generation of such data as are considered necessary for the EIA.

4. Other studies in progress or already completed by the Municipality and ACUACAR that shall be taken into account by the Consultant for the preparation of the EIA:

##### In progress

- Feasibility Study of the Cartagena Wastewater Management Project
- Social Assessment of the Cartagena Wastewater Project

##### Completed

- Environmental Impact Assessment of the Draft Sewer Masterplan – Cartagena Bay watershed
- La Bocana project in the Ciénaga [Lagoon] de la Virgen and its EIA
- (Other studies: Water supply and sewer masterplan, regional development plans, Cartagena Environmental Action Plan, etc.; these are either in existence or underway).

5. The Consultant shall take into consideration that ACUACAR is making a basic environmental impact study as a component of the feasibility studies; this study includes water quality models and oceanographic studies in the Caribbean Sea, technical, economic and environmental analyses of alternatives, identification of impacts during the construction and

operation of the possible outfall, and an environmental monitoring plan for the discharge zone (before, during and after construction of an outfall).

6. **Objectives.** The scope of the studies required will be determined by the magnitude and importance of the negative potential impacts associated with the components of the proposed project. The environmental assessment shall accordingly contribute the elements necessary for the correct planning, location, design, construction, operation and maintenance of the proposed project components in such a way that the expected benefits will be obtained from the investment (improvement of the quality of the bodies of water--the bay, Ciénaga de la Virgen, Caribbean beaches--of concern to Cartagena).

7. **Requirements for the EIA.** The EIA must be consistent with the following basic technical and legal documents:

- World Bank Operational Directive 4.01, Annex A: “Environmental Assessment” and other pertinent Operational Directives, Operating Manuals, Operational Policy Notes and guidelines. Additional information can be found in the World Bank’s Environmental Assessment Manual, Volumes I and II. Special attention shall be paid to Operational Directive 4.04, Natural Habitats, as regards use of wetlands, Directive 4.30 on involuntary resettlement, and Operational Project 7.50 on projects on international waterways.
- National legislation and/or regulations on environmental studies and impact assessments and the environmental licensing and permit requirements for projects.
- Regulations governing urban sanitation and infrastructure at the regional, departmental and local levels.
- Pertinent international agreements and conventions signed by Colombia.

8. **Area covered by Study.** The Consultant shall establish the boundaries of the area of the study for each specific case, especially for the infrastructure components important to the Project, such as: (i) main and intercepting sewers; (ii) pumping stations; (iii) treatment plants or systems, including sludge disposal; and (iv) underwater outfall. The area of influence shall include the areas to the north of the city earmarked for future development.

9. **Task 1. Description of the Proposed Project.** The EIA shall include a detailed (to the extent permitted by the existing studies) and succinct description (using maps on an appropriate scale) of the main components of the Project, employing maps (on an appropriate scale) where necessary, and including the following information: characteristics of the present and future wastewater (flows, quality); location; general disposition; size, capacity of subcomponents; activities prior to construction; construction activities; expected execution schedule; contracting of personnel and of support service facilities; operation and maintenance activities; and expected useful life of the main project components.

10. **Task 2. Description of Environment.** Basic data shall be gathered, evaluated and submitted on the pertinent characteristics of the environment that are relevant to an environmental assessment of a project such as the one proposed. Information shall be included on any change expected prior to commencement of the Project, especially in the zones of high ecological, economic or tourism-related value, and those of a significant social sensitivity such as the low-

income neighborhoods. **To the degree possible the baseline information shall be presented on maps on an appropriate scale, and also using figures and tables and summaries of the pertinent points. The Consultant shall prepare summary maps of sensitive environmental areas in which all areas of high ecological, economic, social and cultural value, and any of significant social sensitivity, in the area of influence of the Project shall be identified.**

11. The baseline shall be designed to establish an analytical knowledge of the pre-Project conditions. Accordingly, the information presented shall be helpful for understanding the impact analysis that will be made later. The baseline shall concentrate primarily on the area of influence defined earlier for each main infrastructure component of the Project. The topics shall include, among others:

(a) Physical environment: geology; topography; geomorphology, soils; climate and meteorology, and their significance in terms of the seasonal nature of the generation of wastewater; air quality; surface and underground hydrology; the dispersal characteristics and assimilative capacity in the alternative discharge site locations including the daily and seasonal effects of the currents, sources of pollution in the bay, the Ciénaga de la Virgen and the Caribbean coastal zone. Special attention shall be paid to the surface drainage to the coastal zones; coastal and oceanographic parameters: water quality and marine currents. The degree of detail in which these topics are studied shall be consistent with their relative significance in the assessment of the environmental impacts.

(b) Biological environment: flora; fauna; rare or endangered species; fragile ecosystems and habitats, both marine and on-land, including parks or reserves, significant natural sites, etc.; commercially important species and their location in the area; and species capable of becoming nuisances, vectors or dangerous. The delimitation of protected areas or of areas of national and international, or metropolitan, importance shall be included, of necessary. The study shall concentrate on the Bay of Cartagena, the Ciénaga de la Virgen, the corals of the Islas del Rosario, and the fishery zone in La Boquilla and Punta Canoa.

(c) Sociocultural environment: population benefited; presence of black communities (according to the Interior Ministry's classification); population and housing density; population projections; present and future land use; planned development activities, particularly the tourism and urban development plans for the North zone; beneficial uses of the marine and coastal waters as primary contact, traditional, commercial and sport fishing, shellfish harvesting, marine resources, esthetic considerations; present and potential tourism zones; community structure; employment; distribution of income, goods and services; recreational and tourism activities and infrastructure; public health and its tie-in with the present sanitation situation; traditional and commercial fishery activities; cultural heritage; land tenure, especially in the case of low-income families likely to be affected by the Project; and customs, aspirations and attitudes of the community regarding the basic sanitation problems. In particular, the socioeconomic studies shall take into account: the underprivileged zones that will be benefited by the Project; the fishing communities of Punta Canoa, La Boquilla and Arroyo de Piedra and others in the area of influence. The traditional fishery activity shall be analyzed as regards its social and economic importance, together with the communities' complementary economic activities.

12. **Rather than a descriptive and static presentation of the above elements, the aim should be to present an analytical and dynamic picture of the present situation.** The following paragraphs set out some of the topics to be discussed in the analysis of the existing situation.

13. A summary description shall be presented of the present situation as regards wastewater disposal and the environmental and social consequences of the inadequate disposal arrangements. The existing sanitation situation shall be discussed in connection with its impact on: (i) the deterioration of the quality of urban life for Cartagena residents; (ii) the increase in morbidity and mortality from waterborne diseases; (iii) the degradation of aquatic ecosystems and loss of biodiversity, especially in the Bay of Cartagena, the marshes and mangrove swamps of the Ciénaga de la Virgen, the corals of the Islas del Rosario and the internal canals in Cartagena; (iv) declining property values; (v) the lack of opportunities for recreation, especially for meeting the needs of Cartagena's least privileged classes; (vi) the health and social situation of the low-income neighborhoods, particularly those located along the internal canals and in the Southeast Zone; and (vii) the constraints and restrictions imposed on the development of tourism by a degraded environment.

14. It must be borne in mind that the Project forms part of a long-term environmental sanitation program in the city of Cartagena and, therefore, the existing sources of pollution shall be located and quantified (to the extent possible, including the discharge sites, Canal del Dique and urban drain systems, controlled or open trash dumps, the industrial zones and the ports and docks. The social and health conditions of the people settled in the existing discharge sites and in the area of influence of the main works planned shall be described and analyzed in detail.

15. A report shall be submitted on the main uses, actual or potential, made of the Caribbean coast, with special emphasis on recreational, tourism and fishery activities. The potential for such uses and the limitations imposed by the current environmental situation shall be discussed in detail.

16. The feasibility of reuse of the existing raw wastewater is to be discussed in connection with: (i) the possible repercussions on health; (ii) the potential areas to be used in the future under likely urban growth assumptions; and (iii) the potential of new areas that could benefit from controlled reuse of treated wastewater.

17. The sources of the degradation of critical natural ecosystems in the Cartagena zone shall be identified and analyzed. Among other things, the following shall be included: (i) the contribution of industrial wastewater, both in Mamonal and in the city itself; (ii) commercial and tourism-related maritime transport; (iii) unplanned urban expansion and encroachment into mangrove swamps; (iv) the cutting and clearing of mangrove swamps and overfishing; (v) tourism and road infrastructure projects; (vi) development of shrimp fishing; (vii) Canal del Dique sediments; and (viii) human and tourism development in the Islas del Rosario.

18. **Task 3. Institutional, Legislative and Regulatory Consideration.** The institutions, regulations and rules that govern the quality of the environment, health and safety, the protection of fragile areas, the protection of endangered species, control of land use, community participation, etc., at national, regional and local level, shall be described and critically analyzed. In particular, the following shall be discussed: (i) the current environmental licensing procedures; (ii) the role of the national (Ministry of the Environment), regional (CARDIQUE) and local (DAMARENA) agencies in the licensing process; and (iii) the role of the Dirección Marítima y Portuaria (Maritime and Ports Directorate – DIMAR) in the approval of the Project. The relevant international conventions signed or accepted by Colombia shall be discussed and their significance for the subsequent phases of the Project shall be analyzed, with special emphasis on: the Convention for the Protection of the World Cultural and Natural Heritage, the Convention on Biodiversity; the Convention on Wetlands of International Importance Especially as Waterfowl

Habitat (Ramsar Convention), the United Nations Convention on the Law of the Sea, the United Nations Environment Programme (UNEP) on Regional Seas, which includes the Caribbean.

19. In particular, the environmental quality standards proposed by the feasibility study now in progress shall be considered. Special attention shall be paid to the standards proposed for the mixing zone of the outfall discharge, the bacteriological standards for the beaches, the parameters for nutrients in marine waters and their relationship with coral ecosystems, and toxic parameters in sediments.

20. **Task 4: Determination and Assessment of the Potential Impacts of the Proposed Project.** In this analysis a distinction shall be made between the significant positive and negative, direct and indirect, immediate and long-term, impacts. The inevitable or irreversible impacts shall be identified. Where possible, the impacts shall be described quantitatively in terms of their environmental costs and benefits. Economic values shall be assigned where feasible. The quantity and quality of the available data shall be specified, explaining significant deficiencies in the information and any doubts associated with the impact predictions.

21. The impact analysis shall pay special attention to discussion of the following possible environmental and social impacts:

- The degradation of marine ecosystems or other sensitive ecosystems such as marshes, mangrove swamps and coastal lagoons.
- The quality levels of mainland and coastal water at the discharge sites and their impact on the uses of the water, together with their influence in strategic locations such as beaches and coral ecosystems, including adverse esthetic effects.
- The impacts of toxic waste discharges from industries connected to the Cartagena sewer system.
- The impact on quality of life (smells, nuisances, visual impacts, etc.) due to the location of infrastructure components or the operation of such components (pretreatment waste disposal, for instance).
- The need to rehouse or relocate residents to accommodate infrastructure.
- Emergency situations due to partial or total system failures.
- Land-use conflicts caused by the location of infrastructure components such as lines, plants, pumping stations and the underwater outfall itself in zones of potential tourism or urban development.
- Impact on ecosystems of importance for traditional and commercial fishery and the magnitude and significance of such impacts on the fishing communities.
- The impact on and need to dialogue with any black communities.
- The impacts during construction of certain components such as dredging in areas with possibly contaminated sediments, construction work in wetlands and the construction of the in-sea part of the outfall.

- The positive impacts on the improvement of the health and environmental conditions of Cartagena and their influence on quality of life, public health and the tourism-related and economic development of the city.

22. **The Consultant shall discuss the cumulative existing and future impacts and the need for intervention in other sectors to obtain the hoped-for benefits of the Project**, in particular: (i) the need for an integrated solid-waste management system for the city of Cartagena; (ii) treatment and control of industrial wastewater in Mamonal and the need for a pretreatment system covering the industries connected to the sewer system; (iii) management of wastes from port and dockside activities; (iv) control and management actions in the watersheds draining into the Ciénaga de la Virgen (agricultural wastes); and (v) the need to manage and control urban spread into fragile zones such as the mangrove swamps of the Ciénaga de la Virgen. This analysis shall include the relationship and the synergetic impacts of the Project in connection with other programs and projects in progress or planned in the area of influence, such as: (i) the La Bocana project in the Ciénaga de la Virgen; (ii) the perimeter road planned by INVIAS around the southern part of the Ciénaga; and (iii) the tourism development projects for the North zone.

23. **Task 5. Analysis of Alternatives of the Proposed Project.** The alternatives examined during the preparation of the proposed project shall be described and other alternatives that would have achieved the same objectives shall be identified. The concept of the alternatives covers their location, design, selection of technologies, techniques and construction phases, plus operating procedures and maintenance. The alternatives shall be compared as regards their potential environmental impacts, capital and operating costs, utility under local conditions, and institutional, training and monitoring costs. In describing the impacts, those which are irreversible or inevitable shall be indicated, as shall those which can be attenuated. To the extent possible, the costs and benefits of each alternative shall be quantified, including the estimated cost of each pertinent mitigating measure. The alternative of not constructing the project shall also be included, for the purpose of demonstrating the environmental conditions without the project. The potential of wastewater reuse for irrigation shall be analyzed.

24. The analysis and comparison of alternatives shall be based chiefly on consideration of the expected environmental quality scenarios in the case of each alternative (including that of not constructing the project). For the projecting of these scenarios the simulation models that ACUACAR is developing in the feasibility studies for this project and in the Bay of Cartagena watershed project shall be used.

25. The EIA must recommend the optimum alternative from the environmental standpoint. Selection of another different alternative must be justified in the report.

26. **Task 6. Preparation of the Masterplan for Mitigating the Negative Impacts.** Feasible and cost-effective measures for preventing or reducing the significant negative impacts to acceptable levels. The effects and costs of these measures shall be calculated, together with the institutional and training requirements for implementing them. The compensation due to the parties affected by the impacts that cannot be attenuated shall be considered.

27. A Project Environmental Management Plan shall be prepared that is to include:

- a. A detailed description of each mitigation measure proposed, the impact to which it relates, the conditions under which it will be required (in the design stage, before or during

construction, permanently, for contingencies, etc.), and its design and equipment requirements and procedures for its execution.

b. A schedule of the activities that will have to be synchronized with the construction activities for the main project components and with the operation of same.

c. An estimated budget of all the capital and recurrent costs, together with an analysis of how the Management Plan would be financed.

d. A clear definition of the institutional responsibilities (District-ACUACAR, CARDIQUE, DAMARENA, Construction Contractor, DIMAR, other local entities, NGOs, community associations, etc.) for the implementation of each mitigation measure, including: (i) operation; (ii) maintenance; (iii) control and inspection during implementation; and (iv) environmental monitoring.

28. The key components of the Management Plan include: (i) a proposal for regulation of land use and control of watersheds for the future urban and tourism development works in the Cartagena North zone and the protection and management arrangements for the corridor through which the main lines will run; (ii) a plan for the creation of an ecological reserve for the conservation and protection of the Ciénaga de la Virgen wetlands, or for any other natural ecosystem or habitat considered important in the area of influence of the project; (iii) a construction activity management plan, including specific requirements to be taken into account in the design and construction of the works (protection of wetlands and marine ecosystems, nuisances to the population, protection of fauna during construction, disposal of construction waste); (iv) social development programs in impacted fishing communities, including a program of consultation and dialogue with black communities, if any, and a family relocation plan if necessary; (v) an environmental monitoring plan (see following paragraphs); (vi) a pretreatment plan for industrial wastewater from industries connected to the system; (vii) an environmental education plan and an environmental awareness program; and (viii) a special management program for the mixing zone of the discharge from the outfall including closed seasons, signs, prohibitions, monitoring and surveillance.

29. **Task 7. Identification of the Institutional Requirements for Implementing the EIA Recommendations.** The authority and capacity of the sector institutions shall be reviewed and steps shall be recommended to strengthen or expand them so that the management and monitoring plans referred to in the assessment can be implemented. The recommendations can include new legislation and regulations, new agencies or functions, new intersectoral arrangements, administrative procedures and training, personnel hiring, additional studies and research required for better urban environmental planning, training for operation and maintenance of the works, budget preparation and financial support. The key entities for this analysis are the Ministry of the Environment, CARDIQUE, DAMARENA, ACUACAR, DIMAR and the District of Cartagena.

30. **Task 8. Prepare a Monitoring Plan.** On the basis of the Monitoring Plan that will be prepared in the feasibility study, a detailed plan shall be drawn up for verifying the implementation of the measures for mitigating the project's impacts prior to and during its construction and operation. The parameters, the sampling points, the sampling frequency, the formats for recording and processing the information and the criteria for interpreting the monitoring data shall be specified. The plan shall include a calculation of the capital (equipment, laboratories, etc.) and operating costs, plus a description of other inputs (such as training and institutional strengthening) necessary for its execution.

31. The chief elements to be included in the Monitoring Plan would be, inter alia, water quality, sediments, currents, aquatic life, operation of the systems (plant efficiencies, for example), and social monitoring of fishing communities, among others.

32. **Task 9. Facilitate Interinstitutional Coordination and Participation of the Public and of NGOs.** The Bank expects that the District of Cartagena and ACUACAR will coordinate the environmental assessment with other governmental agencies, in particular CARDIQUE, DAMARENA, the Ministry of the Environment and DIMAR, obtain the viewpoints of the local NGOs and impacted groups plus the relevant trade associations and unions, and keep records of the meetings and other activities, communications and comments, and of their disposition, which shall be summarized and submitted in an annex to the EIA report. In particular, the entities of the sanitation, tourism and health sectors, the organizations responsible for water-quality management, NGOs and the groups or communities in the area of influence of the main infrastructure components shall be consulted.

33. One month after the commencement of the EIA, the Consultant shall propose to ACUACAR for its approval a program for conducting the required consultations. This program shall also include, for each meeting, seminar or workshop: (i) the official agencies and entities, the NGOs and the representatives of the communities who would be invited; (ii) the methodology, content or agenda that will be used; and (iii) the speakers (for the Consultant, ACUACAR or other entities).

34. This program of consultations shall form part of a broader Community Consultation Plan that will be developed by ACUACAR during the preparation of the Project. The Consultant's program shall be coordinated with ACUACAR so as to prevent duplication of efforts. In any event, as part of its proposal the Consultant shall arrange for participation of key personnel in consultation and community participation workshops and seminars programmed by ACUACAR. The funding for this program, and the necessary logistic support, shall be provided by ACUACAR.

35. **Report.** The report of the EIA must be concise and limited to the significant environmental problems. The main text shall concentrate on the findings, conclusions and recommended actions, supported by summaries of the data gathered and the reference of any quotation used in interpreting said data. It is not appropriate for the detailed data and those used without interpretation to be included in the main text; they are to be presented in the appendices or in a separate volume. The unpublished documents used in the assessment may not be readily accessible and should also be set out in an appendix. The EIA report shall be organized as follows:

- Executive Summary (no longer than 10 to 20 pages, in Spanish and English)
- Policy, Legal and Administrative Context
- Description of the Proposed Project
- Description of the Environment
- Significant Environmental Impacts
- Analysis of Alternatives

- Environmental Management Plan
- Monitoring Plan
- Interinstitutional Participation, and Participation by the Public and NGOs
- List of References
- Appendices

List of Writers of the Environmental Assessment  
Records of Interinstitutional Consultations and  
Communications and of those with the Public and NGOs  
Unpublished Data and Documents

As a special requirement, a Summary, no more than 20 pages long, of the EIA report shall be prepared, in simple language, understandable by persons who are not technical specialists, to be used in the community consultations.

36. **Team of Consultants.** The team of consultants that performs the EIA shall be of a multidisciplinary nature. The following specialties shall be considered the minimum required: (i) a specialist in environmental impact assessments and interdisciplinary analysis of capital projects, who would act as coordinator of the working group; (ii) a marine biologist or ecologist, with experience in fishery and marine ecosystems; (iii) a sociologist/anthropologist, with experience in social analysis of projects; (iv) a sanitary/environmental engineer, with experience in water-quality management and pollution control; and (v) a civil/sanitary engineer with experience in construction of sanitation projects. ACUACAR shall guarantee for the team of consultants: (i) provision of the information at its disposal; (ii) the running of scenarios in the simulation models generated in the feasibility study and agreement; and (iii) support for the consultation program.

37. The Consultant shall identify the specific members of the working group, their professional capability and relevant experience in the preparation of complex environmental evaluations. The specific responsibilities and activities of each member of the proposed working group shall be defined in the proposal. The Consultant shall identify local experts to provide capacity for some of the disciplines required by the EIA.

38. **Schedule.** The total time estimated to be needed for the EIA is six months. In its proposal, the Consultant shall develop a detailed schedule of activities identifying key points for delivery of partial products or for making important decisions in the study.



**COLOMBIA  
CARTAGENA WATER SUPPLY, SEWERAGE AND  
ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 7.  
Cover letter from Georges Vernetto to  
Director of CARDIQUE and  
Summary of Vernetto's Findings on  
Risk of Diapirism related to the Submarine Outfall**



Bordeaux, March 12, 2001

Dr. Guillermo Ariza  
Director, CARDIQUE  
Cartagena

Dear Dr. Ariza,

I thank you for the meeting we had in the afternoon of Friday March 9.

I was surprised that diarrhoeism is a matter of such great concern. The risk that could result from this phenomenon is really minimal. On the other hand, the benefits that will flow from the implementation of a large drinking-water supply project and the construction of an outfall for the discharge and treatment of the city's wastewater are obvious.

In the 1960's, Cartagena awoke from a long slumber and set about making itself into a modern city with its multiple activities; as a result the city grew, at times in an uncontrollable fashion. Also, with its history and its architecture the old city has been designated a Heritage of Humanity. Difficulties and a glorious history should not be permitted to hold it forever buried in its past.

On the contrary, Cartagena must move ahead and cannot afford to lose the opportunity to carry out a project of this magnitude for the benefit of all. If this opportunity is not seized, for decades sewage will continue to be discharged, without pretreatment, into the Bay and the *Alpunga*, with the possibility of it spilling out into the adjoining sea.

By way of summary of the topic discussed at our meeting, I am taking the liberty of attaching the conclusions and recommendations that form part of the report submitted to Aguas de Cartagena (ACUACAR).

With warmest best wishes and assuring you of my readiness to respond to any concerns.

Georges Vernet

## CONCLUSIONS

Both the previous research findings and those of the geological studies performed in the context of the water-supply and wastewater treatment project for the city of Cartagena, together with the field studies made during this consultancy, warrant emphasizing the following points:

### 1. Clay Diapirism

Diapirism generally manifests itself as a dome the outcropping of which is small in area, usually less than a square kilometer. The expulsion of mud from the tops of active domes (mud volcanoes) occurs either continually or in a recurrent fashion, and in the latter case the process can be explosive; the presence of gases facilitates the expulsion of the materials; **however, not one single report refers to this occurring with the devastating potential that characterizes magmatic volcanism or major temblors.**

As with magmatic volcanism or seismic phenomena, the precise timing of recurrence of the diapiric phenomenon cannot be predicted, we can only speak of probability of recurrence. On a human time scale, the flow or violent expulsion of clay material always occur at the same site.

**The geological and geophysical studies made in the context of the project do not indicate traces of clay diapirism in the route of the planned outfall, either in its on-land stretch (the volcanoes of the Bayunca sector are more than 5 km from it) or where it runs under water (Punta Volcán is located more than one kilometer from it). Therefore, on the basis of these data and knowing that diapirism is a phenomenon involving no more than a small area, it can be correctly assumed that clay diapirism should not directly affect the route of the planned outfall.**

### 2. The Faults

Mention is made of the *Tectonic Faults* mainly in the lower formations (Arjona and Bayunca formations) of the land sector of the region under study, but which do not affect the overlying quaternary formations. This is precisely the case with the Las Canoas Fault, which runs in a northwest direction, **which leads one to think that these faults were active earlier but are inactive today.** Any estimate regarding reactivation of these faults (amplitude and time) in the near future would be pure speculation.

With regard to the *Nonsedimentary Faults* generated by the flow of clay, it has been ascertained that these occur either on the actual flanks of or very close to the diapiric edifice. Accordingly, since the geological and geophysical studies made in connection with the project do not indicate traces of clay diapirism along the route of the planned outfall, it can correctly be assumed, as for clay diapirism, that the nonsedimentary faults should not directly affect the route of the planned outfall.

### 3. Temblors

The Cartagena region is located in a sector recognized as experiencing little seismic activity: since 1644 there has only been one earthquake of a magnitude greater than 6 (1975), which means that the phenomenon has a recurrence period of longer than a century; **the probability that a temblor of magnitude 6 (or greater) will occur during the coming century is therefore quite small. Neither is there any magmatic-type volcanism that would eject molten lava in the vicinity.**

There are some data which justify thinking that there are at times relationships between temblors and clay diapirism. This could help in the future in estimating the probability of the diapiric phenomenon.

#### 4. The Sedimentary Strata

Based on the geological and geophysical studies on land it is clearly evident which formations the planned outfall would be buried in (mainly quaternary deposits), and **no problem of a geological type has been found that could be a reason for opposing construction of the outfall.**

For the final part of the marine section, the diffuser appears to be passing through two very distinct layers of compaction, namely those of the Pleistocene and that of the Holocene (see Appendix C, page 36, of the study by Marine Resources, Inc.). **It is possible that the diffusion of the water in different layers could affect the stability of the diffuser over the long term.**

#### RECOMMENDATIONS

Personally, and having known for some 20 years now the city of Cartagena and its repeated problems with disposal of its constantly increasing volumes of domestic wastewater (due to population growth), and also the negative consequence of the discharging of these waters into the Bay and the Ciénaga without pretreatment, **I am convinced of the benefit that this water-supply and wastewater treatment project could bring for the city of Cartagena.**

The exhaustive studies made over the past more than five years to find the best solution with the techniques now available are correct and positive. They have enabled ACUACAR to propose the type of process (outfall and treatment plant) and the site (Punta Canoas) for disposal of the city's wastewater, which involve:

- *The Paraiso pumping station near El 3Rlyn as general collector point;*
- *The on-land conveyance system;*
- *A pretreatment plant in Punta Canoas;*
- *A final marine section for discharge of the waters into the sedimentary layers of the seabed.*

**The proposed solution appears viable to me, both from the geological (constitution of the layers in which the outfall will be buried) and the geophysical (absence of major seismic activity and of magmatic volcanism) standpoints.**

In any event a zero risk situation does not exist, and since no diapiric phenomenon appears in the actual route of the outfall (in either its on-land section or the marine section), all that could possibly occur would be a mudslide at the bottom of the sea in the event of reactivation of the edifice closest to the route (Punta Volcán), but this would very probably have minimal consequences on the outfall buried over 3 meters below the seabed. Nevertheless this minimal risk has to be recognized and it should be proposed to the geotechnicians and structural engineers that an estimate be made of the impact of a mudslide on a structure such as the outfall, taking for example the slide that occurred in the case of the El Reposo volcano (approximately 30,000 m<sup>2</sup>, according to H. Carval, 1996), or the 29,500 m<sup>2</sup> estimated by David and Rico (1992) for the explosion of the Don Juan volcano (both examples being to the north of Bayunca). It is likely that the plasticity and/or fluidity of the clays involved in the phenomenon minimize the impact.

It is also important to emphasize that in the consideration of the structural design of the outfall the diapiric phenomenon of the tectonics (faults) should be analyzed separately.

Another possible incidence of a geological nature derives from the fact that the final part of the marine section (the diffuser) would be passing through two layers (Holocene and Pleistocene) of significantly different constitution, **so that it would appear more desirable that the end part of the outfall should be located solely in one single formation.**

In any event, it is important to be in a position to cope with any problem that arises, and therefore to think in terms of a *Plan of Action*, which could be organized in two levels:

Colombia

- A Contingency Plan that can be swiftly activated in the event of an emergency of any sort in the outfall line and involving deployment of a team of geotechnical specialists and engineers specialized in this type of work.
- A Monitoring Plan of long-term nature for the monitoring of the environmental parameters in the area of the marine section (water quality, sea dynamics, seabed topography, soil mechanics, seismic and diapiric activity and their possible relationship); this monitoring could be performed by the regional institutions (such as CIOH, INGEOMINAS, INVEMAR) responsible for studying these matters.

The considerable concerns that some may have regarding the possible impact of diapirism on the route of the outfall are unfounded, the risk that might be associated with this phenomenon is really minimal and bears no comparison with the benefits a project of this magnitude will bring. Supply of drinking water and the construction of an outfall for the removal and treatment of the city of Cartagena's wastewater are of vital importance for the healthy development of the city and its population and of their coastal (Bay of Cartagena, Ciénaga de Tesca and connecting channels) and marine (Caribbean Sea) environments.

Cartagena, March 7, 2001

**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 8.**  
**Colombian Ministry of the Environment**  
**Ratification of Environmental License**



"Decision resolving certain actions of appeal"

**THE MINISTER OF THE ENVIRONMENT**

In exercise of the legal powers conveyed upon him, in particular those of Law 99 of 1993 and Regulatory Decree 1753 of 1994, and

**CONSIDERING:**

**BACKGROUND**

The CORPORACION AUTONOMA REGIONAL DEL CANAL DEL DIQUE (Autonomous Regional Corporation for the Dique Canal, CARDIQUE), by means of Resolution 0345 of June 5, 2001, granted an environmental license to DISTRITO TURÍSTICO Y CULTURAL DE CARTAGENA DE INDIAS (Tourism and Cultural District of Cartagena), through its Special Agent AGUAS DE CARTAGENA S.A. E.S.P. ACUACAR (Cartagena Water Co.), for the construction and operation of the project known as "Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent to the Adjacent Sea through its Submarine Outfall"

Upon notification of this administrative act, and acting within the legal time limit, Messrs. SAMUEL PALACIO PÁEZ, as president of SOCIEDAD INGENIEROS Y ARQUITECTOS DE BOLIVAR (SIAB) (Bolivar Society of Engineers and Architects), NESTOR F. CARRILLO MARTINEZ, RAFAEL E. CEBALLOS CALVO and EMIRO VANEGAS ORTIZ, as residents and citizens of Cartagena, Doctor DORANCE CURE JANNA and Doctor JAIRO MORALES NAVARRO, acting as representatives of the community of the Corregimiento [municipality] of Punta Canoa, brought action for *reposición* (reversal) and, with subsidiary effect, an action of appeal against Resolution 03405 of June 5, 2001.

By means of Resolution 0550 of September 19, 2001, the Autonomous Regional Corporation for the Dique Canal (CARDIQUE)) confirmed each and every portion of Resolution 03405 of June 5, 2001, and conceded the actions of appeal [*The meaning of this phrase is not clear to the translator: the implication is apparently that CARDIQUE rejected the "action for reversal", thereby paving the way for the "action of appeal" to the Ministry, which is the subject of this decision.*]

By means of an official notice held in the Ministry of the Environment under No. 3111-1-14251 of November 6, 2001, the Secretary General of CARDIQUE, Dr. JHONNY [sic] DUNOYER BALLESTEROS, sent to this Ministry the file and documents relating to the licensing process for the project for "Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent to the Adjacent Sea through its Submarine Outfall."

**ARGUMENTS OF THE APPELLANTS**

To facilitate the evaluation of and response to the arguments put forward by the appellants, this office will group them by topic in the following order:

1. With respect to new and existing users, SOCIEDAD DE INGENIEROS Y ARQUITECTOS DE BOLÍVAR SIAB, DORANCE CURE JANA, NESTOR F. CARRILLO M, RAFAEL E. CEBALLOS C., EMIRO VANEGAS O. and JAIRO MORALES NAVARRO argue that it is improper to grant the District of Cartagena the status of existing user in Punta Canoa for the purpose of exempting it from complying with the more restrictive standard established by Decree

1594 of 1984 for new users. They argue that the District has never discharged sewage into the adjacent sea (at Punta Canoa), and that only now, for the first time, does it intend to do so.

2. With respect to the alleged disregard of the principle of subsidiary severity, in deferring the deadline for enforcement of the [pollutant] removal parameters contained in Decree 1594 of 1984, SIAB, Dorance Cure Janna and Jairo Morales Navarro declare that the contents and scope of the country's environmental legislation were ignored in granting the owner of the project the benefit of exemption from Decree 1594 of 1984, in that, without any technical or legal arguments, the requirement to meet the discharge standards contained in that Decree was postponed for 15 years, suspending its validity, whereas environmental rules have the force of law and cannot be negotiated or set aside in their application, either by the authorities or by private parties (Article 107 (2), Law 99/93).

SIAB for its part argues that CARDIQUE, determined by all means to issue the license contained in the administrative act, against which the appeal is brought, has postponed the deadlines, suspending application of the provisions contained in that Decree as to the removal parameters for sewage discharge, and neglecting, deliberately or not, the legal nature of environmental provisions: that legal nature means that compliance with them cannot simply be postponed for 10 years, particularly when this violates the principle of "subsidiary severity" [*rigor subsidiario*, a principle by which subnational levels of government may stiffen the regulatory standards contained in national legislation, but not soften them], contained in Law 99/93.

3. With respect to violation of Law 70 of 1993, requiring prior consultation with the black communities located in the project area, the appellants Dorance Cure Janna and Jairo Morales Navarro argue that the project promoter did not conduct prior consultation within the form and terms stipulated by the law, and that the documents provided as a result of the prior consultation process do not allow the environmental authority to assess the form of consultation or the degree of community participation in the project, nor to determine whether those communities really understand the project. It must also be noted that the consultation did not extend to communities in the southeastern zone, recognized as such by the Ministry of the Interior.

Mr. Jairo Morales Navarro argues that CARDIQUE was grossly negligent in delegating and transferring to the advisory commission a function that is proper to the environmental authority itself, namely to evaluate the consultation process that is an essential part of the environmental assessment of the project and of its environmental impact study, which it must conduct in order to grant or deny the environmental license.

4. With respect to international standards, Messrs. Nestor F. Carrillo Martinez, Rafael E. Ceballos Calvo, Emiro Vanegas Ortiz and Jairo Morales Navarro argue in general terms that the project does not comply with international treaties or with the international Law of the Sea, because it would violate all international standards on marine law, and would place Colombia in the position of a country that ignores commitments signed and ratified by law.

5. With respect to application of the Technical Regulations for the Drinking Water and Basic Sanitation Sector, RAS 2000, issued by the Ministry of Economic Development, SIAB argues that section E.5.7, on primary treatment prior to discharge through the submarine outfall, requires that "a primary treatment plant for sewage must be designed, built and operated in order to guarantee the effective removal of BOD5 to a minimum of 60%."

6. With respect to the baseline for the environmental impact study, Mr. Jairo Morales Navarro and SIAB argue that the studies on the biotic, abiotic, socioeconomic and cultural aspects must,

according to Law 99/93, be conducted before the environmental license is granted, and not afterward, as the text of the license itself recognizes, and that this must be done in accordance with the stipulated conditions (Article 3.b, Resolution 03405 of 2001). How, they ask, can there be any scientific certainty to the analyses conducted by the applicant if the baseline has not been determined and if those aspects are not known? Their evaluation will be biased, and it will not be possible to propose necessary and sufficient measures of control, mitigation or correction because there is no baseline, and so it is impossible to identify the environmental impacts correctly. The appellants therefore conclude that the administrative act in question violates the principle contained in Law 99/93, which provides that lack of scientific certainty is grounds for refusing a license.

7. With respect to the jurisdiction to consider the environmental license, Mr. Dorance Cure Janna declares that, according to Decree 1741 of 1978, the Special Management Area was created for the administration, management and protection of the environment and of renewable natural resources, because of their ecological importance. As well, he argues that, according to Article 1 of that Decree, the area was declared as such, under the direction of the General Manager of INDERENA [the National Institute of Renewable Natural Resources], and that consequently jurisdiction passed to the Ministry of Environment [upon extinction of that agency].

8. With respect to jurisdiction to consider the environmental license for the project in question, Mr. Dorance Cure Janna argues that making changes and transfers from the current basin or watershed of the Cienaga de la Virgen [the La Virgen Lagoon] (through various watercourses, pipes, and sewer channels) in order to bring the sewage to the sea implies a significant change in the course and channeling of those waters. The volume of flow in these watercourses and other portions of the sewage system will exceed [current] volumes and consequently jurisdiction to grant the environmental license must lie with the Ministry of Environment and not with CARDIQUE.

9. In light of the fact that other government entities have declared their opposition to the project, SIAB maintains that CARDIQUE should have refrained from granting the environmental license.

10. With respect to the regional land-use plan, Mr. Dorance Cure Janna argues that it is not possible to grant an environmental license when there is no such plan, a point that is established in the Constitution and in Law.

11. Messrs. Nestor F. Carrillo Martinez, Rafael E. Ceballos Calvo and Emiro Vanegas Ortiz declare their opposition to the project, starting with the argument that the Punta Canoa zone where the sewage is to be discharged has special environmental importance for the following reasons:

11.1. It is the only point on the Caribbean Sea within Colombia where coastal waters have oceanic quality, which means that this resource constitutes a strategic ecosystem for food production.

11.2. The zone is rich in watergrass meadows and plant life, and hydrobiological resources, hosting species that are threatened with extinction such as the snail *Strombus gigans*, Carey's turtle *Eretmochelis imbricata*, and countless species of marine flora and fauna of great ecological and social importance for black communities.

11.3. The sea currents that pass by Punta Canoa irrigate the coral reefs of Nokomis, Salmedina Barú, Tierra Bomba, and Parque Corales Islas del Rosario, and so any dumping of nutrients in those currents will have an impact on biological succession in those ecosystems.

11.4. The existence in the sea of organisms such as the Portuguese man-of-war (*Physalia physalis*), whose attack tentacles can measure two meters or more in length and can produce human cardiorespiratory arrest and death, and dinoflagellates that under conditions of eutrophication or heavy nutrient contributions such as will result from the submarine outfall from Cartagena can produce populations much greater than normal, with high risk both to the ecology and to aquaculture, fishing, and tourism, putting at risk human lives not only at the point of discharge but throughout all ecosystems (documents cited).

11.5. In the opinion of the fisheries authority, the National Fisheries and Aquaculture Institute INPA, the Cartagena Submarine Outfall Project will cause damage to natural resources and will diminish the quality of life for the population, as noted in the document "Observations and Proposals on the Cartagena Submarine Outfall Project", prepared by the biologist of the Cartagena INPA, Eliecer Rodas (portions of that study cited).

12. When it comes to social considerations, Messrs. Nestor F. Carrillo Martinez, Rafael E. Ceballos Calvo and Emiro Vanegas Ortiz point to the following:

12.1. The marine ecosystem of Punta Canoa and La Boquilla and the La Virgen Lagoon itself, into which the project will continue to dump sewage forever, and will raise the proportion of city sewage discharged in the locale from 60% to 100% over the next five years.

12.2. The current production of shrimp larvae (nauplius) in Punta Canoa is essential to the Colombian shrimping industry, because without it the country would have to import seed shrimp and this would pose serious threats through the possible introduction of pathogens and through a loss of the genetic pool, adapted to our ecology, now held by Ceniagua (Colombian Aquaculture Research Center) and the private aquaculturists of Punta Canoa.

13. With respect to the technical shortcomings of the project, Messrs. Nestor F. Carrillo Martinez, Rafael E. Ceballos Calvo and Emiro Vanegas Ortiz argue that it fails to consider the possibility of using the La Virgen Lagoon for dumping wastewater that has been previously treated in stabilization ponds, despite the fact that the Colombian government, under an agreement with the Netherlands, has invested \$25 million in stabilizing the tidal inlet as a dilution mechanism, for the specific purpose of assuring the resilience of that ecosystem and preparing it for this function,. They also argue that:

13.1. There are no secure mechanisms for dealing with contingencies, such as rupture of the submarine portion of the pipeline, which would require a sewage storage system with capacity for one week at least.

13.2. During construction of the submarine outfall, the plan is to dump 100% of sewage into the southern (inhabited) portion of La Virgen Lagoon, for a period of five years, with pipes that will reach 200 m from the shoreline, and this ecosystem will be maintained as a dumping site in case of contingencies, posing a grave risk to health, life and the quality of life for the entire population of the Lagoon area, as well as to the environment, which is intended to be restored with the Stabilized Tidal Inlet project, and the shoreline and beaches of La Boquilla, where the inlet discharges its waters.

13.3. The point of discharge of effluent from the submarine outfall from Punta Canoa into the sea will be at a depth of 20 m or less, and only 2 km from the shoreline, which means that the thermocline phenomenon will not be present, and the higher temperature of the effluent, together with its greater density (because its salt content is less than that of the sea) and the release of effluent through elevated nozzles, together with the buoyancy of the solid greases it contains, will cause the sewage to rise to the surface, where it will be at the mercy of the winds which, under normal conditions, can reach speeds of 19 m per second, meaning that pollutants and fecal odors will reach the shore point of primary contact [i.e. where people bathe] in minutes or at most hours, a time shorter than that required to kill the pathogens that are susceptible to sea salt and the chlorine that it contains: one can imagine, they argue, what will happen with the more resistant pathogens that can not only survive for days but can multiply in the marine medium, and in organisms such as shellfish and fish.

13.4. Taken together with the dry land area required for the pipeline corridor and the marine areas that will be prohibited for primary and secondary contact, aquaculture and fishing, the district will lose much more area than was lost to the oxidation ponds or the treatment plant, and there will be a negative impact on users of marine resources and on property owners in the area.

13.5. The possibility of polluting ecosystems of primary contact is real and recognized by the consultants themselves, who give only a 99% assurance that there will be no pollution of the beaches.

14. On failure to respect the standards contained in Decree 1594/84, Messrs. Nestor F. Carrillo Martinez, Rafael E. Ceballos Calvo and Emiro Vanegas Ortiz argue that the project does not comply with articles 42, 43, 44 and 45 of Decree 1594/84, which refers to the total absence of visible greases, floating oils and foam produced by human activity, toxic substances or irritants that affect human health. They note the presence of nitrogen and phosphorus: the outfall will dump between 11 and 20 tons a day of nitrogen. They also say that the project does not comply with the parameters of Article 72 of that Decree.

15. As to the public hearing, Mr. Jairo Morales Navarro argues that the applications submitted by himself and the persons intervening in the citizen consultations should be resolved at the time the social, cultural, economic and environmental assessment of the project is made, taking into account the concepts, recommendations and evidence submitted, elements that should serve as a basis for taking the respective decision.

16. With respect to the precautionary principle cited by Mr. Jairo Morales Navarro, he adds that the Resolution issued by the Corporation granting the environmental license should be revoked, because the sedimentary solids will have an adverse impact on the natural features of the sea floor.

17. With respect to Decree 1875/79, Mr. Dorance Cure Janna argues that industries or any other class of installations must be equipped to avoid pollution.

18. On the five-year social management program, Mr. Jairo Morales Navarro argues that the validity of that program is for five years, while the useful life of the project is 20 years, without taking into account the time of project execution.

19. On the phenomenon of diapiirism (mud volcanism), Mr. Jairo Morales Navarro notes that this phenomenon is recognized along the Punta Canoa Coast, which means that the environmental

impact assessment and the contingency plan must provide for the measures necessary to deal with the probable occurrence of that phenomenon.

### **PETITIONS OF THE APPELLANTS**

The appellants submitted a petition requesting the following:

To revoke in its entirety Resolution 03405 of June 5, 2001, whereby CARDIQUE granted an environmental license to the Tourism and Cultural District of Cartagena, through its Special Agent ACUACAR, for the construction and operation of the project for Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent to the Adjacent Sea through its Submarine Outfall, on the grounds that it is patently illegal and harmful to the environment.

### **DECREE AND PRESENTATION OF EVIDENCE**

By means of official notice (*Auto*) No. 65 of January 24, 2002, the Licenses Division of this Ministry, while processing the appeals submitted, decided to provide a period of 20 working days for the presentation of evidence, and ordered a technical inspection of the project site in order to verify the allegations in the appeals and establish the grounds for taking a decision.

Pursuant to the foregoing, following is a list of the documents contained in file 2616:

1. The Tourism and Cultural District of Cartagena, acting through the Mayor, Carlos Diaz Redondo, submitted the following (documents held in this Ministry under numbers 3113-1-2652 and 3113-1-2735 of February 12 and 14, 2002, respectively):

- Decree 0977 of November 2001, adopting the Land-use Plan for the Tourism and Cultural District of Cartagena.
- Reports containing a historical review of the operation of the Stabilized Tidal Inlet in the La Virgen Lagoon.
- Agreement 14 of March 25, 1994, adopting the Master Land-use Plan for the Island of Baru and the Northern Zone of Cartagena.
- Agreement 44 of 1989, approving and issuing the Cartagena Development Plan 1989-2010 and instruments for its implementation.

2. The National Fisheries and Aquaculture Institute (INPA), by means of official letters (*oficios*) held in this Ministry under numbers 3113-1-2383 of February 8, 2002, and 3113-1-2522 of February 11, 2002, submitted the following documents:

- Socioeconomic characterization of the fishing communities along the northern portion of the coastline in the area of influence of Cartagena (Bolívar) in 1994 (INPA).
- Magnitude, composition and economic value of the catch by the net fishing unit of La Boquilla and in the area of influence of Cartagena (Bolívar) between 1987 and 1991 (INPA).
- Integral development for strengthening the small-scale marine and inshore fishery of Colombia, subproject: Community of Punta Canoa, Municipality of Cartagena, March 2001 (INPA).
- Prototype fishing vessel for the small-scale marine fishery in the area of influence of Cartagena, 1992.
- A list of larviculture laboratories and shrimping firms engaged in aquaculture.

3. Autonomous Regional Corporation of the Dique Canal, CARDIQUE, (file number 3113-1-2615 of February 12, 2002):

- Copy of Resolution 0808 of December 29, 1998, granting an environmental license to the Tourism and Cultural District of Cartagena for execution and development of the project "Cartagena Bay Watershed".
- Copy of Resolution 0501 of September 17, 1999, deciding an appeal and issuing other provisions.
- Land-use Development Plan for Cartagena (Decree 0977 of November 20, 2001).
- Design, scope and historic performance of the work on the tidal inlet in the La Virgen Lagoon.

4. The appellants Rafael E. Ceballos Calvo and Nestor F. Carrillo Martinez submitted the following documents, held by this ministry under numbers 3113-1-2209 of February 6, 2002, and 2211-1-1281 of February 18, 2002:

- Four annexes containing various documentation relating to the project in question. Those annexes are also included in the file submitted by CARDIQUE in opposition to the appeal.
- Photocopies of pages 47 and 48 of Agreement 44 of December 26, 1989.

5. The Institute for Geological, Mining, Environmental and Nuclear Research and Information, INGEOMINAS, by means of a letter held in this Ministry under No. 3111-1-2255 of February 18, 2002, reported that it did not have the information requested by the Official Letter of January 28, 2002, relating to the Final Outfall, and explains that the existing INGEOMINAS studies of the planned project area are regional in nature and inadequate for conceptualizing the proposed works.

6. The University of Cartagena, in a letter held on file 3113-1-1754 of February 4, 2002, submitted:

- Copy of studies on "Control and Monitoring of the La Virgen Lagoon Water System".
- "Responses of the La Virgen Lagoon System to Changes in the Communication Channels between the Bay and the Sea," produced by CARDIQUE and EDURBE, respectively.

7. The Oceanographic and Hydrographic Research Center (CIOH), by means of a letter held in this Ministry under no. 3111-1-2214 of February 18, 2002, submitted the following:

- Standardization of the study of water masses in the Colombian Caribbean (CIOH).
- Analysis of water masses (CIOH).
- Characterization of tides in the Colombian Caribbean (CIOH).
- Influence of wave action and drift in the coastal region of Cartagena (CIOH).
- Final report on "Self Purification of Pollutants from Water" (CIOH).
- Studies to determine the coliform degradation time (T90) conducted by CIOH, including: modeling criteria, description of the model, modeling parameters, results, analysis of results and conclusions.
- Study of oceanic water masses in the Colombian Caribbean, conducted by CIOH, including procedures, results and conclusions derived from the data on measurements of currents, tides, wave action, and stratification. Basis for deciding whether the discharge

of sewage through the projected submarine outfall would affect the production and sustainability of the food chain.

8. The Department of Black Communities and Ethnic and Cultural Minorities of the Ministry of the Interior, by means of letter 3113-1-2531 of February 11, 2002, responded to the request contained in notice 065 of January 24, 2002.

9. The Environmental Administration Department, DAMERENA, by means of official letter 3111-1-2198 of February 15, 2002, submitted the following documentation to this Ministry:

- Evaluation of Water Quality Monitoring: Final Report.
- Video on technical criteria for construction of the tidal inlet.
- Video on results obtained during the operational stage.

Having received the above-mentioned documentation and conducted a visit to the project site on February 14 and 15, 2002, the Licenses Division of this Ministry undertook a technical evaluation of the documents submitted, together with the studies and other documents contained on the file, and on this basis issued Technical Report to 98 of March 14, 2002, containing a technical analysis of each of the appeals in question.

### **JURISDICTION TO DECIDE THE APPEALS**

In accordance with Article 63 (final paragraph) of Law 99 of 1993, the Ministry of the Environment has jurisdiction to hear appeals against administrative acts of Autonomous Regional Corporations that grant or deny environmental licenses, under the terms and conditions established in the Code of Administrative Dispute Procedures.

As well, Article 30 (9) of Decree 1753 of 1994 provides as follows: "Any decision to grant or to deny an environmental license is subject to action for reversal (*recurso de reposición*) before the environmental authority that issued the decision, and to action of appeal (*recurso de apelación*) before the Ministry of Environment, if the decision was issued by other competent environmental authorities".

In light of the foregoing, the Ministry of Environment has jurisdiction to hear and decide the actions for appeal against Resolution 345 of June 5, 2001, whereby CARDIQUE granted an environmental license to the Tourism and Cultural District of Cartagena through its Special Agent ACUACAR, for construction and operation of the project for "Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent to the Adjacent Sea through its Submarine Outfall."

### **CONSIDERATIONS OF THIS OFFICE**

Considering that the appeals in question were brought in a manner consistent with the provisions of the Code of Administrative Dispute Procedures, this office will proceed to decide them.

Before beginning its technical evaluation of the appeals in question, this office considers it relevant to provide a description of the project, in order better to understand the issues at stake.

## **DESCRIPTION OF THE PROJECT**

The project for “Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent to the Adjacent Sea through its Submarine Outfall” has three primary objectives:

1. To eliminate the discharge of municipal sewage into the Bay of Cartagena, the La Virgen Lagoon, and the city's system of lakes and watercourses.
2. To maintain sewage service coverage at 95 percent.
3. To decrease the infiltration of rainwater into the sewer system through irregular storm sewers.

To achieve these objectives, it is planned to build a collector pipeline (land section) of 20,850 m in length, with a diameter of 1.83 m, continuing in a submarine section (the submarine outfall) of 2,850 m in length, made of reinforced concrete or fiberglass; the discharge ports will be distributed along a diffuser of 500 m in length, at depths ranging from 17 to 22 m (average depth 20 m).

The collector will be built using the open ditch technique, and will pass through areas of environmental importance, including nine surface watercourses (Arroyo Guayepo, Caño Ballesteros, Arroyo Mesa, Arroyo Tabacal, Caño Palenquillo, Caño del Medio, Arroyo Hormiga, Caño Tabla and Arroyo Limón). Most of the land-based pipeline will be constructed on undeveloped land with little or no access, which will require the construction of access roads along the length of the pipeline corridor, which averages 20 m in width. The installation sequence for the pipeline includes the following steps: cleanup of the right away, excavation of the ditch, installation of the pipeline bed, installation of the pipeline, filling the ditch (using borrowed material from existing nearby sources), and restoration of the site to existing conditions.

The foregoing alternative, which is still at the predesign stage, was selected following a prefeasibility study of four systems of final disposal through submarine outfalls, known by the following names: 1. Opposite the Tesca Lagoon; 2. La Boquilla; 3. Punta Canoa; and Isla de Tierra Bomba.

The project is planned for execution in three phases, as follows:

### *Construction of the outfall (interim phase, to 2005):*

During the first five years of the project, sewage from Cartagena, which currently drains into two specific zones, the Tesca Lagoon [apparently another name for, or a portion of, the La Virgen Lagoon] and the Bay of Cartagena, will continue in this pattern, while construction proceeds on the collector and on the preliminary treatment systems (rotary screens and vortex-type grit chambers) within the facilities of the Paraiso pumping station, and while the submarine outfall is being built. However, in order to control dumping in these two zones, interceptors will be constructed to provide two discharge points.

The discharge into the Tesca Lagoon will require construction of 950 m of pipeline, 1.37 m in diameter, discharging into the Caño Limon [creek] zone, and conveying to that point the waters that are currently discharged into the Tesca Lagoon basin. At the same time, sewage from the Cartagena Bay basin will be concentrated in the El Bosque station, for dumping into the Bay. This pattern will be maintained until the submarine outfall is fully constructed.

This phase includes execution of an environmental monitoring plan, in order to establish the baseline or environmental status of Cartagena Bay, the Tesca Lagoon, and the coastal zone, as a supplement to existing information, so as to optimize the design of the submarine outfall, confirm the modeling of its functioning, and evaluate the changes that will occur as different parts of the project are executed.

*Phase I (2005-2015):*

During this phase, the Paraiso pumping station will come into operation, together with the preliminary treatment plant and the submarine outfall, and dumping into Cartagena Bay and La Virgen Lagoon will be eliminated. This phase calls for implementation and operation of the following components:

1. Paraiso pumping station, together with the improvements made, including preliminary treatment by means of:

- Six rotary screens (1.5 mm clearance), with the possibility of installing two additional screens in the future.
- Two vortex-type grit chambers, each with a capacity of 52 m<sup>3</sup>, designed to remove 75% of particles that pass through the 140 [-gauge] screen.

2. Operation of the final outfall, in reinforced concrete piping with an interior diameter of 1.83 m (or fiberglass, for the land portion).

- Land portion: 20,850 m in length, using for the most part the existing right-of-way.
- Submarine portion, 2,850 m in length at a maximum depth 20 m, 1.83 m in diameter.
- Diffuser of 500 m in length with 27 risers, each with two discharge nozzles of 0.20 m in diameter.
- Environmental monitoring of the performance of the submarine outfall, the receptor area, and adjacent zones including the beaches.

*Phase II (2015 to 2025)*

This phase calls for a treatment system designed in accordance with the performance of the submarine outfall in the previous phase, involving the following components:

- Construction of a transfer pumping station.
- Addition of small-aperture rotating screens.
- Construction of aerated flow-equalization ponds of 9 hectares, with a volume of 68,000 m<sup>3</sup> and about 200 HP [i.e. pumps of around 200 horsepower], for service at times of peak flow.
- Conveyance pipeline of 1.37 m in diameter to convey water from the pumping system to the lagoons, and from there to the submarine outfall (bypass).

Disposal of waters from the treatment systems via the submarine outfall.

## **TECHNICAL AND LEGAL CONSIDERATIONS**

Following is a discussion of the technical considerations according to the Technical Report 298 of March 14, 2002, issued by the Licenses Division of this Ministry, as well as the legal considerations that this office deems pertinent to the argument at hand:

1. With respect to the appellants' arguments about new or existing users, this office considers that the construction and operation of the project complies with environmental protection standards, and therefore, and in accordance with Technical Report 298 of March 14, 2002, issued by the Licenses Division, and the provisions of the discharge standards of Decree 1594 of 1984, [we find that] the final disposal of effluent will comply by a wide margin the required characteristics, which means that the project will not violate those standards, but will on the contrary contribute to environmental improvement in the zone, for the general benefit of the community.

This office also considers that, as the appellants maintain, the rationale for the classification of new or existing user arises from the discharge standard that must be obeyed, pursuant to Decree 1594 of 1984 (Article 72).

In the case at hand, the system consisting of the submarine outfall and the marine environment's capacity of assimilation and dilution in the mix zone, under normal conditions, will leave 1% of organic load, with the remote possibility that that figure could exceed 15% under very severe conditions.

Consequently, there is no need in this case to classify and distinguish the discharges from Cartagena in terms of new user or existing user, because, as noted, the limits to be met in this case far exceed those stipulated in the standard, ensuring that the project for dumping of sewage from Cartagena at the final disposal site will be properly managed, thereby improving existing conditions and enhancing the quality of life in this district, which suggests that the arguments put forward by the appellants about new and existing users are irrelevant.

2. With respect to the principle of "subsidiary severity" cited by the appellants, the Resolution issuing the environmental license contains no reference to postponing compliance with dumping standards: on the contrary, the submarine outfall project designed to intercept discharges that are currently flowing into Cartagena Bay and Tesca Lagoon, for conveyance to the final disposal site (off Punta Canoa), complies with the provisions of Decree 1594 of 1984, specifically those of its Article 66, which provides that dumping standards must be set in light of the quality criteria established for use or uses assigned to the resource, and that enforcement of quality criteria will be done outside the mix zone. In addition Article 90 provides that in no case will sewage discharge be permitted that would alter the existing characteristics of a body of water that make it suitable for all the uses indicated in this Decree. Thus, consistent with the Cartagena Land-use Management Plan (POT) adopted by Decree 0977 of November 20, 2001, and Decree 1594 of 1984, elimination after the interim phase of sewage discharges into the La Virgen Lagoon and Cartagena Bay, which are classified as areas of natural resource protection and landscape conservation of the Tourism District, will allow the water to be used for primary-contact recreational purposes, as necessary to conduct the recreational and sporting activities contemplated in the POT. Moreover, with reference to the beach shoreline, to which the Punta Canoa sector belongs, and where, according to the POT, recreation, tourism, education and supplementary or related services are permitted, as well as small-scale and recreational fishing, those uses will be assured with the existence of an underwater discharge within the conditions and characteristics established in the environmental license issued by CARDIQUE.

In the construction and operation of the project, pursuant to Article 103 of Decree 1594 of 1984, the first phase calls for preparation of an engineering program and a work schedule, presented in accordance with procedures, that in this case will be compatible with the procedure for granting the environmental license for the project. The second phase calls for the works to be executed in accordance with the timetable submitted and approved, pursuant to the environmental license, and the third phase calls for verification of compliance with discharge standards, as established in the monitoring plans contained in the environmental license, before and during operation of the submarine outfall, and under which, according to the results, the subsequent technical measures will be determined, depending on the behavior of the receptor body.

With these points clarified, it must be noted that, according to Article 63 of Law 99 of 1993, the rules that the environmental authorities issue for regulating the use, management, exploitation and mobilization of renewable natural resources, or for preserving the natural environment, may be made successively stricter, but never less strict, by the competent authorities at the regional, departmental, district or municipal level, as one moves down the hierarchy and the territorial scope of the environmental jurisdiction is narrowed. It is clear that the principle of subsidiary severity is not violated by the environmental license granted by CARDIQUE, as the appellants claim, because that principle applies to standards of a general nature and not to standards of a particular and concrete nature, as is the case with the environmental license in question and consequently, the argument posed by the appellants' is rejected by this office.

3. With respect to the appellants' arguments relating to violation of Law 70 of 1993, as noted in the technical and social considerations, on the basis of the certification issued by the Office of Black Communities and Ethnic and Cultural Minorities of the Ministry of the Interior, which indicated the presence of black communities in the project area, CARDIQUE, by means of official notice of October 30, 1998, required compliance with Decree 1320/98, and the document on the file dated November 20, 2000, reveals the intervention of Mr. Francisco Hernandez, as advisory for the Atlantic Coast, who declares that he is aware that the communities of the Southeastern zone were indeed consulted.

Similarly, Mr. Dionisio Miranda Tejedor, as councilor representing the community, declared that the prior consultations with the black communities have been fully and properly concluded in terms of procedures and activities for involving the communities.

Finally, Dr. Gabino Hernandez Palomino, as representative of the Ministry of the Interior, reiterates that the consultation process has been completed.

Having analyzed the information on the file and taking into account the interventions of the councilors appointed as valid spokesman for the black communities in the Southeastern zone, and for the settlements of Arroyo de Piedra, Manzanillo del Mar, La Boquilla and Punta Canoa and the representative of the Ministry of the Interior, we conclude that the process of evaluating the environmental license complied with the provisions of Decree 1320/98.

Consistent with the foregoing, we may conclude that the black communities located in the area of influence of the project were indeed taken into account in the environmental impact study for the project, as noted in the document on the file, recognizing and protecting their cultural, social and economic integrity, pursuant to the constitutional mandate, by which the state must recognize and protect the ethnic and cultural diversity of the nation, and it is therefore compliant with the provisions of Article 76 of Law 99 of 1993, considering that in order to grant the environmental license in question, CARDIQUE consulted representatives of those communities in advance, a fact that contradicts the arguments of the appellants.

4. With respect to international standards, it should be noted that on March 24, 1983, the Protocol concerning Pollution from Land-based Sources and Activities, relating to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, was signed in Cartagena. Annex III (3) to that Protocol defines "Class II waters" to mean waters "that due to oceanographic, hydrologic, climatic or other factors are less sensitive to the impacts of domestic wastewater and where humans or living resources that are likely to be adversely affected by the discharges are not exposed to such discharges", i.e. they differ from "waters containing coral reefs, seagrass beds, or mangroves; critical breeding, nursery or forage areas for aquatic and terrestrial life; areas that provide habitat for species protected under the Protocol Concerning Specially Protected Areas and Wildlife to the Convention (the SPAW Protocol); protected areas listed in the SPAW Protocol; and waters used for recreation", which belong to Class I waters. Consistent with the foregoing, the characteristics of the area where the submarine outfall is planned to discharge correspond to class II waters.

Letter C of Annex III to that Protocol provides that the Effective Date of Obligation (in years after entry into force for the Contracting Party) will be 20 years for communities with more than 50,000 inhabitants not possessing wastewater collection systems. Those characteristics currently apply to the city of Cartagena.

As well, the Protocol establishes that each contracting party must ensure that domestic wastewater discharging into class II waters, or that have a negative impact on such waters, must be treated by new or existing wastewater treatment systems, the effluents from which satisfy the following effluent limits (calculated according to the annual average): Total Suspended Solids - 150 mg/l; Biochemical Oxygen Demand (BOD<sub>5</sub>) - 150 mg/l; pH - 5-10 pH units; Fats, Oil and Grease - 50 mg/l; Floatables - not visible.

Finally, it must be noted that the Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) does not yet have the status of domestic law in Colombia, but that once it is ratified by Colombia it must be strictly respected, in accordance with our domestic legislation.

With respect to the other conventions cited by the appellants, such as the 1971 Ramsar Convention on Wetlands, they do not apply because at the disposal site the sea depth exceeds 6 m, which according to Article 1 of Law 357 of 1997 is the limit for consideration as a "wetland" that, according to the Ramsar convention, would constitute an ecosystem of international importance as a habitat for waterfowl.

With respect to the 1972 Stockholm Conference on Man and the Environment, it sets forth general considerations and principles as the basis for countries to develop their policies, and to establish institutional guidelines and domestic legislation. Colombia responded to the Stockholm conference with Decree 2811 of 1974, the National Code on Natural Resources and Protection of the Environment. Under that code, various regulatory decrees have been issued, including Decree 1594 of 1984, which has been analyzed in this report. In conclusion, the environmental standards developed on the basis of the Stockholm conference have been included in all the technical and legal work supporting the arguments behind this decision.

With respect to the Cartagena Convention's Protocol concerning Specially Protected Areas and Wildlife, approved by Law 356 of 1997, it builds upon Article 10 of the Convention, which requires that specially protected areas be established, recognizes the value of vulnerable ecosystems, and the need to promote sustainable development in the wider Caribbean region. As

concerns the present case, and in accordance with the Technical Report 298 of March 14, 2002, environmental management measures are planned to prevent and mitigate environmental impacts on the ecosystem.

With respect to protective measures, Article 5 of that Protocol provides as follows: “Each Party, taking into account the characteristics of each protected area over which it exercises sovereignty, or sovereign rights or jurisdiction, shall, in conformity with its national laws and regulations and with international law, progressively take such measures as are necessary and practicable to achieve the objectives for which the protected area was established. Such measures should include, as appropriate: the regulation or prohibition of the dumping or discharge of wastes and other substances that may endanger protected areas,” as discussed in section 11 of the technical considerations. In the present case, and in accordance with the Technical Report 298 of March 14, 2002, environmental management measures are planned to prevent and mitigate environmental impacts on the ecosystem, and consequently there will be no irreversible harm either to species or to the ecosystem.

With respect to the International Convention for the Prevention of Pollution from Ships, MARPOL (London, 1973), the Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific (Cali, Colombia, 1981), the Protocol for the Protection of the Southeastern Pacific against Pollution from Land-based Sources (Quito, Ecuador, 1985), the Protocol for the Conservation and Administration of Marine and Coastal Protected Areas in the Southeast Pacific (Paipa, Colombia, 1989) and the Agreement on Regional Cooperation for the Fight against Pollution in the Southeast Pacific from Hydrocarbons and Other Harmful Substances (Lima, Peru, 1981), it should be remembered that the conventions and protocols and the agreement mentioned apply to marine areas that are different from the one in question, and consequently it cannot be said that those instruments would be overlooked by implementation of the project.

As well, the appellant should be reminded that the United Nations Convention on the Law of the Sea (Montego Bay, Jamaica, 1982) has still not been ratified by Colombia.

Taking into account the foregoing, the argument of the appellants with respect to failure to observe international treaties must be rejected.

5. With respect to the argument relating to the Technical Regulation for the Drinking Water and Basic Sanitation Sector, RAS 2000, issued by the Ministry of Economic Development, with respect to the design, construction and operation of a primary sewage treatment plant that guarantees effective removal of at least 60% of DOB5, the appellant should be reminded that the environmental authorities have jurisdiction to establish permissible discharge limits, pursuant to Decree 1594 of 1984. Nevertheless, recognizing that the quality of the effluent from the submarine outfall of Cartagena is projected to be greater than that stipulated in RAS 2000, this office has even stronger grounds for declaring that the appellant's challenge to the regional environmental authority's decision to issue the environmental license is unfounded.

6. With respect to the existence of the baseline for use in the environmental impact assessment process in deciding to grant the environmental license, the Ministry has evaluated information relating to the licensing process as follows:

6.1. Geophysical Investigations Offshore Punta Canoa, Colombia (summary document translated into Spanish). This document presents the results of research by Geofisica Marina in Punta Canoa, to determine the bathymetry of the seabed. This consisted of sweeping the seabed with

lateral sonar to detect abnormalities, investigating the subsoil profile to identify geological formations, and identifying the thickness of the surface sediment mantle. In conclusion, it presented three possible geological risks: (1) Faults dating from the Pleistocene era (*pleitoceno*), noting that these faults are not currently active and have not been active for the last 8000 years, and classifying them as of minimal geological threat in the area of the proposed outfall. (2) Localized settling/subsidence, identifying two possible deposits in the Holocene sedimentary layer, located on the seaward side of the project's path (near line 2 and 9), both of which are buried in the lower part of the sedimentary layer; it is concluded that while settling is possible, this is a minor geological risk. (3) Diapirism of mud in the surface portion of the area studied: one event of diapirism (line 4) was identified, located approximately 300 m to the southwest of the proposed path of the outfall, and this was the only event detected within the 25 km [radius] covered by the analysis.

6.2. Modeling of the submarine outfall for Cartagena, by Philip J. W. Roberts, dated June 23, 2000 (Spanish version). This report describes the use of an acoustic Doppler current profiler located along the outfall path at 2.5 km from Punta Canoa, at a depth of 17.7 m, making continuous measurements between January 1, 1998, until February 12, 1999, i.e. for 408 days, taking recordings every 15 minutes with six cameras mounted 3 m above the water column: i.e., measurements were made of the direction and magnitude of the sea currents.

That same report reveals records on salinity, density and temperature at different depths for 188 profiles that were made between January 23 and June 25, 1998. According to information provided by ACUACAR to the environment Ministry, those oceanographic recordings are made continuously, and in this way the Ministry has data between November 8, 1999, and August 1, 2000.

6.3. With respect to the characterization of the biotic component, as part of the studies or documents used during the environmental licensing process, there are hydrobiological descriptions of samples and identification made in Cartagena Bay, La Virgen Lagoon and the Punta Canoa area, presenting a record of the species encountered. In the case of Punta Canoa, there are very few records of organisms, because of the particular features of the zone, where strong currents impede the formation of reefs, and nutritional conditions on the sea bottom are poor. Thus, this argument of the appellant is unfounded, since existing information is sufficient for taking a decision on the project's environmental feasibility from the biotic viewpoint. Nevertheless, and in order to maintain a constant registry of monitoring information to support any adjustment to the project, CARDIQUE requests, in the environmental license, that hydrobiological and physical-chemical monitoring be conducted before and during project operation, so that those data can be used to analyze the behavior of the biotic and physical resources on the basis of data from more comprehensive records taken during the construction phase of the submarine outfall.

6.4. It is true that in the environmental impact assessment presented by ACUACAR the characterization of the social environment was incomplete. Subsequently, however, at CARDIQUE's request (Resolution 842 of September 27, 2000), ACUACAR, through the Jorge Artel Corporation for the Development of Afro-American Communities, presented a socioeconomic characterization of the communities of La Boquilla, Punta Canoa, Arroyo de Piedra and Manzanillo del Mar. That study provided a timetable of activities which included workshops on ethno-historic awareness and Law 70/93, workshops on the submarine outfall, an evaluation of environmental impacts, and the environmental management plan that was produced by NEOTROPICOS and offered for consideration by CARDIQUE. With authorization from the Council, the Jorge Artel Corporation committed itself to develop procedures for preparing the

communities for the public hearings and prior consultations on the project. Moreover, ACUACAR presents, as support for the baseline of the socioeconomic environment, the final report prepared by the anthropologist Alvaro Baquero, for the study on sewage and submarine outfall for environmental sanitation of the city of Cartagena, containing a succinct characterization of the neighborhoods located in the southeastern zone of the municipality, considered as the project's area of influence. That southeastern zone is potentially the area of Cartagena that will benefit the most from the project, since the disposal system contains a Basic Sanitation Plan that calls for expansion of water and sewage services to the zone, mitigating the present situation, where it can clearly be seen that "gray water" from the Olaya residential neighborhood and its immediate surroundings is mixed with sewage because there is no proper channeling and conduction system, making it a focal point for vectors that carry skin diseases and respiratory and gastrointestinal ailments.

Consistent with the foregoing, the Ministry of the Environment considers that it has sufficient information on current conditions in the area (baseline) to analyze the project's impacts and to make decisions as to its feasibility.

7. With respect to the appellant's argument concerning Decree 1741/98: the purpose of that Decree is to protect the area indicated therein, while the Cartagena submarine outfall project is intended to protect the environment by regulating activities so as to control or correct existing pollution, in order to prevent it from intensifying or from extending to other areas: therefore there is no contradiction between the Decree and the project in question. On the contrary, the project will assist in meeting the objectives of the special management area.

The environmental impact study for the submarine outfall project includes an evaluation of the negative impacts during its construction and operating phases, establishing measures for mitigating, controlling and preventing those impacts; those measures are adopted, expanded and optimized in the environmental license granted by CARDIQUE.

8. With respect to *transvase* [apparently the transfer or diversion of sewage from one basin to another], this Ministry considers that the appellant's interpretation is incorrect, since in technical terms the transfer of watercourses corresponds to the extracting, conduction and usage of waters for different purposes from the same course (river, creek, etc.) located within a given hydrographic basin, to another, different basin. The case of waters from a sewer system does not correspond to the concept of *transvase*, and consequently this argument must be rejected.

9. With respect to the opposition of government bodies, the fact is that CARDIQUE, as the responsible environmental entity, requested the relevant specialized entities that had the ability and the technical and legal means to do so to contribute opinions on the submarine outfall project. In its effort to find evidence for deciding the appeal in question, this Ministry requested information from various scientific institutions, of which the following are extracts:

CIOH: the Oceanographic and Hydrographic Research Center (CIOH), by means of official letter 3111-1-2214 of February 18, 2002, responded to this Ministry's request for documentary evidence as follows. With respect to the T90 analysis (i.e. determining the degradation time of coliforms) the study conducted by CIOH was part of the specific project for modeling water quality in Cartagena Bay, a body of water that has oceanographic characteristics different from those of the area where the sewage from Cartagena is to be discharged through the submarine outfall. Essentially, the experiment was conducted in a closed body of water, whereas the area in question is open water. In Annex A to letter 635-DCIOH-JDESAT of June 19, 2000, addressed to ACUACAR, the CIOH explains (paragraph 2), in response to CIOH's concerns over the T90

degradation time of coliforms, that for the bacterial transport models it used a T90 of 4.4 hours, which represents 30% of the daytime value (two hours) and 70% of the nighttime value (nine hours) (page 2 GAR-010-00) for selecting alternative locations for the outfall. Once the outfall site was selected, and in order to determine bacterial transport, a cosine equation was used that assumed variation during the day and night over a simulation period of nine months, taking as a minimum T90 value 1.5 hours at noon and 20 hours at midnight (page 3 GAR-010-00). Experiments conducted in the CIOH laboratory to determine the T90 corroborated those values. The foregoing means that, taking into account the characteristics of the closed-in Bay of Cartagena, the degradation times of coliforms are greater than those for the submarine outfall discharge area. And since the degradation times used in the Hazen & Sawyer model (also used by Philip Robert in his modeling), are similar to those obtained from Cartagena Bay, the results may be considered conservative.

The study of oceanic water masses in the Colombian Caribbean. The CIOH sent to this Ministry the studies conducted by that entity, noting that for the most part they were conducted in the Colombian Caribbean (at a depth of up to 5000 m, average 1000 m), i.e., in deep water where oceanographic conditions are different from those observed in the coastal zone. On the other hand, CIOH notes that the specific data for the site are those recorded and reported by ACUACAR, data analyzed by CIOH, and from which it was determined that the firm Hazen & Sawyer took its measurements under the worst conditions, with winds from the west at a velocity of 4 m per second; nevertheless there are isolated events that can occur rapidly in excess of those limits, for which reason they recommend a modeling exercise in order to understand the effect that this might generate, on the understanding that such conditions will last only a short time, recognizing moreover that any kind of isolated event that imperiled human health by exceeding the water quality standards would be handled at the treatment plant with disinfectants, emphasizing that the use of chlorine will be strictly confined to emergencies such as a rupture of the pipeline on land or underwater, and in response to elevated levels of pathogenic bacteria discovered through routine monitoring of the outfall operation.

Finally, CIOH declares that, given the current situation of pollution generated by the dumping of sewage into city watercourses, the installation of a submarine outfall under the conditions established for the project is a very good alternative for improving the environmental quality of the ecosystems involved, and thereby helping to improve social and health conditions for the local populace.

National Fisheries and Aquaculture Institute (INPA). The "Summary, Observations and Proposals on the Cartagena Submarine Outfall Project" includes a brief description of the project and of the principal aspects covered by the Environmental Management Plan, such as (quoting from the document): "4. Control and management of industrial wastes. 7. Environmental education and awareness. 8. Institutional strengthening. 9. Supply of drinking water to population centers in the zone." In addition, it refers to Program 4 as follows: "...called Complementary prior information and monitoring, it covers fishery resources and exploitation (submarine outfall zone and lagoon), which will be conducted by INPA through a contract with ACUACAR, beginning in July 1999, until December 2004, with an estimated budget of US \$116,375, for 66 months of work". The document also includes observations referring, among other things, to the following aspects: 1. ... Within the EIA document the INPA is not given its proper and fair recognition; nor is sufficient importance given to the fishermen in the zone who are not officially protected by the compensation and mitigation measures established in the EIA. On this point, the Ministry of Environment considers that this aspect can be discarded, to the extent that the Environmental Management Plan includes a program dealing with fishery resources and their exploitation, as noted in the previous paragraph.

2. [The appellants claim that] the study, in describing the characterization of the wastewater from Cartagena, does not consider pollutants of class III (heavy metals), class IV (toxic chemicals), nor does the study present any type of evaluation of the discharges from factories, hospitals, gas stations, etc. This aspect may be discarded because, while the study does not include an exhaustive characterization of those sources and pollutants, the Environmental Management Plan includes a program for control and management of industrial wastes, which will handle those discharges as well as those generated by the Mamonal industrial zone in particular, and therefore those wastes will not be a component of the sewage to be discharged through the Cartagena submarine outfall, as the INPA notes in the document of reference.

3. There must be an updated inventory or biological diagnostic analysis. This aspect is covered in the Environmental Management Plan (PMA), and in the Cardique Resolution granting the environmental license for the Cartagena submarine outfall.

4. The project does not have adequate programs for managing contingencies (rupture of the pipeline). This aspect may also be discarded, because there is a contingency plan for adding chlorine at the treatment plant, in order to avoid bacterial pollution of ecosystems as a result of any emergency.

As can be seen, INPA does not disagree with the project. On the contrary, it offers several observations and presents some proposals, of which those relating to the fishery are in part covered by the PMA program, on fishery resources and their exploitation, and those relating to the management of industrial wastewaters are also part of the PMA, as noted elsewhere in this document.

10. With respect to the absence of a POT (land-use plan), it is apparent to this office that the appellant believes that no license can be issued for a project unless there is a land-use plan. This idea is entirely false, because neither Law 388 of 1997 (land-use planning law), nor Law 99 of 1993, nor any other national legislation stipulates that an environmental license cannot be issued or granted for a project located in a zone where there is no land-use regulation plan. On the contrary, those laws specify that POTs must contain technical and legal aspects that will guarantee their compatibility with the environment and with all its components.

11. The environmental reasons for opposing the project can be summarized as follows:

11.1. According to the studies conducted by CIOH, such as: "Standardization of the water mass study -- Colombian Caribbean, 1982": Stages of calculation; Ocean Cruise Ship II (areas 2 and 3) -- National Navy -- Colombian Caribbean, 1982: Ocean Currents, analysis of water masses and vertical stratification; "Characterization of Tides in the Colombian Caribbean" -- CIOH, 2001; it may be noted that the oceanic masses of the Caribbean are: North Atlantic Central Water (NACW), North Atlantic Deep Water (NADW), and Antarctic Intermediate Water (AIW), which has been detected at 20 miles to the west of the area of influence of the submarine outfall, and at depths of between 1000 and 5000 m. The studies also identify surface coastal water masses with homogeneous mixture characteristics (Atmospheres [of ambient pressure]– marine waters) to a depth of 100 m, which do not have the characteristics of ocean waters, because they are influenced by the contribution from the rivers that flow into the Colombian Caribbean, such as the Rancherías, the Magdalena, and the Sinu.

The influence of the Magdalena River on the physical conditions of the coastal surface waters has been demonstrated during the season of the *Alisos* winds, a condition that generates a plume of

suspended sediments with a front of turbidity that borders the coastal zone, inclining toward the southwest from the influence of the Caribbean current and the Darien countercurrent that penetrates between the plume and the coast as far as the river delta itself, which runs parallel to the coastal drift current as a consequence of the heavy wave action produced by the *Alisos* winds, with its influence reaching as far as the islands of Rosario, as analyzed in the document, "Time study of suspended solids between the mouth of the Magdalena River and the Dique Canal, Caribbean Sea, Colombia," C. Andrade, F. Arias and I. Thomas.

That phenomenon was considered in the design of the outfall, and for this reason the narrowest point of the turbidity plume was selected as the site for the outfall.

From the foregoing, it may be concluded that the dumping of wastewater after preliminary treatment in a location off Punta Canoa will not affect the quality of the water taken by the CENIACUA larviculture laboratory, particularly since the point of water intake is located 50 m from the coast at a very shallow depth.

11.2. According to studies conducted in zone 4 (using the zoning of INVEMAR, 1997), which includes Punta Canoa and Punta Galeras, such as "The Colombian Caribbean, environmental reality and development. CORPOES Costa Atlantica, 1992", there is little development of seagrass meadows, because of the high dynamics and turbidity of the waters and the instability of the coastline. The graduate thesis, "Cartography of biotypes and characterization of the reef community of Arena Island, Colombian Caribbean", by Perdomo and Pinzon, 1997, reports the presence of patches of *Thalassia* and *Yringodium* [??] around Isla Arena (located opposite Galerazamba, which will be beyond the dilution plume from the outfall, according to the Hazen & Sawyer model).

11.3. While the sea currents themselves, such as the coastal drift (descending) and the Caribbean current (descending and ascending, depending on the time of year), will influence the coral reefs and ecosystems mentioned by the appellant, there is no probability that effluent from the submarine outfall will extend to these areas, particularly when it is considered that the immediate dilution ratio at the diffusion nozzles is greater than 85: 1, which means that the effluent plume from the outfall will not reach those ecosystems.

We note, in this regard, that it is not possible to compare the biodiversity and abundance of coralline species, species associated and related with the existing ecosystems on the islands of Rosario and Baru, nor even those of the Salmedina Basin, with the biotopes of Punta Canoa, where the bottom is essentially mud, where there is great turbulence and where luminosity is therefore insufficient for pioneer coral species to establish themselves, much less for them to grow to maturity.

11.4. Considering that wastewaters from Cartagena have concentrations as follows: Total P 15 mg/l, Total N 65 mg/l and N-NH<sub>3</sub> 40 mg/l and that the outfall was designed to handle concentration of Total P of 18 mg/l, Total N of 70 and N-NH<sub>3</sub> of 45 mg/l, and that the discharge flow for the year 2025 will be 36,000 m<sup>3</sup>/day, and that the currents are generally swift, which will result in efficient dilution and immediate mixing in the vicinity of the diffuser, this means that concentrations of these nutrients in the receptor body, even the most extreme cases, will bear a ratio of 1:85 to the values recorded in the wastewaters themselves. This process will militate against the phenomenon of eutrophication, as will the prevailing oceanographic and meteorological conditions. It must also be noted that the effluent from the submarine outfall will not contain industrial wastewaters, which might contribute the greatest quantities of nutrients to the receptor body.

From the foregoing, there is no likelihood of large populations of jellyfish *Physallia sp.*, commonly known as the Portuguese man-of-war, which are found in tropical seas and which arrive at the coast due to the influence of the winds, because they have no means of locomotion of their own.

11.5. The Environmental Impact Study, Chapter 3, Page 21, includes a characterization of the sewage from Cartagena and refers to concentrations of class III pollutants (heavy metals), according to the analysis conducted by Carinsa-Haskoning, 1996, in sediments of the Tesca Lagoon (La Virgen Lagoon). On the other hand, as noted in the response to the actions of appeal lodge by the SIAB (Bolivar Society of Engineers and Architects), the environmental management plan calls for special handling and treatment of wastewaters of industrial origin, both those from the city's industrial area and those from the Mamonal industrial zone, the latter of which is covered by the Ministry of Environment's "clean production" programs and will therefore not form part of the effluent from the submarine outfall, an aspect described in the Technical Report presented by the INPA and prepared by the biologists Elicer Rodas and David Osorio (undated), at page 4, No. 5, "Control and management of industrial wastes."

From the foregoing, we conclude that there is no possibility of the accumulation of heavy metals from discharges from the outfall in fish species of commercial value, nor in any hydrobiological resource.

12. With respect to the social arguments put forward by the appellant, this Ministry considers:

12.1. The submarine outfall project seeks to guarantee the health and quality of life of the people of the Cartagena Tourism District by improving the city's basic sanitation, since sewage service coverage will rise from 46% to 95%, and by restoring the environmental quality of the Tesca or La Virgen Lagoon, considering its great ecological value as one of the most important coastal lagoons of the Colombian Caribbean, and its environmental and social importance as the producer of great quantities of fish species of commercial value: in fact, the Lagoon accounts for 60% of fishing activity at La Boquilla. We conclude that the scenario described by the appellant will not occur, and on the contrary we may expect recovery of the Lagoon and of its fishery resources.

12.2. With respect to the impact on the quality of water captured by the laboratories at La Boquilla and Punta Canoa, in terms of bacteria that affect the shrimp larva *Panaeus vannamei* produced in those laboratories, as indicated by CARDIQUE this involves *Cryptosporidium*, enteric coccidia that produce zoonotic diseases, and which rely on mammalian hosts.

13. With respect to the technical reasons for discharging into the La Virgen Lagoon, on the basis of the information provided by the Administrative Department of the Environment (DAMARENA) an official letter 3111-1-2198 of February 15, 2002, this Ministry finds as follows, regarding the tidal inlet project:

- It began operation on November 25, 2000.
- Since January 30, 2001 communication between the Lagoon and the system of waterways has been rehabilitated.
- As of May 30, 2001, the Chambacu sluice began operation.

According to the data submitted, the general benefits of the tidal inlet are reflected in an improved quality of life for the 400,000 people who live along the banks and areas of influence of the Lagoon, and the system of lakes and watercourses, in the improvement of water quality within

the Lagoon and the watercourses as far as Cartagena Bay, in the recovery of its natural function as a species nursery, increasing biodiversity, improving the mangrove swamps, eliminating flooding from zones adjacent to the Lagoon, and generating beaches to the north and south of the inlet.

The stabilized tidal inlet project, as planned from the outset, must be accompanied by a Sewage Master Plan for reducing the discharge of wastewaters into the Lagoon and the system of watercourses. That program is now being carried forward by ACUACAR, and its second stage consists in eliminating current discharges into the Tesca Lagoon and Cartagena Bay, which will be conveyed and disposed of through the submarine outfall, after pretreatment, at a point 2,800 m from Punta Canoa.

In selecting the Punta Canoa area as the final site for the outfall pipeline, the project consultants conducted a series of tests using technical, economic and environmental variables to select the most appropriate area. That analysis, which rejected the La Virgen Lagoon as the receptor body of the Cartagena sewage system, considered the following aspects:

- By discharging the effluent from the treatment system into the La Virgen Lagoon, this receptor body would have to be able to assimilate the inflow, in accordance with the quality of the water available, i.e. there would be the possibility that the southern part of the Lagoon could become an extension of the treatment system, which would be contrary to the provisions of the Cartagena land-use management plan.
- The discharge of organic loads and nutrients would create within the Lagoon optimal conditions for the growth of algae and the phenomenon of eutrophication.
- With functioning of the tidal inlet and concentrations of wastewaters from Cartagena in the Lagoon, there would be a risk of pollution to the adjacent beaches, which could not be used for primary contact activities, and this would have serious consequences for tourism.
- Fishing activities that are currently possible, thanks to the operation of the tidal inlet, would be affected by the increase of sewage discharges, and one of the objectives of the tidal inlet project would thereby be lost.

13.1. [The appellants claim that] there are no sure mechanisms for dealing with emergencies such as a rupture of the pipeline. On this point, the plan incorporates a chlorination system to disinfect wastewaters in the event that coliforms should increase in the beach area, or the submarine outfall pipeline should rupture. The chlorine dose is set at between 10 and 20 mg/l. Such concentrations will destroy pathogenic organisms and the dilution affect will keep residual chlorine concentrations at around 0.003 mg/l, which will avoid toxic effects on aquatic life. It is also planned to construct an aeration pond, the purpose of which would be to serve as a sewage storage system in the event peak flows during operations were to prevent normal functioning of the disposal system. On the other hand, as part of the activities covered in the contingency plan, in the case of a failure of the outfall, at sea or on land, drainage systems to be installed in Cartagena Bay and in La Virgen Lagoon would be activated, so that the discharge of wastewaters would not exceed six days of sewage flow, as stipulated in Article 9 of CARDIQUE Resolution 345 of June 5, 2001. That Resolution moreover provides that the project owner must submit within six months an emergency manual for the pumping system and wastewater treatment system for the city of Cartagena, indicating in detail the main contingent events and the measures of control, considering the required methods, equipment, personnel, economic resources, among other matters. In this way, and with the additional measures presented in the contingency plan and other provisions in the environmental license, the Ministry considers that the project does indeed have a contingency plan, which will be the object of continuous monitoring.

13.2. [The appellants claim that] during the construction phase of the underwater outfall, the plan is to dump 100% of wastewaters into the La Virgen Lagoon, for five years. The appellant's interpretation with respect to the use of the La Virgen Lagoon as the receptor body for 100% of wastewater during the construction phase for the submarine outfall is mistaken, because according to the study projections that body of water will receive only 60% of effluent from the sewage system, while Cartagena Bay will serve as the receptor for the remainder. These two cases are consistent with the current pattern of wastewater drainage, which arrives at these bodies of water either through the direct discharge systems from the current collectors or from indirect discharge through surface channels or ditches, which will be rehabilitated as part of the Basic Sanitation Plan. It is logical, and is so provided in the project's interim phase, that while the submarine outfall is being constructed, wastewater should continue to be disposed of where it is currently dumped. Nevertheless, and in order to reduce the impact on the receptor bodies, improvements are planned to the pretreatment systems in the El Bosque and Paraiso pumping stations. In addition, in the environmental license, CARDIQUE does not accept the option described for discharging wastewater in the interim phase, which refers to a 950 m pipeline of 1.37 m diameter for discharging into the Caño Limon, and from there into the La Virgen Lagoon, for the reasons given in Technical Report 491 of May 31, 2001, which states that a discharge into the Caño Limon, and thence into the La Virgen Lagoon, could have severe environmental impacts that were not assessed in the EIA. To correct this proposal by the project owner, the environmental license establishes, in Article 8, that alternative 4 in Chapter 6 (table 49) of the EIA must be adopted, so as to diffuse discharges into the Lagoon by using the emergency pipeline from the EP1, EP2 and EP3 pumping stations, expanding this requirement with other supplementary provisions.

With respect to the possibility of flooding, according to the information provided to this Ministry by the Mayor of Cartagena, one of the benefits from the operation of the stabilized tidal inlet will be to eliminate flooding in areas bordering the La Virgen Lagoon, because outflow to the sea is now assured by the system of sluice gates.

13.3. [The appellants claim that] the Punta Canoa submarine outfall will release its effluent into the sea at a depth of 20 m or less, and at a point only 2 km from the coast, which means that the thermocline phenomenon will not occur. The likely absence of thermocline was taken into account in the simulations conducted both by Hazen & Sawyerhis i(models), and by Philip J. W. Roberts (near field model and far field model). In the first case, the study showed a slight stratification due possibly to the presence of waters from the Magdalena River, while the document prepared by Dr. Roberts specifies clearly that the stratification of densities is generally weak, indicating that the plume will reach the surface. These stratification aspects were taken into account when running the models, and it is possible to catalog negative aspects of the outfall's discharge area, yet action to lengthen and deepen the outfall would not resolve those natural difficulties, as shown in the document from ACUACAR prepared in response to CARDIQUE Resolution 842 of 2000, which mentions that due to the weak stratification and the shallow depth of the coastal waters near the diffuser, the plume will generally rise to the surface. Nevertheless, dilution of the residual field that rises to the surface will generally exceed 100 [i.e. 1:100??]. Because of strong currents, dilutions will usually be much higher, with an average value of around [1:]250, and maximum values of nearly [1:]1000. Although some cases of dilution of less than [1:]100 were predicted, these are unlikely to have any importance because they will occur only occasionally.

Although some improvements can be made to the length and diameter of the diffuser, these will have no significant impact on water quality. The outfall does not have to be located further from

the beach or in deeper water in order to meet water quality standards at the coastline. On this point, and contrary to the claim of the appellant, CIOH, in official letter 635 DCOH-JDESAT-585, declares: In preliminary measurements by CIOH (June 99), the CTD [??] records showed 30 m as the depth at which significant density gradients begin to be detected, which suggests the possibility of seasonal stratification. Recalling that the Hazen & Sawyer study's calculations reflect the worst conditions (effluent outburst), the possibility of stratification in the water column becomes one more element that would increase dilution of the effluent, but it would be neither sufficient nor necessary to take into account; in any case, the project is conducting field measurements in the area of influence of the outfall, covering the period from November 1999 to November 2000, so as to determine the stratification more accurately (page 7, paragraph c, GAR-010-00).

In the resolution granting the project's environmental license, CARDIQUE includes as a contingency measure the possibility of implementing one or more alternatives of management or treatment to comply with the effluent specifications approved for phase 1, in case of failure to meet the quality standards for the marine ecosystem as modeled in the EIA and its annexes, once the sewage pretreatment system is in operation and after the environmental monitoring program has been implemented.

13.4. [The appellants refer to] the land areas required for the pipeline corridor and the sea areas in which primary and secondary human contact will be prohibited. According to the performance of the outfall as projected in the studies, the restriction on water use in the area of the outfall would focus on prohibition of primary contact in the mix zone. In this respect, Article 9 of Resolution 345 of 2001 provides that the mix zone “will have to be indicated and demarcated in order to prevent primary contact activities,” at the same time allowing primary contact use in areas further removed, depending on the result of the studies, which will be monitored before and during operation of the outfall, as required in the environmental license resolution. In this way, the tourism potential of Cartagena’s beaches, and not only those at Punta Canoa, will be maintained, and the tourism uses described in the land-use plan can proceed.

13.5. [As to the claim that] the possibility of pollution in the primary-contact ecosystem is real and recognized by the consultants themselves, who give only a 99% assurance that there will be no contamination of the beaches, the studies submitted during the license process predicted that coliform concentrations at the beaches will depend primarily on three variables: flow of sewage, dilution by the diffusers, and coliform mortality in the sea. On the first point, it is expected that the flow will reach 3.5 m<sup>3</sup> per second during 2% of the year, i.e. 7.3 days, not necessarily continuous days, and it must also be recalled that the higher flows will occur in the final stage described in the outfall design, i.e. between 2015 and 2025.

With respect to the presence of dilution of less than 100: 1 (the standard set by the international scientific community), the Roberts simulation shows that for 15% of the year, at an estimated flow of 3.9 m<sup>3</sup> per second, dilution in the near field would be less than 100: 1, but as with point 1 this phenomenon would occur for peak flows that will occur only in the final stage of the project, and moreover in this case there is no consideration of what is known about the direction of currents or the T90 behavior, aspects that when taken together show no likelihood that bacteria will be transported to the beach.

The behavior of coliform decay examined in the feasibility study shows that, at least beyond a radius of 1.2 km around the diffuser site, fecal coliform values will not exceed 200 NMP/100 mm, while for total coliforms this condition will apply at 1.5 km: the beaches are in fact located at greater distances from the outfall diffusers.

The results of Dr. Roberts' model run show that coliforms will not be transported to the beaches, because of the direction and intensity of currents, and for this reason those beaches will never be affected by discharges from the outfall: moreover, with T90 calculated at 1.5 hours the length of the affected area is significantly reduced, and this is a conservative figure according to CIOH estimates in response to this and other appeals challenging the environmental license.

14. Failure to meet the standards specified in Decree 1594/84, with respect to the type of user (new or existing), as claimed by the appellants. This point has already been analyzed. With respect to compliance with the requirement for total absence of visible grease films and floating oils and foam from human activity, toxic substances or irritants that affect human health, odor-producing substances, substances that produce turbidity or coloration that interferes with photosynthesis, the fact is that comprehensive treatment by the rotating screens and the dilution that will occur in the near field will ensure that there are no visible films on the sea.

15. With respect to the public hearing, while it is true, as Mr. Jairo Morales Navarro claims, that CARDIQUE made no reference to the individual interventions in its official report on the public hearing, it is also true that, upon analyzing each of the interventions in the public hearing, we find that, while there may have been no specific notes on each of the points, those points were considered both in the technical report reflected in Resolution 345 of 2001 and in the [license] resolution itself, as stated in Resolution 520 of September 19, 2001, by which CARDIQUE decided the actions for reversal (*reposición*), presenting an analysis of the relevant points expressed at the public hearing, and the manner in which those points were taken into account in the final stage of the licensing process.

16. With respect to the precautionary principle to which the appellants refer, according to the environmental impact studies and the technical evaluation and analysis conducted, the negative impacts that the project will generate are clearly understood, and adequate environmental management measures are planned to prevent, mitigate and compensate for such impacts. Consequently, the precautionary principle is not applicable.

17. As to Decree 1875/79, cited by Mr. Dorance Cure Janna in claiming that industries or any other type of facility must avoid pollution, Article 2 of that Decree explicitly states that the Maritime and Ports Administration, upon request of the respective port captaincy, may authorize the discharge, dumping or release into the sea of polluting or potentially polluting substances, in amounts and concentrations that do not exceed the regeneration limits of the specific medium. To this end, the Administration may request, as appropriate, the opinion of the National Institute of Renewable Natural Resources and the Environment (INDERENA), the Ministry of Health, or the Institute of Nuclear Affairs, points that were taken into account in the environmental licensing process.

18. With respect to the five-year social management program, it is important to note that the project will have an impact on local communities during the construction stage. However, during the operating phase, those impacts are of a positive nature, because they will improve the quality of life through the management of the city's sewage. For that reason, the appellant's argument is rejected.

19. With respect to diapirism, Mr. Jairo Morales Navarro claims that this phenomenon has been recognized along the coast at Punta Canoa, and that therefore the environmental impact assessment and the contingency plan must include it measures to deal with a probable occurrence. INGEOMINAS, in official letter 3111-1-2255 of February 18, 2002, and the Mining,

Environmental and Nuclear Information and Research Institute have declared to this Ministry that, given the lack of detailed information on the geological stability of the planned site for the submarine outfall, it is impossible to conceptualize this point. They explain that the existing studies of INGEOMINAS in the project zone are regional in nature and do not allow for conceptualizing the projected works, but that there is evidence of fracturing in the region that could be associated with mud volcanism, and that the threats this might pose to the works would have to be determined in detailed geological and geophysical studies. Based on the study entitled "Geophysical Investigations Offshore Punta Canoa, Colombia" by Marine Resources Inc., presented to CARDIQUE during the licensing process, we conclude that the three possible geological risks in the area (Pleistocene faults, localized settling, and diapirism), while they cannot be discarded, are classified as minimal geological risks because they are not located directly in the path of the pipeline, or are of low magnitude. Those geological risks will have to be taken into account by the Cartagena authorities in the technical specifications for construction of the outfall and its components. This factor is dealt with in the environmental license in articles 5 and 6 of the CARDIQUE Resolution.

As well, the Licenses Division of this Ministry, by means of Technical Report 298 of March 14, 2002, which is an integral part of this Resolution, offered the following general considerations on the actions of appeal:

1. The arguments set forth in the appeal actions lack the technical and social substantiation for declaring the project unfeasible, and thus from the technical and environmental viewpoint the appellants' request to revoke CARDIQUE Resolution 345 of 2001 cannot be accepted.
2. The submarine outfall is an optimal system for sewage disposal that uses the features of the receptor body, in this case the sea, to assimilate the physical, chemical and bacteriological conditions of domestic sewage, thereby guaranteeing, in line with mathematical modeling projecting the operating behavior of the outfall, that there will be no impact on biotic, abiotic and social conditions in the area.
3. This Ministry considers that, from the technical and environmental viewpoint, the disposal system using a submarine outfall offers environmental characteristics that meet the conditions for being considered indistinguishably as a new or existing user in light of Decree 1594 of June 26, 1984.
4. With respect to the validity of the prior consultations with the black community, this Ministry considers that, while this is a step that must be taken into account as part of the environmental impact study, and in the environmental licensing procedure itself, the responsible authority in this process is the Ministry of the Interior, which has certified that the consultations took place, as demonstrated by CARDIQUE in file document 1683.

In the Technical Report referred to, the Licenses Division of this Ministry, after evaluating the information provided in the actions of appeal and the documentary evidence requested by this Ministry, recommends that the appeals against CARDIQUE Resolution 345 of 2001 be rejected, and that the Ministry should confirm all portions of that Resolution, in which CARDIQUE granted an environmental license to the Tourism and Cultural District of Cartagena for construction and operation of the project for Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent in the Adjacent Sea through Its Submarine Outfall.

## **OTHER LEGAL CONSIDERATIONS**

As the authority of second instance concerning the actions of appeal brought by SOCIEDAD INGENIEROS Y ARQUITECTOS DE BOLIVAR (SIAB) NESTOR F. CARRILLO MARTINEZ, RAFAEL E. CEBALLOS CALVO and EMIRO VANEGAS ORTIZ, CURE JANNA and JAIRO MORALES NAVARRO against Resolution 345 of 2001, in which CARDIQUE granted an environmental license to the Tourism and Cultural District of Cartagena for construction and operation of the project for Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent in the Adjacent Sea through Its Submarine Outfall, this Ministry has conducted a legal analysis of the arguments put forward by the appellants, in light of the evidence on file 2616 and the relevant legal and regulatory provisions, as follows:

Within the relevant constitutional framework, it is important to consider a series of environmental protection regulations as indicated below:

According to Article 79 of the Constitution, all persons have the right to enjoy a healthful environment, and to this end the law guarantees participation by the community in decisions that may affect it, and imposes upon the State the duty to protect the diversity and integrity of the environment.

In turn, Article 80 of the Constitution makes it the duty of the State to plan the management and exploitation of natural resources in such a way as to guarantee their sustainable development, their conservation, restoration or substitution, and to prevent and control the causes of environmental degradation.

On the basis of the concepts of sustainable development and the related planning obligation, the activities of the project must be conducted in such a way as to prevent the causes of degradation, in order to comply with the State's obligation to guarantee the collective right to a healthful environment, pursuant to Article 79 of the Constitution as interpreted by Law 99 of 1993.

In accordance with Article 1 of the National Code of Renewable Natural Resources and Environmental Protection, the environment is a common heritage, with respect to which the State and private individuals must participate in its preservation and management, in the public interest.

Sustainable development is defined in Article 3 [of that code] as development that leads to economic growth, to a higher standard of living and social welfare, without exhausting the renewable natural resources base on which it relies, or damaging the environment or prejudicing the right of future generations to use it in order to meet their own needs.

Of particular importance to the matter at hand is judgment T-067/93, from the Unified Jurisprudence of the Constitutional Court, written by chief justice Fabio Moron Diaz and chief justice Ciro Angarita Baron, which indicates:

Principles and criteria for protecting the right to a healthful environment:

A. Principles of interpretation

1. Principle of fact

Protection of the environment is especially important within the framework of the constitutional protection of rights. This importance results from the idea of a healthful environment as a

necessary condition for the existence of a healthy and dignified life. In the current circumstances of industrialized society and growing urbanization, a clean environment is seen as closely linked to protection of human health and life. This is an indisputable factual assertion in the circumstances of the developed world.

#### Criteria of interpretation

In the juridical treatment of conflicting interests and values, those values that have constitutional rank take precedence over those values or interests that do not. When it is not possible to resolve the conflict of interest by means of a directly applicable constitutional rule, we must resort to constitutional principles and values. In the case of conflict between two or more community interests of equal constitutional ranking, the interest that must prevail is the interest of those persons who find themselves in a situation of inferiority with respect to the other interest and persons in the conflict. The principle of equity of burdens is normally observed by finding a reasonable balance between the interests in conflict. The time factor must be taken into account as an essential element. A decision that will affect a fundamental right of immediate application must not necessarily be reduced to the short or medium term. The decision must be weighed in such a way as to result in a reasonable solution.

On the basis of the foregoing, we conclude that the environment is a common heritage and therefore the State and society are obliged to guarantee its protection, because compliance with that duty determines the possibility that present and future generations can live in conditions of dignity and security, within a clean environment.

With respect to the lack of jurisdiction claimed by the appellant, the following should be noted: on the basis of doctrine relating to administrative jurisdiction, we may turn to the definition offered by the jurist Manuel Maria Diez in his work "Administrative Law" (Bibliografica Omeba, Buenos Aires, 1965, page 29), as the set of attributes, powers and faculties that one body has in comparison with those of other bodies, constituting legal title, under certain conditions and within predetermined limits, to issue the corresponding administrative acts.

Jurisdiction to grant or deny environmental licenses is governed by Article 51 of Law 99 of 1993, which provides that the Ministry of Environment as well as the Autonomous Regional Corporations and certain municipalities, districts and other metropolitan areas have authority for such purposes.

As well, Article 52 of that law establishes the prerogative of the Ministry of Environment to grant or deny environmental licenses under conditions specifically listed therein. The case that concerns us, the project for Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent in the Adjacent Sea through Its Submarine Outfall, does not fall within the matters referred to there.

Moreover, the Ministry of Environment does not have jurisdiction to consider the environmental license in question, under the assumption that this Ministry assumed the functions of the former INDERENA, whereby it could assume certain powers only if they were not expressly assigned to another environmental authority. As we shall see below, jurisdiction to consider matters of this type is assigned expressly to the Autonomous Regional Corporations.

Furthermore, Article 31 (12) of Law 99 of 1993 provides that the autonomous regional corporations have authority for the evaluation, supervision and environmental monitoring of the

use of water, soil, air and other renewable natural resources, which includes the discharge, emission or incorporation of liquid, solid or gaseous substances or wastes into waters of any kind.

Consistent with Article 53 of that law, the national government is authorized to define those cases in which the Autonomous Regional Corporations would have jurisdiction to issue environmental licenses.

Pursuant to that legal authority, the national government issued Regulatory Decree 1753 of August 3, 1994, Article 8 (15) of which provides that the Autonomous Regional Corporations are competent within their respective jurisdiction to grant or deny environmental licenses for the construction and operation of sewage systems, marginal interceptors, pumping stations and systems and treatment plants, and the final disposal of waste waters from territorial entities.

As well, it is important to note, as a means of reiterating the foregoing, that the project in question, which was granted an environmental license by CARDIQUE, is also subject to the provisions of Article 8 (30) of Decree 1753 of 1994, according to which works or activities that require authorization from DIMAR are within the jurisdiction of the autonomous regional corporations, a point that reaffirms the competence of that Corporation [CARDIQUE] to grant the environmental license in question.

On the basis of the foregoing considerations relating to jurisdiction, this Ministry considers that the Autonomous Regional Corporation of the Dique Canal, CARDIQUE, contrary to the arguments put forward by Messrs. Dorance Cure Janna and Jairo Morales Navarro, has acted under the powers that our legal system conveys upon it, and that it has observed that system's strict rules of jurisdiction.

With respect to the argument relating to the alleged lack of legal standing of ACUACAR, we must note the following. The juridical interest of the Tourism and Cultural District of Cartagena is duly accredited by the fact that it was granted an environmental license, and its legal representative, the Mayor of Cartagena, was so notified. Effluent to the Adjacent Sea through Its Submarine Outfall," the appellant's objection is based on the lack of legal standing, with respect to the contract signed between the District of Cartagena and the company ACUACAR to exercise its activity (maintenance).

To question the legality of the contract signed between the Tourism and Cultural District of Cartagena and ACUACAR, referred to above, as the appellant so expresses, is not within the powers of the environmental authority, and consequently this Ministry is unable to pronounce itself on that point.

In the case in question, we have a project for the treatment and final disposal of sewage, implementation of which will permit the community of the Tourism District of Cartagena to improve the quality of life, in accordance with its constitutional and legal mandate, under the principles of sustainable development. For the reasons set forth above, [the Minister of Environment] RESOLVES:

ARTICLE 1. To confirm in all its parts Resolution 345 of 2001, in which CARDIQUE granted an environmental license to the Tourism and Cultural District of Cartagena for construction and operation of the project for Treatment of Sewage from the City of Cartagena and Final Disposal of the Effluent in the Adjacent Sea through Its Submarine Outfall, in the Department of Bolivar, for the reasons explained in this Resolution.

ARTICLE 2. To return file 1683 LA to the Autonomous Regional Corporation of the Dique Canal, CARDIQUE, together with the records of the appeal proceedings in file 2616 of this Ministry, a copy of which shall remain in the archives of this Ministry.

ARTICLE 3. To order the Tourism and Cultural District of Cartagena to publish, at its expense, the title page and the operative portion of this Resolution in a newspaper of broad national circulation, a copy of which it must provide for file 2616 of the Ministry of Environment and the Autonomous Regional Corporation of the Dique Canal, CARDIQUE.

ARTICLE 4. To notify the contents of this resolution to the Tourism and Cultural District of Cartagena, to the Bolivar Society of Engineers and Architects (SIAB), to Messrs. Nestor F. Carrillo Martinez, Rafael E. Ceballos Calvo and Emiro Vanegas Ortiz, Mr. Dorance Cure Janna and Mr. Jairo Morales Navarro.

ARTICLE 5. The Tourism and Cultural District of Cartagena must see to the corresponding publication, in a newspaper of wide national circulation. A copy of that publication must be sent to this Ministry, for file 2616, and to the Autonomous Regional Corporation of the Dique Canal, CARDIQUE.

ARTICLE 6. The Licenses Division shall communicate the contents of this Resolution to the government of Bolivar, to the Inspector General for Environmental and Agrarian Affairs, to the Captaincy of the Port of Cartagena, and to the ACUACAR Company.

ARTICLE 7. This Resolution is not subject to appeal, and the administrative route is hereby exhausted.

**TO BE NOTIFIED, COMMUNICATED, PUBLISHED AND FULFILLED**

**JUAN MAYR MALDONADO  
MINISTER OF ENVIRONMENT**

File No. 2616



**COLOMBIA  
CARTAGENA WATER SUPPLY, SEWERAGE AND  
ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 9.  
Legal Opinion on  
Requester's Claims regarding the Submarine Outfall**



MG 168 / 2004

Bogota D.C. May 3<sup>rd</sup> 2004

Mr. Menahem Libhaber  
Lead Water and Sanitation Specialist  
Latin America and the Caribbean Regional Office  
The World Bank  
Washington D.C.

Subject: Concept on the Cartagena underwater outfall

Dear Mr. Libhaber;

In this document we are responding to your request about a concept concerning the arguments presented in Cartagena city, related to the procedure and legal compliance of the project “*Cartagena de Indias waste water treatment for the final disposal of the adjacent marine effluent through an underwater outfall*”.

In order to respond to your request this document follows the following methodology:

- I. Topics 6 and 7 from annex 1 “Claims and Responses” will be considered.
- II. The legal problem of this case will be identified and answered.
- III. Additional topics that could need more analysis under Colombian legal framework will be considered.
- IV. Finally, some general conclusions are high lighted.

## **I. Concept development**

First, it is important to indicate that almost all of the arguments against the administrative decision granting the environmental license/permit have been stated in an appeal before CARDIQUE (regional environmental authority) that subsequently was reviewed by the environmental ministry (national environmental authority) in a second appeal. Both environmental authorities have rejected all of those arguments.

### **1. Violation of National Norms (Claims/issues 6: violation of national norms)**

In this first argument against the environmental license, two main legal problems could arise:

- i) Was the environmental license granted to the underwater outfall project violating, or not complying with, Decree 1594 of 1984 and Law-Decree 2811 of 1974 (Renewable Natural Resources Act) when it established a deadline to reach the quality standards indicated in these norms?

The obligation imposed by CARDIQUE in environmental license No. 345 of June 5, 2000 Article 2-a. indicates that the company *Aguas de Cartagena* should do the following tasks:

*“a. Before 2010, submit to the environmental authority –cardique- the alternatives and design of a treatment system that will meet the removal standards established in Decree 1594 of*

1984, for existing users. The approved alternative should be built and start working in time for the second phase of the project (2015)”.

To respond to the question stated above, it is necessary to point out that articles 42 and 43 of Law-Decree 2811 of 1974 are not dealing with water emissions, but with property rights over renewable natural resources. Perhaps those articles correspond to the Decree 1594 of 1984, since they make reference to the quality of water uses for recreation.

It is also relevant to cite article 4 of Decree 1594 of 1984, which establishes the following:

*“Article 4: The quality criteria established in this Decree, are guidelines to be used as a baseline when regulating, assigning uses and determining water characteristics for each use”.*

The importance of this article is based on the fact that it clearly establishes the decree as a guideline. This characteristic opens a window for environmental authorities, under particular circumstances, to move away from the specific standards stated in this decree toward more appropriate standards depending on the case.

It is appropriate to indicate the definitions of *existing user* and *new user* contained in the Decree 1594/84:

*“Article 8: For the effects of this ruling, new user is understood as the activity that is initiated after the day of entry into force of this Decree”.*

*“Article 9: For the effects of this ruling, existing user is understood as the activity has been going on before the entry into force of this Decree”.*

The status of new or existing user is given by the current activity and not by the water emission. In other words, the essential requirement to adopt either type of user relies exclusively on the existence of an activity dated before or after the entry in to force of Decree 1594/84, without any consideration to the existence of a water emission. The user status does not depend on the date of the water emission itself (before or after the decree), it only relies on the fact that the activity that originates such water emissions is dated before or after the entry into force of the decree.

In this case it is clear that the activity carried out by the Cartagena district, (running the sewage system), started long before the entry into force of Decree 1594/84. This leads us to affirm that this is an existing user; therefore it is subject to the removal norms applicable for this type of users.

Article 72 of Decree 1594 of 1984 establishes the rules and norms that water emissions have to comply with:

*“Article 72: Every water emission into a water body should comply, at least, with the following rules:*

Reference	Existing User	New User
pH	5 to 9 units	5 to 9 units
Temperature	<40 °C	<40 °C
Floating material	Absent	Absent
Suspended solids, domestic or industrial	Removal >50% in charge	Removal >80% in charge
Biochemical Oxygen Demand:		
For domestic sewage	Removal >30% in charge	Removal >80% in charge
For industrial sewage	Removal >20% in charge	Removal >80% in charge
Maximum permitted charge (MPC)	According with articles 74 and 75 of Decree	1594 of 1984.

At the same time, article 66 of Decree 1594 of 1984 was the fundamental norm used by the Environment Ministry to reject the appellant’s arguments against the environmental license, regarding an alleged non-compliance with water emission standards:

*“Article 66: The norms for water emissions will be fixed considering the quality criteria established for the uses assigned to the resource.*

*In the tracts where multiple uses are assigned, water emissions norms will be established considering the most restrictive values of each of the parameters fixed for each use.*

***The control over the quality criteria will be done outside the mixing zone, which will be determined on a case by case basis by EMAR”. (Emphasis out of text)***

Today, the EMAR are known as the regional environmental authorities, in this particular case CARDIQUE. This environmental authority can establish the quality criteria for each case, and the Ministry of the Environment sustained this argument when it resolved the appeals presented before it.

This means that the arguments have been discussed and have been resolved in favor of the environmental license granted.

However, there are other aspects that should be considered in order to state the responses to the opponents of the project accurately.

First, it is important to consider that the marine underwater outfalls are included and recognized by the Colombian legislation as wastewater treatment systems.

On November 17, 2000 through Resolution No. 1096, the technical regulation for potable water and basic sanitation –RAS 2000- was adopted. On May 18, 2001 Resolution 424 modified this norm only in articles 178 and 180 that make reference to the outfalls.

Article 177 of Resolution 1096/00 states the following:

*“Article 177: underwater outfalls, definition: this type of outfall is a tubing installed in the sea bed that transports domestic sewage waters to a desirable depth and distance from the*

*coast line so the organic charge and pollutants resulting from this emission do not cause sanitary or ecological damages to the marine and terrestrial ecosystems, to the human settlements in the surrounding coast line, to the beaches for public recreation or to the fisheries industry”.*

This means that the environmental license was given considering the legal framework, which is perfectly clear and includes indications for the construction and compliance with water emissions norms.

Article 178, modified by Resolution 424, 2001, establishes:

*“Preliminary studies of the underwater outfalls. The following studies should be done before projecting an underwater outfall: characterization of the waste waters in order to establish the type of necessary treatment before making the water emission. A screen grid should be used to separate the non-biodegradable floating objects that could return to the beaches. Hydrology and barometry of the water emissions area. Statistics study of the ocean currents and its correlation with the wind velocity and direction per hour, tides, and existing ecosystems. Determination of the time T90, necessary for the disappearance of 90% of the coli forms. Geological studies of the sea bed in order to determine the best route for installing the underwater outfall tubing, avoiding irregular rocks formations or coral reefs. It is important to reach the depth needed to obtain a dilution of 1:100, which is the minimum standard”.*

Article 179 establishes the rules for the design and construction:

*“Design and construction of underwater outfalls. In the design dimensions should be established: longitude, diameter, location and depth of the discharge. Additionally, it is mandatory to complete the diffuser hydraulic design before initiating the construction. In the final structural design it is important to specify the tubing materials, the construction techniques and the requirements to maintain the tubing in the seabed.*

*The installation system should guarantee the safe anchoring of the tubing in the sea bed. The diffuser should be installed in a way that guarantees the expected level of dilution”.*

And article 180, modified by Resolution 424 of 2001 establishes:

*“Previous treatment to the water emission of the under water outfall. It should be designed, build and operate a system of previous treatment of waste waters that combining with initial dilution processes, dispersion, assimilation and decay, guarantee compliance of the quality goals for the receiver body indicated in the sanitary and environmental norms in force”.*

The norm is clear when it establishes the obligation of conducting a previous treatment in order to comply with the quality criteria of the receiver body. This implies the existence of a legal imperative that has to be followed, as it was done in the environmental license discussed in this case.

The legal obligation consists in complying with the water quality criteria of the receiver body; however a specific quality for the resulting water emission is not required.

In relation with the water quality of the receiver body, which was argued as well, is important to clarify that the quality standard of the water emission that is finally discharge in the deep sea is different from that of the receiver body.

Therefore and according to our criteria, the project opponents are confusing types of water uses with quality standard of water emissions. This can be appreciated in their argument regarding the violation of articles 42 and 43, which correspond to Decree 1594/84 and not to Law-Decree 2811/74.

These articles establish water quality standards according to the different uses intended, as is shown in the following transcription:

*“Article 42: The admissible water quality standards for recreational uses through primary contact are the following:*

<b>Reference</b>	<b>Express as</b>	<b>Value</b>
<i>Fecal Coli forms</i>	<i>NMP</i>	<i>200 microorganisms/100 ml.</i>
<i>Total Coli forms</i>	<i>NMP</i>	<i>1.000 microorganisms/100 ml.</i>
<i>Phenol Compounds</i>	<i>Phenol</i>	<i>0.002</i>
<i>Dissolve Oxygen</i>		<i>70% saturation concentration</i>
<i>pH</i>	<i>Units</i>	<i>5.0 - 9.0 units</i>
<i>Ten so actives</i>	<i>Active Substances to metilen blue</i>	<i>0.5</i>

*Paragraph 1: The following materials and substances will not be allowed in the water body: Floating oils, greases, human originated floating materials, toxic and irritating substances that could have adverse effects on human health through direct contact, ingestion or inhalation.*

*Paragraph 2: Nitrogen and phosphorous should under controlled levels to avoid eutrophication.”*

*“Article 43: The admissible water quality standards for recreational water uses through secondary contact will be the following:*

<b>Reference</b>	<b>Express as</b>	<b>Value</b>
<i>Total Coli forms</i>	<i>NMP</i>	<i>5.000 microorganisms/100 ml.</i>
<i>Dissolve Oxygen</i>		<i>70% saturate concentration</i>
<i>pH</i>	<i>Units</i>	<i>5.0 - 9.0 units</i>
<i>Ten so actives</i>	<i>Active Substances to metilen blue</i>	<i>0.5</i>

*Paragraph: In addition to these criteria the ones established in paragraphs 1 and 2 of the previous article will be considered.”*

It is convenient to explain the meaning of primary and secondary contact with water bodies, which intended uses are going to be recreational, according to article 34 of Decree 1594/84:

*“Article 34: Water use for recreational purposes happens when:*

- a. Primary contact, like swimming or diving.*
- b. Secondary contact like nautical sports or fishing.*

*Paragraph: By extension, among the water uses that this article refers to, medicinal baths are also included.”*

At the present time all the water uses named above need to be determined and authorize by the environmental authorities, before the competent authority was the EMAR or the Health Ministry. This signifies that the water uses pointed out only will be in force and will have legal effect once the water resource uses have been regulated, according to article 22 of Decree 1594/84’

*“Article 22: In order to assign water generically to the different uses mentioned in article 29 of this Decree, a water management plan should be developed by the competent environmental authority”.*

*“Article 23: For the management plan mentioned in the previous article, the following aspects should be considered:*

- a) Essential factors indicated in Decree 2811 of 1974, Decree 2857 of 1981, Decree 1875 of 1979 and Decree 1541 of 1978.*
- b) Existing uses.*
- c) Projected water uses according to estimated demand increase and new users.*
- d) Establish quality simulation models that allow the assimilative capacity of biodegradable or cumulative substances and the dilution capacity of non-biodegradable substances.*
- e) Water quality criteria and water emission standards in force when adopting the management plan.*
- f) Preservation of the natural characteristics of the resource.*
- g) Conservation of limits according to consumption needs and to the development of characteristics of the resource toward safe levels appropriate for human consumption in order to reach the development goals in the area of influence.”*

*“Article 24: For the establishment of the quality simulation models refer to in literal d) of article 23 the environmental authority should periodically perform substantial analysis in order to obtain the following information:*

- a) BOD: Biochemical oxygen demand in five (5) days*
- b) COD: Chemical oxygen demand*
- c) SS: Suspended solids*
- d) pH: Hydrogen ions concentration, H<sup>+</sup>*
- e) T: temperature*
- f) DO: Dissolve oxygen*
- g) Q: volume*
- h) Hydro biological data*
- i) Coli forms (NMP)*

*“Article 25: The Health Ministry or the institution it delegates to, and the environmental competent authority will determine which substances of sanitary interest would require priority analysis.*

*“Article 26: By request of the Health Ministry or the institution it delegates to, the environmental competent authority should inform about the results according to the rules and procedures established in this Decree.*

*“Article 27: The generic assignment of the resource done by competent authorities will be considered when this Decree enters in to force, until the management plan of the resource is*

carried out for the application of the quality criteria and water emissions standards. (Emphasis out of text)

The previous articles have been cited to show that the use of the resource requires a specific procedure and a precise pronouncement by the competent authority. To our knowledge, this line of action has not happen yet in the area where the underwater emissions will occur, indicating that it is a generic use for different and diverse activities that not necessarily are among the uses contemplated and ruled by Decree 1594/84.

In addition, the paragraph of article 29 of this Decree establishes that in the cases that the resource is going to be uses for activities different to the ones listed in the norm, the environmental authority will establish them indicating the scope of such uses. As an example we find the case of water being use to receive emissions, this is dilution. Accordingly, it is possible to affirm that CARDIQUE as the regional environmental authority decided the use of the open sea as the area to locate the underwater outfall for the dilution of the water emissions.

And if the above argument is not enough to controvert the opponents of the project, there is the Decree 3100 of 2003 that regulated the tax/deduction for water use “tasa retributiva”, this norm clearly establishes that water emission standards should be determined by the competent environmental authority on a case by case bases, when issuing an emissions permit, according with article 4 which defines the allowable limits:

*“Permissible limits for emissions are the allowable content of an element, substance, compound or environmental factor, individually or combined, or the products of their metabolism established in the emissions permit and/or in the management plan, according to article 30 of this Decree.*

*The allowable limits for emissions of substances, parameters, elements or compounds fixed in the emissions permit and/or in the management plan will determine the adverse and harmful consequences of those emissions.”*

The above transcription of the norm is clear in pointing out that the environmental authority can fix the limits in each emissions permit or management plan. The latter was considered by the Environmental Ministry when resolving the appeal in this case. This ministry highlighted the point that due to the fact that in this case they were dealing with an existing user, a management plan could be granted (instead of an emissions permit).

The Decree 3100 of 2003 goes beyond the emission permit or management plan and establishes especial instruments for sewage and sanitation companies. This norm inn article 30 states the following:

*“Paragraph: For the users that performed a utility service of sewage and sanitation, the management plan for sanitation and water emissions will be recognized as an emission permit and/or management plan”.*

The above means that at the present time, the water public utilities managing sewage and sanitation have an especial instrument through which the environmental authority regulates their emissions, such instrument is the management plan for sanitation and water emissions that has a similar content of an emissions permit or management plan.

Thus, if there was any doubt by the opponents regarding CARDIQUE difficulties, limitations or lack of authority to impose on the water utility company “Aguas de Cartagena” the responsibility of presenting an alternative system that allows reaching the removal fixed in Decree 1594/84, now it is supported by the new regulation in force. This argument is based in Decree 3100 of 2003, which article 30 cited before indicates that the management plan for sanitation and water emissions is the instrument the environmental authorities like CARDIQUE should impose to water utility companies like “Aguas de Cartagena”.

## Conclusions

After reviewing the norms relevant to this case, regarding the questioning of non-compliance with Decree 1594/84, especially with the environmental license, it is possible to conclude the following:

- 1) The Environmental Ministry evaluated and rejected the alleged violation of Decree 1594/84, deciding the appeals in favor of the administrative act that grants the environmental license.
- 2) The water utility company “Aguas de Cartagena” is considered as an existing user, therefore the removal that the company has to comply with is the one established for this type of users in article 9 of Decree 1594/84.
- 3) When multiple uses of the receiver body are intended, the environmental authority can specifically establish the quality standard of the resource out of the mixing zone, according Article 66 Decree 1594/84.
- 4) Underwater outfalls and preceding wastewater treatment systems should comply with environmental and sanitary regulations (Resolution 1096/00 and Resolution 0424/01 issued by the Development Ministry).
- 5) Articles 42 and 43 of Decree 1594/84 that establishes the uses of seawater where the underwater outfall will be located have not been regulated or develop.
- 6) The new regulations established that the emissions standards will be fixed by the environmental authority, for water utility companies providing sanitary and sewage services the sanitary and emissions management plan will serve as a compliance plan (i.e. permit) according to article 30 Decree 3100/03. In this case, “Aguas de Cartagena” will have to ask for this type of permit in order to legally strengthen the environmental license they were granted.

## 2. Violation of article 24 of Decree 1753 of 1994

The opponents of the project point out the studies required by Resolution 842 of 2000 were not included, resulting in a violation of article 24 of Decree 1753 of 1994 (this decree is no longer in force, it has been replaced by Decree 1180 of 2003, which regulates environmental license).

Article 24 of Decree 1753/94 stated the following:

“Article 24, the environmental impact assessment will have the following goals and scope:

1. Describe, characterize and analyze the biotic, a biotic and socio economic system, where the project or activity is expected to be develop.
2. Define the ecosystems that under the environmental analysis indicated above, are sensitive, strategic or have especial environmental importance, and identify the areas that should have special management or that need to be excluded from the development of the project or activity.

3. Evaluate and assess the supply and vulnerability of the resources used or affected by the project or activity.
4. Evaluate the impacts and adverse effects of the project or activity in order to establish their seriousness and the appropriate preventive, controlling, mitigation, compensatory and corrective measures to be taken if necessary.
5. Identify the existing governmental plans at the national, regional and local levels for the area of interest of the project or activity, in order to evaluate their compatibility.
6. Point out the information deficiencies that generate uncertainty in the estimation, dimensioning or valuation of the impacts.
7. Design environmental management plans for prevention, mitigation, correction, and compensation of impacts necessary during the project development.
8. Estimate the costs and elaborate an investment and execution chronogram of the works and actions for environmental management.
9. Design environmental monitoring systems that allow the user evaluate and assess the efficacy and efficiency of the environmental management plan.
10. Evaluate and compare the project environmental performance foreseen against the environmental quality standards establish in environmental norms in force and multilateral environmental agreements ratified by Colombia.
11. Define the technologies and actions that will be used in the project for the preservation, mitigation, control, correction and compensation of the impacts and adverse environmental effects cause a specific project.

This article does not establish the content of the environmental impact assessment; it only defines the assessment's goals and scope. In any case, CARDIQUE declare in an administrative act dated April 25<sup>th</sup> of 2001 that the information was complete indicating that the information was received by them and was properly evaluated by the environmental authority.

The legality of administrative acts is presumed and in that order of ideas it should be understood that the environmental license was granted to "Aguas de Cartagena" on the bases of the requested information by the environmental authority.

It is important to point out that this consideration was also presented by the opponents of the project to CARDIQUE who rejected it in the same way that the Ministry of Environment did, after evaluating the appeals.

Having discuss the matter before Cardique and secondly before the Environmental Ministry, and both authorities rejected the appellants allegations, it would we possible to conclude that the information requested through Resolution 842 of September 27, 2000 was delivered by "Aguas de Cartagena". In virtue of the legality presumption principle that states that the legality of an administrative act is presume until a judicial authority decide differently, in the present case the legality of the Resolution 842 which granted the environmental license for the underwater outfall, can not be disputed.

### 3. Violation of International Norms (Claims/Issue 7: Violation of international norms)

The allegation in this point resides in disavowing the international protocol related to the contamination coming from terrestrial sources and activities of the Convention for the protection and development of the marine environment in the Caribbean region.

## Colombia

This point was also resolved by Cardique and the Environmental Ministry. They concluded that there was no violation of such treaty that has not been ratified by Colombia and therefore is not in force in the country's jurisdiction.

Article 224 of the Political Constitution of Colombia states that for an international treaty to be in force in the country it needs to be ratified by Congress. Additionally, article 241-10 establishes that the Constitutional Court should do the following:

*“Decide about the legality of international treaties and of the laws that approve them. To that end the government will submit within the following six days after sanctioning the law...if the court declares it constitutional, the government can do the notes exchange; if this does not happen the treaty will not be ratified.”*

This means that international treaties will not enter into force and will not have any legal effects only with the subscription by the government. There are some rules to be followed:

- Sanction by Congress through an approval law.
- The Constitutional Court performs the legal control over such approval law.
- Government ratifies through a Decree or executive order.
- Perform the notes exchange with the secretary of the treaty.

The Protocol alleged by the opponents has not been ratified and approved by Colombia yet, despite having been subscribed. This means that such protocol does not have legal effects in the country and therefore its violation can not be alleged.

The Protocol establishes recommendations to member countries about the need to evaluate the environmental impacts of productive activities over the marine environment, the adoption of preventive and control measures to minimize the risk of pollution in the areas covered by this protocol. Finally, article 7 of the Convention for the protection and development of the marine environment in the Caribbean region, is ratified by Colombia through the Law 56 of 1987, which states the following:

*“The contracting parties will adopt all the adequate measures to prevent, decrease and control pollution in the areas covered by this convention, caused by waste discharge in coastal zones coming from rivers, sewage systems, estuaries and any other located in this territory.”*

The above does not mean that the Protocol is forbidding waste water discharges in the marine ecosystem of the Caribbean Sea; on the contrary it clearly states the preventing and corrective measures should be taken in order to control the adverse environmental and health effects that such activities may cause. These conditions are met in the present case considering the fact that the underwater outfall was evaluated by the competent environmental authority. Additionally, the Environmental Ministry rejected the allegations stated by the appellants against the administrative act that grants the environmental license.

In Colombia the environmental license is the legal instrument to carry out the environmental assessment in order to control, prevent, reduce or mitigate the adverse environmental impacts resulting from the project. In this order of ideas, when the underwater outfall was subject to the environmental license, the obligations of this treaty were fulfilled.

In relation with the standards established in such treaty, even though they are not mandatory, it is important to note that CARDIQUE established in article 16 of Resolution 345 of June 5<sup>th</sup> 2001, which granted the environmental license:

*“Article 16: The project should adjust its treatment system to the standards resulting from international treaties adopted by Colombia and incorporated into the national legislation for the protection of marine waters and ecosystems”.*

The above shows that the environmental authority was diligent enough to foresee the entry in to force of the Protocol and request compliance once it was ratified by Colombia and was incorporated to the national legal system.

The Protocol in question establishes in its Annex II the definition of water class I and the standards and parameters of the emissions discharge in the Caribbean waters.

*“Waters class I: the waters subject to the convention ruling due to its inherent environmental characteristics, or to its biological or ecological vulnerability, or use by humans, are particularly sensitive to the impacts of domestic water sewage. Water class I includes:*

- Waters with coral reefs, mangroves and seaweeds.*
- Critical zones for reproduction, breeding and nursing of aquatic and terrestrial life.*
- Zones assigned to provide habitat for protected species under the SPAW Protocol.*
- Protected areas included under the SPAW Protocol.*
- Recreational waters.*

Annex III literal C establishes the date when the obligation to comply with the standards of the effluents will rise. Such date is never less than 10 years for all the categories listed. Additionally, literal C-2 establishes the following parameters for water discharges class I:

- Total of solids suspended 30 mg/l;*
- Biochemical demand of oxygen (DBO5) 30 mg/l;*
- pH 5 – 10 units de pH;*
- Greases y oils 15 mg/l;*
- Coli forms faeces (the parties could comply with the limits of effluents for fecal coli forms o E. coli (fresh water), or entero cocos (sea water);*
- Coli form fecals: 200 mg/l; o*
  - 1. E. coli: 126 organisms / 100ml*
  - 2. Entero cocos: 35 organisms / 100ml;*
- Floating substances not visible. Does not include the algae of the treatment tank.*

The resolution emitted by the Environment Ministry when resolving the appeals, classify the waters that will receive the emissions of the underwater outfall as class II and not as class I alleged by the appellants.

The treaty defines class II waters as:

*“Waters in the area of the treaty, different from class I waters that due to oceanographic, hydrological, climatic or other factors, are less vulnerable to the adverse effects of the domestic sewage waters, and such discharges do not expose humans or other living organisms that could be adversely affected by the discharges.”*

The parameters and standards for class II waters are:

## Colombia

- Suspended solids 150 mg/l;
- *Biochemical oxygen demand (BOD5) 150 mg/l*
- *pH 5 – 10 Units de pH;*
- *Greases and oils: 50 mg/l;*
- *Non-visible floating substances. Does not include algae from treatment pools.*

This would be the standards to be met once the treaty and the protocol enter in to force.

## Conclusion

According with the preceding information it is possible to conclude the following:

- 1) The *international protocol related to the contamination coming from terrestrial sources and activities of the Convention for the protection and development of the marine environment in the Caribbean region* is not yet in force in Colombia and therefore compliance can not be required yet.
- 2) This argument was recognized by the Environment Ministry when resolving the appeals over the environmental license granted by CARDIQUE.
- 3) The waters assigned for the underwater outfall discharge have been identified as class II waters.
- 4) The parameters and standards establish by the treaty are not for immediate compliance, instead there is a period of 10 years to comply.
- 5) There is no incomppliance with a treaty that is not yet in to force.

## 4. Claims/Issue 12: Consultation and indigenous peoples

The appellants argue that consultations with ethnic minorities (indigenous and afro-Colombians communities) were ignored. Of all the arguments we believe this is the weakest since the project of the underwater outfall have had a widely participation and consultation with the community.

Thus, articles 69 and followings of Law 99 of 1993 establish different forms of public participation, including the following:

- Public audience
- Consultation with indigenous and Afro-Colombian communities
- Third party interventions
- Publicity of the decisions
- Petition of information right.

In the environmental license granted to the underwater outfall project it is clear that all applicable mechanisms for public participation were implemented.

It is important to explain each of the participation mechanisms in order to clarify their scope within the Colombian legislation.

### **Public Audience**

This mechanism is contemplated in article 72 of Law 99/93. The main purpose of this instrument is to inform the different stakeholders in the project (i.e. project proponent, authorities and local communities) about the various aspects of it, from the technical to the social and environmental.

### **Consultation with Afro-Colombian communities**

This consultation is a special form of public participation established in article 76 of Law 99 of 1993 and is targeted to ethnic minorities (i.e. indigenous and Afro-Colombian communities). The main purpose of this instrument is also to inform communities about the different aspects of the project, in order to facilitate an informed decision.

### **Third Party Interventions**

This innovative mechanism allows any interested person to intervene as a third party in the procedure of an environmental permit or license. This instrument intends to protect the citizen's right of intervention and information according to article 74 of Law 99 of 1993.

## **II. GENERAL CONCLUSIONS**

After reviewing applicable legislation and studying the documents related to the environmental license granted it is possible to conclude the following:

- 1) The appeals and arguments against Resolution 345/01 were timely resolved by CARDIQUE; subsequently the Environment Ministry confirmed CARDIQUE decision.
- 2) The administrative act of CARDIQUE that grants the environmental license No.345 of 2001 is in force, therefore its legality is presumed and compliance with it is mandatory for all parties subject to it.
- 3) CARDIQUE acknowledge Decree 1594/84 in the sense that recognizes its faculty to establish the obligations needed to meet water emission standards.
- 4) Decree 3100 of 2003, article 30 strengthens the legal certainty of the obligation because it clearly indicates that the parameters and standards for water emissions will be fixed in the sanitation and water emissions management plan, which will replace the compliance plan.
- 5) Aguas de Cartagena deliver all the required information by CARDIQUE, who acknowledge it through the memo dated on April 25<sup>th</sup> 2001.
- 6) The *international protocol related to the contamination coming from terrestrial sources and activities of the Convention for the protection and development of the marine environment in the Caribbean region* has not been ignored. On the one hand, it has not been ratified by Colombia and therefore does not have legal effect yet; on the other hand the Environment Ministry has classified the receiving area of the water emissions as class II waters; and finally the parameters and standards for water emissions coming from the underwater outfall should be applied within 10 years of the entry into force of this treaty in Colombia.
- 7) Public participation was plentiful during the procedure of the environmental license. A public audience was carried out according to article 72 of Law 99/93. Additionally, a consultation with Afro-Colombian communities was done

*Colombia*

following Decree 1320 of 1998. Finally, there were third party interventions, complying with article 69 of Law 99 of 1993.

- 8) Finally, once the Resolution 345 of 2001, that granted the environmental license to the underwater outfall, was effective its legality is presumed and only a Colombian judge can decide over the compliance of that administrative act with the national law and constitution.

With these considerations the requested legal concept is fulfilled. If you need any additional information please do not hesitate to contact me.

Yours truly,

Luis Fernando Macias Gomez

cc. Charles E. Di Leva. Lead Counsel, ESSD and International Law. The World Bank Legal Department

**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 10.**  
**Social Assessment Workshops**  
**List of Participants**



## SOCIAL ASSESSMENT WORKSHOPS

### LIST OF PARTICIPANTS

#### LA BOQUILLA WORKSHOP

At the Headquarters of the Organization “Uvita de Playa”.

August 22, 1998

NAME	ORGANIZATION
Bienvenida	“Our efforts”, La Boquilla, Sector Arriba
Delvis Hueto	“United for Health”, La Boquilla, Sector Arriba
Gloria Inés Núñez	“Our efforts”, La Boquilla, Sector Arriba
Wilmer Valiente Alcázar	“The Manglar”, La Boquilla Sector Arriba
Myriam Gómez	“Our efforts”, La Boquilla, Sector Arriba
Lewis Caicedo B.	JAC La Boquilla
Vidal Gómez	JAC La Boquilla, Sector Centro
Luis Fernando Pérez	President JAC, vereda Zapatero
Emilce Azán N.	Organization Uvita de Playa, Sector Bogotá
Gustavo Jiménez	JAC Arroyo de Piedra
Eliceth Perriñán	Organization Uvita de Playa, Sector Cra9
Janeth Jiménez	Organization Uvita de Playa, Sector Cra4
María Carranza	Women Union, Bolivar South East Zone
Leonardo Ortiz	JAC Puerto Rey
Germán Mendoza	JAC Puerto Rey
Juan (illegible last name)	“United for Health”, Playón Boquilla
Javier E. Jiménez	JAC La Boquilla
Dixon Cabarcas	JAC Puerto Rey
Agustina Carmona	JAC Puerto Rey
Luis R. Alvarado Flórez	JAC La Boquilla
Remberto Herrera	JAC
Senen Iglesias	JAC Punta Canoa
Tomás Núñez	JAC Arroyo de Piedra
Manuel Gutiérrez	Organization Uvita de Playa, La Boquilla
Gloria Sánchez	JAL La Boquilla, sector Villa Gloria
Luis Vitola	Las Aliadas, La Boquilla
Alvaro Lara	Secretary JAC La Boquilla
Alvaro Guzman Cantillo	La Boquilla
Lucía Puello de V.	Legión de María, La Boquilla
Osiris García Pinedo	Welfare Homes, Inspectors

Moderator: Pilar Vásquez

Speakers: Gisela Monroy, Leonor de Aceros

**OLAYA HERRERA AND SAN FRANCISCO DISTRICTS WORKSHOP**

At La Puntilla School, Olaya Herrera District

August 2, 1998

<b>NAME</b>	<b>ORGANIZATION</b>
Stevenson Carranza	President, Community Organization
Elio Berrio de la Cruz	Secretary JAC Fredonia
Armando S. Altamiranda	JAL Palo Blanco
Bety Ospino	JAC El Progreso
Ramón Orozco	JAC 11 de Noviembre, Public Services Committee
Silvia Quintero	Edil Comuna 7, Las Palmeras
Marco Monterosa	JAC 11 de noviembre, Public Services Committee
Evangelina B.	Municipal Official 3, San Francisco
Alfredo Carcho Lara	Municipal Official 6 Playas Blancas
Manuel Teus Ch.	La Magdalena Committee
Eduardo (illegible last name)	JAC Sector Central
Héctor Henríquez	JAC Sector Central
Ramón Beltrán	JAC Las Américas
Mario Morales B.	Civic Leader, Foco Rojo
Carlos García S.	JAL Stella
Ismael Salinas	Cultural Committee, La Puntilla
Teobaldo Cavadis M	Civic Leaders Association, South Eastern Zone Boston
Eligio Sanjuan	Civic Leaders Association, South Eastern Zone El Progreso
Guillermo Gonzalez	JAC Playa Blanca
Julio de Avila T.	Community Action Chiquinquirá
Saúl Pacheco	ASE Codafe, Central Sector
José Polo Rodríguez	Community 5. 11 de Noviembre
Jorge Chavarriaga M	JAL Community 5, 11 de Noviembre
José Cuero Castillo	JAL Community 5, Líbano
Eduardo E. Gonzalez	JAL Community 5, Central Sector
Marquesa Machado	JAL Community 5, Líbano
Mery Carranza	Community Olaya
Bety (illegible last name)	JAL Community 6, Olaya
José Castro Gómez	Civic Committee, 11 de Noviembre

Moderator: Pilar Vásquez

**SAN JOSE DE LOS CAMPANOS DISTRICT WORKSHOP**

At Pedro De Heredia School

Julio 20, 1998

<b>NAME</b>	<b>ORGANIZATION</b>
Cecilio Barajas	Civic Association
Gustavo de la Espriella	Edil
Oscar Bolívar	Community Development Association
Benjamín Cordero	Community Development Association
Nelly Reytmar	Environmental Promoter
José Mendoza	Kinder garden
Atilano Banquez	
Francisco Olivo	
Eddie Gutiérrez	Sayco
Pablo Avila	Community Action Association
Raomir Barrios	
Lina Meza	
Bienvenida Molano	Association
Illegible Signature	

Moderator: Pilar Vásquez

Speakers: Gisela Monroy, Leonor de Aceros

Aguas de Cartagena: Gustavo Valverde

Mr. Alvaro Baquero also participated in the workshop

**WORKSHOP INTRODUCTION AND PRESENTATION OF OBJECTIVES**

The workshop started with the introduction of the speakers and the presentation of the objectives by the moderator.

The community expresses that at this moment they are having conflicts with ACUACAR due to the failure to conclude works in the district, in roads, sidewalks, and the only access road.

**EL POZON SECTOR WORKSHOP**

At “Nuestros Esfuerzos” School

Julio 19, 1998

**PARTICIPANTS**

<b>NAME</b>	<b>ORGANIZATION</b>
Sabino M. Rios	Community Action Association
Liliana Tamayo	Community Action Association
Antonio J. Vasquez	Business Committee
Jhon Alexis Mosquera	Public Library
Heidel Tuirán Bolaño	Public Library
Elvira Zamir	Community 6
Juan de Dios Ruiz	Community 6
Manuel del Toro	
Elena Figueroa C	Community (Mother)
José Arrieta	Municipality 6 Official
Herlinda García	Municipality 6 Official
Belisario Mercado	CDV
Leyda Monterrosa	Community Action Association
Francisco Padilla	Community Action Association
Rigoberto Castro	Community Action Association
Glenia Romero Durango	Community Action Association
María Victoria Velásquez	Community Action Association
María Isabel Porras	Community Action Association
Antonio Gonzalez	Community Action Association – Attorney
María Montero	

Moderator: Pilar Vásquez

Speakers: Gisela Monroy, Leonor de Aceros

Aguas de Cartagena: Andrés Javier Fernández

Mr. Alvaro Baquero also participated in the Workshop

**WORKSHOP INTRODUCTION AND PRESENTATION OF OBJECTIVES**

The workshop started with the introduction of the speakers and the presentation of the objectives by the moderator.

The participants introduced themselves (attached is a list of participants), emphasizing the organization to which they belong.

**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 11.**  
**Summary of Dissemination of the**  
**Water and Sanitation Master Plan**



## DISSEMINATION OF THE WATER SUPPLY – SEWERAGE MASTER PLAN, SUBMARINE OUTFALL PROJECT

During the period of the month of October 2000 to the month of April 2004, Aguas de Cartagena, S.A. E.S.P., under the Dissemination Program of the Submarine Outfall Project, employees assigned to the Quality and Environmental Operational Area organized [*the dissemination program*], resulting in an ample participation of community members of the City of Cartagena and other places of Colombia, interested in knowing the characteristics of the project.

A relevant number of 3,094 people attended this program. Physical files are kept in the Quality and Environmental Management Unit and the records are available to demonstrate and support these activities.

<b>DATE</b>	<b>PLACE</b>	<b>NUMBER OF PARTICIPANTS</b>	<b>PARTICIPATING POPULATION</b>	<b><u>FACILITATORS</u></b>
October 27, 2000	Jorge Tadeo Lozano University	58	<ul style="list-style-type: none"> <li>• University students (Jorge Tadeo Lozana University – Cartagena University)</li> <li>• Independent Consultant of the Mangle Project</li> </ul>	Joan Borell Benjamin Alvarez
November 17, 2000	University Corporation Rafael Nuñez	22	<ul style="list-style-type: none"> <li>• University students</li> </ul>	Jose Zapata
May 4, 2001	South Eastern area	17	<ul style="list-style-type: none"> <li>• South Eastern Teachers</li> </ul>	Benjamin Alvarez
May 4, 2001	ETAP “Forest” Training Room – Aguas Cartagena, S.A. E.S.P.	28	<ul style="list-style-type: none"> <li>• Sucre University</li> </ul>	Benjamin Alvarez
May 11, 2001	“El Universal” Training Room	10	<ul style="list-style-type: none"> <li>• Journalists</li> <li>• Social communicators</li> </ul>	Joan Borell Benjamin Alvarez
February 28, 2002	Saint Rita Social Center	28	<ul style="list-style-type: none"> <li>• Members of the Community Action Board</li> <li>• District Planning Office personnel</li> <li>• Administrative Tribunal personnel</li> </ul>	Luis Alfonso Pinzon Benjamin Alvarez
March 27, 2002	“Sena” Training Room	138	<ul style="list-style-type: none"> <li>• Administrative and Educational Personnel of the National Learning Service (SENA)</li> </ul>	Benjamin Alvarez Jose Zapata
May 8, 2002	ETAP Forest Training Room – Aguas de Cartagena, S.A. E.S.P.	22	<ul style="list-style-type: none"> <li>• University students, National University</li> </ul>	Benjamin Alvarez
May 22, 2002	ETAP Forest Training Room – Aguas Cartagena, S.A. E.S.P.	74	<ul style="list-style-type: none"> <li>• University students, Cartagena University</li> </ul>	Benjamin Alvarez
July 4, 2002	Bogota Public Service Superintendence Office	50	<ul style="list-style-type: none"> <li>• Public Service Superintendence Personnel</li> </ul>	Benjamin Alvarez
October 12, 13 and 14, 2002	3 <sup>rd</sup> Virtual Environmental Technology Congress on “Clean Technologies, a challenge for the Human Development	1,500 at national level and 200 participants in the Cartagena regional area	<ul style="list-style-type: none"> <li>• University students</li> <li>• Administrative and educational personnel</li> </ul>	Benjamin Alvarez

<b>DATE</b>	<b>PLACE</b>	<b>NUMBER OF PARTICIPANTS</b>	<b>PARTICIPATING POPULATION</b>	<b>FACILITATORS</b>
	Sustainability”			
October 29, 2002	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	20	<ul style="list-style-type: none"> <li>University students, Cartagena University.</li> </ul>	Benjamin Alvarez
November 29, 2002	Napoleon Franco Pareja Clinic Conference Room	30	<ul style="list-style-type: none"> <li>Doctors of the “Napoleon Franco Pareja de Cartagena de Indias Clinic”</li> </ul>	Benjamin Alvarez
December 4, 2002	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	20	<ul style="list-style-type: none"> <li>University students, Cartagena University – “ Engineering Faculty”</li> </ul>	Benjamin Alvarez
December 11, 2002	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	8	<ul style="list-style-type: none"> <li>Water of Cartagena, S.A. E.S.P. staff – CARDIQUE: (Channel of the Dock Regional Autonomous Corporation)</li> </ul>	JanWillen Jongbloed
January 31, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	36	<ul style="list-style-type: none"> <li>“Club Guardianes de la Gotica” (Waters of Cartagena’s children of laborers)</li> </ul>	Patricia Alvarino Jose Zapata
March 3, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	21	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Institute</li> </ul>	Benjamin Alvarez
March 21, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	25	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Institute</li> </ul>	Patricia Alvarino
March 22, 2003	II Forum - “Life and Conservation of the Virgin Swamp” – Administrative Center of Educational Services “CASD”	26	<ul style="list-style-type: none"> <li>Teachers at basic and elementary level of the “CASD”</li> <li>Members of the Local Administrative Board</li> </ul>	Luis Alfonso Pinzon Jose Zapata
March 25, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	107	<ul style="list-style-type: none"> <li>Personnel of the following companies: <ul style="list-style-type: none"> <li>Davienda</li> <li>Nautriport</li> <li>COMPENALCO</li> <li>La Esperanza</li> <li>Salucoop</li> <li>Bancolumbia</li> <li>IDER</li> <li>COPSERVIR</li> </ul> </li> </ul>	Jose Zapata Patricia Alvarino
March 26, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	100	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Students</li> </ul>	Jose Zapata Patricia Alvarino

<b>DATE</b>	<b>PLACE</b>	<b>NUMBER OF PARTICIPANTS</b>	<b>PARTICIPATING POPULATION</b>	<b>FACILITATORS</b>
March 27, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	18	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Students</li> </ul>	Patricia Alvarino
April 2, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	18	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Students</li> </ul>	Patricia Alvarino
April 11, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	39	<ul style="list-style-type: none"> <li>San Juan de Damasco High School students</li> </ul>	Patricia Alvarino
April 15, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	49	<ul style="list-style-type: none"> <li>BIFFI High School students</li> </ul>	Patricia Alvarino
April 29, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	30	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Students</li> </ul>	Patricia Alvarino
May 30, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	41	<ul style="list-style-type: none"> <li>“Universidad de la Paz de Barrancabermeja” university students</li> </ul>	Benjamín Alvarez
September 10, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	16	<ul style="list-style-type: none"> <li>San Buenaventura University, university students</li> </ul>	Benjamin Alvarez
September 19, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	100	<ul style="list-style-type: none"> <li>Participants of the First Meeting of Environmental Projects organized by “EPA”</li> </ul>	Patricia Alvarino
October 31, 2003	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	14	<ul style="list-style-type: none"> <li>University students – COMPENALCO Technological Students</li> </ul>	Gustavo Valverde
December 15, 2003	COTECMAR – ARC “Bolívar” Naval Base Conference Room	25	<ul style="list-style-type: none"> <li>Administrative personnel participating in the First Environmental Journey organized by COTECMAR</li> </ul>	Luis Alfonso Pinzon
February 18, 2004	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	26	<ul style="list-style-type: none"> <li>“SENA” students.</li> </ul>	Patricia Alvarino
March 23, 2004	ETAP “Forest” Training Room – Aguas de Cartagena, S.A., E.S.P.	43	<ul style="list-style-type: none"> <li>ABOLSURE Military High School students</li> </ul>	Patricia Alvarino
March 24, 2004	ETAP “Forest” Training Room – Aguas de	51	<ul style="list-style-type: none"> <li>San Buenaventura University students</li> </ul>	Patricia Alvarino

<b>DATE</b>	<b>PLACE</b>	<b>NUMBER OF PARTICIPANTS</b>	<b>PARTICIPATING POPULATION</b>	<b><u>FACILITATORS</u></b>
March 24, 2004	Cartagena, S.A., E.S.P. ETAP "Forest" Training Room – Aguas de Cartagena, S.A., E.S.P.	46	<ul style="list-style-type: none"> <li>• Olga Gonzalez Bustamante Educational Institute</li> </ul>	Patricia Alvarino
April 27, 2004	ETAP "Forest" Training Room – Aguas de Cartagena, S.A., E.S.P.	40	<ul style="list-style-type: none"> <li>• Alberto Fernandez Bustamante Educational Institute</li> </ul>	Patricia Alvarino
<b><u>Total Participants</u></b>		3094		

**COLOMBIA**  
**CARTAGENA WATER SUPPLY, SEWERAGE AND**  
**ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 12.**  
**Letter from Ministry of the Interior regarding**  
**Finding of Non-Indigenous Peoples in the**  
**Impact Area of the Project**



**REPUBLICA DE COLOMBIA**

MINISTERIO DEL INTERIOR

To answer cite note No. 4080

Santa Fe, Bogota, D.C.

Doctor  
Guillermo Zambrano Tores  
Director, Judicial Department  
Water of Cartagena  
Avenida del Arsenal  
Carrera 10, No. 24-02 Getsemani  
Cartagena

Reference: Feasibility study project for the residual water and sewerage treatment in Cartagena de Indias and for the final disposal of the affluent to the adjacent sea through the Submarine Emissary.

Dear Doctor:

In response to your request of a certification stating that there are or not Indigenous Communities in the impact area of the referenced project, based in our records, maps and database, we hereby certify that in the area where it is pretended to develop this project, neither indigenous communities nor partial communities are present, that could be themselves affected.

However, in the event the respective Environmental Impact Study is being made, ordered by the Ministry to grant the respective Environmental License and specifically in the socio-cultural component, the presence of any Indigenous Community in the project is found, in such a case, compliance should be made to the Consultancy Process to give fulfillment to Articles 330, paragraph of the Political Constitution 71, Law 21 of 1991 and 78 of Law 99 of 1993.

In such a case, the Directorate of Indigenous Issues should be informed in accordance to Law 199 of 1996 and Decree 0372 of 1998, since this the Directorate in charge to coordinate the development of the processes of previous consultations that are made.

Sincerely,

General Director of Indigenous Issues



**COLOMBIA  
CARTAGENA WATER SUPPLY, SEWERAGE AND  
ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 13.  
Letter from Ministry of the Interior regarding  
Finding of Black Communities in the  
Impact Area of the Project**



**REPUBLICA DE COLOMBIA**

**MINISTERIO DEL INTERIOR**

To answer cite note No. 132

The General Directorate of Black Communities  
and other ethnic collectivities  
of the Ministry of the Interior

**CERTIFIES:**

Under an official note dated July 30, 1999, the Doctor Luis Albacete Perea, General Manager of the Water and Sewerage company of Cartagena, requested information about the presence of Black Communities in the impact area of the Wastewater Treatment Project for Cartagena de Indias via a submarine outfall, within the process in getting an Environmental License of the mentioned project.

That according to the current information of this Directorate, THERE IS a presence of Black Communities, in the impact area of the project, especially in the Eastern South area of Cartagena and in “Arroyo de Piedra, Manzanillo del Mar, La Boquilla y Punta Canoa” establishments.

In conformance with meeting carried out by the Consulting Commission of Black Communities of the Atlantic Coast by Cartagena, the consultants Dionisio Miranda, Uriel Salgado and Francisco Hernandez were appointed as official representatives of this consulting.

This note has been issued as per interested party request and in compliance with Article 3o. of the Decree 1320 of 1998.

Santafe, Bogota, D.C., September 15, 1999

**GABINO HERNANDEZ PALOMINO**

General Director of Black Communities  
And Other Ethnic collectivities

/molina



**COLOMBIA  
CARTAGENA WATER SUPPLY, SEWERAGE AND  
ENVIRONMENTAL MANAGEMENT PROJECT**

**Annex 14.  
Letter from CCH Executive to the World Bank  
and  
Bank Response**



**CORPORACION CARTAGENA HONESTA  
CITIZEN WATCHDOG AGAINST CORRUPTION**

Cartagena, June 25, 1999

CH-033-99

Messrs.  
The World Bank  
P.O. Box No. 10229  
Santafe, Bogota

Ref.: PROJECT DOCUMENTS' REQUEST

We respectfully approach the World Bank office in Colombia to request, in accordance with the information policy that this organization possess, copy of all documents related to the aqueduct and sewerage project (including the construction of a submarine outfall) that the City of Cartagena is presently carrying out, which is partially financed by The Bank for more than US\$85 million.

The documents urgently needed at this moment in relation to the referenced project are:

- a) Staff Appraisal Reports
- b) Environmental Data Sheets
- c) Environmental Assessments
- d) Environmental Analysis
- e) Summaries of Project Evaluation Reports
- f) Loan and Credit Agreements

With regard to our request submitted to the Bank on May 31, 1999 through the Director of the Fight Against Corruption Presidential Program (attached copy), we would appreciate your informing us the date we would be receiving said reply. If further information is required or supporting information is needed to approve our request, please let us know.

Cordially,

William J. Dau  
Executive Director

Cc: World Bank Public Information Center

**CORPORACION CARTAGENA HONESTA  
CITIZEN WATCHDOG AGAINST CORRUPTION**

Cartagena, May 31, 1999

CH-017-99

Doctor  
Bernard Gilchrist  
Director – President’s Anti-Corruption Program  
Carrera 8 No. 7-26  
Santafe, Bogota

Ref.: Assistance Request

As a citizen watchdog organization, affiliated to the Network of Citizen Watchdog Organizations of Cartagena, we respectfully approach your Office to request your mediation on our behalf before The World Bank’s representative in Colombia, with the following purposes:

**1. TO LISTEN THE COMMUNITY SPOKESMEN WITH REGARD TO THE OBJECTIONS PRESENTED ABOUT THE LOAN TO BE REQUESTED TO SAID ORGANIZATION ON THE PART OF THE MAYOR OF CARTAGENA.**

By means of a public call to the citizens, in Public Hearing of May 26 of this year, the District Council of Cartagena invited the population to know and to express their opinion about the viability of the loan that the current local administration is requesting from the World Bank in the amount of one hundred million dollars (\$100,000,000) with the objective of carrying out the Water Supply and Sewerage Master Plan of the city.

Without including the unions, twenty five (25) citizens were registered to publically express their opinions, of which finally nineteen (19) attended.

The unions that sent their spokesmen to the hearing were the Chamber of Commerce of Cartagena, represented by one of the members of the Board of Directors, Dr Alfredo Raad Hernandez and the ANDI (National Association of Industrialists), who was represented by Dr. Felipe Merlano. Both representatives of the unions asked the District Council to postpone the loan request to the World Bank, in view of the limited existing clarity in hiring, method of payment and capacity of indebtedness of the District.

Of the nineteen (19) members of the community that participated in the Public Hearing, eighteen (18) agreed with the petitions submitted by the unions, for the same reasons cited, and for the several reasons which are below-indicated:

- At the present time, there are no necessary guarantees in the city of Cartagena to grant the District Administration a way out, so they do not jeopardize the public treasury of the city, since the District Controller was removed from his position by direct order of the Controller

General of the Republic due to multiple and flagrant irregularities found in the carrying out of his functions. For this reason, through an exceptional and temporary measure (until June 30/99), the Controller General of the Republic assumed control and the auditing of the public expenditures of our city, but limited to only those concrete cases that were reported by the citizen watchdogs.

- 100% of the reports submitted to the Controller General of the Republic, by the community that attended the Public Hearing at the District Council, have a solid base and the corresponding fiscal investigations have been opened, whose results will be presented to public scrutiny at the end of the month of June of this year, results that can possibly bring the suspension and termination of the jobs of several current members of the local administration.
- Since the administration of the current Mayor is a questioned administration that does not offer the community of Cartagena the necessary guarantees to issue a blank check whose aims can be diverse and which indeed will be outside of all legal, honest, clean and correct context, for the time being, it is impossible to provide unlimited power to said administration to indebt the city of Cartagena with the largest loan that has been requested, and that will have the district tied up for more than twenty (20) years.
- With regard to the participation of Acuacar (Aguas de Cartagena, S.A.), in the financing of the Water Supply and Sewerage Master Plan and according to the shareholder participation of the foreign company Aguas de Barcelona, it was questioned and it was clear the gap in the contract between the District and said company, in which Acuacar benefits directly, without making greater investment in the project, without future financial risk, and specially, for being “Judge in their own case” in the development and implementation on the part of the district in the Water Supply and Sewerage Master Plan. In fact, the following roles come together in the same legal person (ACUACAR, S.A.) in relation to the Master Plan, including the specifications and budget control, with which several required works are then bid:
  - Advisor of the District of Cartagena on all related water supply and sewerage subjects.
  - Supervisor of the contracted works
  - Operator of the water supply and sewerage of Cartagena.

Although the Water Supply and Sewerage Master Plan was elaborated various years ago, it was only on the day of the Public Hearing arranged by the District Council (May 26, 1999) that ACUACAR first provided us with the financial information on the project. The representatives of ANDI and the Commerce Chamber in the Public Hearing can also verify this.

- The community in general, and the citizen watchdogs are not against the execution of the Water and Sewerage Master Plan, which they think is necessary for the development of the city, but the project does not seem to be clear in many environmental aspects (the environmental license has not yet been granted) and regarding sewerage in the tourist zone of Bocagrande, Castillogrande and El Laguito, though there have been objections to the

financing exclusively by the community and including the respective construction license. This is in addition to other general questions about the local administration.

- Despite the objection of the community in general to the District Council granting authorization to the Mayor of Cartagena to carry out the US\$ 100m loan under the current conditions; on May 27, 1999 in special session, the Council authorized the administration to negotiate the loan.

2. TO INCLUDE CARTAGENA IN THE MUNICIPAL LEVEL ANTI-CORRUPTION PROGRAM THAT THE WORLD BANK HAS ESTABLISHED THROUGH THE "ECONOMIC DEVELOPMENT INSTITUTE". ATTACHED PLEASE FIND A COPY OF INFORMATION ABOUT THIS PROGRAM AND THE CONTACT NAMES IN THIS INSTITUTION.

We would like to take this opportunity to thank you for your kind words of reply to our invitation to Corporación CARTAGENA HONESTA's first meeting on May 18, 1999. In this meeting, sixty (60) citizens showed in writing their willingness to collaborate in our anti-corruption programs. Subsequently, many other people have been offering their collaboration in our programs, including a group of more than 30 engineers.

We thank you in advance for intervening with the World Bank Representative, in order to achieve a clear process that benefits the community of the City of Cartagena.

Regards,

William J. Dau  
C.C. No. 3.079.552 Cartagena  
Executive Director

cc: Dr. Enrique Román – Cámara de Comercio Cartagena  
Dr. Felipe Merlano – ANDI  
Red de Veedurías Ciudadanas Cartagena

**The World Bank**

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT  
INTERNATIONAL DEVELOPMENT ASSOCIATION

1818 H Street N.W.  
Washington, D.C. 20433  
U.S.A.

(202) 473-1000  
Cable Address: INTBAFRAD  
Cable Address: INDEVAS

July 6, 1999

Mr. William J. Dau  
Executive Director  
*Corporacion Cartagena Honesta*  
Cartagena, Colombia

Ref.: Your letter CH-033-99

Dear Mr. Dau:

We have received your letter CH-033-99 in which you requested the BANK to provide you with documentation related to the Cartagena Water Supply, Sewerage and Environmental Management Project. Regarding each of the requested documents I would like to make the following comments:

1. Staff Appraisal Report (SAR). The Project Appraisal Document (PAD), which replaces the SAR, is currently under preparation. Once we have the approved final version, we will be glad to send you a copy.
2. Environmental Data Sheet. This document is attached.
3. Environmental Assessment. The Environmental Impact Study is available in CARDIQUE and in ACUACAR's website. You may find it through any of these sources. This study contains the information requested in the Environmental Assessment and in the Environmental Analysis. Please do not hesitate to contact us if you encounter any problems when accessing this document.
4. Summaries of Project Evaluation Reports. These summaries are in the PAD, which we will be sending to you once it is finished.
5. Loan Agreement. This document is still under preparation. We would only be able to send you this after the effectiveness date, which we expect to be in the upcoming months.

With reference to the letter the Corporation sent to Dr. Bernard Gilchrist, Director of the President's Anti-Corruption Program, I would like to inform you that Dr. Gilchrist is trying to set up a meeting with the Bank's resident mission in Bogota in the next few days.

Regards,

Jairo Arboleda  
Resident Representative

Environmental Data Sheet  
Colombia – Cartagena Water Supply, Sewerage and Environmental Management Project

<b>Environmental Data Sheet</b>	
<b>Colombia – Cartagena Water Supply, Sewerage and Environmental Management Project</b>	
COUNTRY: Colombia	PROJECT ID: CO-PE-44140
PROJECT: CARTAGENA WATER SUPPLY, SEWERAGE AND ENVIRONMENTAL MANAGEMENT PROJECT	
APPRAISAL DATE: May 1999	IBRD AMOUNT (\$m): US\$100 million
BOARD DATE: June 1999	
MANAGING DIVISION: LCSFP	SECTOR: Water and Sewerage
LENDING INSTRUMENTS: Sector Investment Loan	STATUS: Lending
DATE (est.) FOR RECEIPT OF EA BY BANK (Category A Projects):	Was Received on March 1999
EA CATEGORY: A	DATE ASSIGNED: 10/09/95
DATE DATA SHEET PREPARED/UPDATED: 04/12/99	

## MAJOR PROJECT COMPONENTS

The proposed project would include the following components:

Component A – Expansion of the water supply system: This component includes the following subprojects: (i) expansion and improvement of the water production system; (ii) increase of the water coverage in the city; (iii) replacement of primary distribution mains; (iv) mitigation of environmental impact of water treatment sludge; (v) remote control systems; and (vi) Unaccounted For Water (UFW) reduction plan.

Component B - Expansion of sewerage system in the Cienaga Basin: This component includes the following subprojects: (i) enhancement of conveyance capacity of existing sewage collectors in the southwest, southeast, and central parts of the city that currently drain to the Cienaga; (ii) expansion of secondary sewerage network in the southwest, southeast, and central parts of the city, as well as the Boquilla area, that currently drain to the Cienaga; (iii) construction of new pressure lines and pumping stations; and (v) construction of new gravity collectors in residential areas.

Component C - Construction of the main wastewater conveyance system: This component includes the following subprojects: (i) upgrading of the Paraiso pumping station; (ii) construction of the pipeline from Paraiso pumping station to the treatment plant site; and (iii) construction of the effluent pipeline from the treatment plant to the submarine outfall at the Caribbean shoreline. The conveyance system would consist of a 72" reinforced concrete cylindrical pressure pipe (RCCP) with a total length of 20.85 km.

Component D - Construction of the Wastewater Treatment Installations: The Preliminary treatment Installations will remove floatable materials, grease, oil, sand, and grit. Treatment facilities will include six rotary screens (1.5 mm clearance) followed by two vortex-type grit chambers. The rotary screens will remove rags, floatable material, and large solids. The expected volume of screenings generated by the rotary screens is about 8.5 m<sup>3</sup>/d. In addition. The vortex-type grit chambers will remove about 5.1 m<sup>3</sup>/d of sand and grit.

Component E - Construction of Submarine Outfall: This component consists of construction of the submarine outfall for the safe discharge of the pre-treated effluent to the Caribbean sea near Punta Canoa. The main conveyance system will connect the treatment plant with the submarine outfall. The outfall would be constructed using a 72" reinforced concrete pipe. Total outfall length would be 2,850 m and the discharge point (diffuser area) will be submerged at a depth of 20 m. The diffuser will have a length of 540 m, with a riser spacing of 20 m, i.e., a total of 27 risers. Each riser will be made of a 12" diameter pipe, 2 m long. The upper end of each riser pipe will be sealed by a welded plate, and it will have 2 openings close to the plate, each of diameter 8", i.e., the total number of discharge ports will be 54. In the surf zone between the shoreline and the 3 m-depth contour, outfall pipes will probably be laid using a trestle built over the water. At greater depths, a barge-mounted crane would probably be used for construction.

Component F - Industrial Wastewater Discharge Control: This part of the project would address issues related to industrial wastes discharged to the municipal sewerage network. It is not aimed to provide investments for treatment installation but rather to assist in establishing the regulatory framework and provide technical assistance related to pretreatment of industrial wastes. It would support the following activities: (i) carrying out a survey to identify key sources of industrial pollution in the city of Cartagena, i.e., establishing a baseline inventory and data base for industrial pollution within the city areas served by the sewerage networks (based on preliminary assessments, most of these are expected to be small industrial and commercial establishments, such as restaurants and car shops, since larger industry is located in Mamonal, outside the city's sewerage networks limits); (ii) establishing a system for regulating the discharge of industrial wastes, either to the sewerage system or to receiving bodies; (iii) establishing a system for auditing the status of industrial wastes discharge; (iv) defining strategies for control of small and dispersed sources of industrial pollution discharging to the sewerage networks (gasoline stations and mechanical repair shops); and (v) providing technical assistance in selection and design of pretreatment processes.

**MAJOR ENVIRONMENTAL ISSUES:**

The proposed project is expected to have significant beneficial environmental and health impacts as it will extend and improve the sewage collection network and will provide a safe wastewater treatment and disposal method that is protective of the environment. However, water quality and ecological impacts in treated wastewater disposal areas are the main environmental issues. Therefore, an extensive environmental assessment process was carried out, based on a two-phase approach: (i) a feasibility study analyzed collection, treatment, and disposal options of the wastewater of Cartagena and those were compared on their technical, economic and environmental merits; (ii) once a project scheme was selected, a more detailed environmental assessment designed a comprehensive environmental management plan (EMP). A Bank-appointed panel of five international experts, with broad experience in wastewater management, design and construction of ocean outfalls, water quality and oceanographic modeling, environmental impact assessment and private sector participation provided advice, reviewed technical reports, and participated in public consultation meetings in Cartagena and in a two-day workshop at Bank headquarters in Washington. Perhaps the most important methodological characteristic of the EA was the introduction (for the first time in Colombia) of cumulative impact analysis. Impacts on wetland and marine ecosystems, water quality, fisheries, communities and cultural heritage were evaluated and adequate mitigation and compensation measures were identified. The selected outfall site ensures minimum environmental risks. All the above mentioned reports have been made available in the Public Information Center of the World Bank in Washington.

No involuntary resettlement is expected to take place as a result of the construction of any component of the facilities to be financed by the project, as indicated by the feasibility analysis and the environmental analysis of alternatives. The EA has provided additional field evidence that no involuntary resettlement will take place.

Other project components, not related to wastewater treatment and disposal, include the construction of water and sewerage networks, expansion of water storage and treatment systems, pumping stations, and water intakes. All sites were screened for potential sensitive impacts such as affectation of wetlands and other ecosystems, resettlement and nuisances for communities. No sensitive issues were identified. An Environmental Data Sheet for each proposed infrastructure site was prepared and was submitted to the Bank. The water supply component for the northern area will take water from an existing small, private reservoir. Complementary measures for the protection of water quality in this reservoir were identified and included in project costs (reforestation in micro-watershed, land use restrictions to be included in land use plan). Finally, an environmental manual with specifications for the construction of water and sewerage networks and other water and sanitation infrastructure will be prepared and included in bidding documents.

**JUSTIFICATION/RATIONALE FOR ENVIRONMENTAL CATEGORY:**

Although the proposed project is expected to have significant beneficial environmental and health impacts, the construction of sewage collection networks and treatment and other ancillary facilities, as well as disposal of treated wastewater through a marine outfall has the potential to cause, if not properly mitigated, negative environmental impacts. For this reason, the project has been classified as EA Category A. A full EA was commissioned under terms of reference agreed with the Bank. Formal Bank review of the final reports was carried out before appraisal and they were found to conform fully to Bank policy guidelines regarding environmental and social issues.

**PROPOSED ACTIONS:**

The EA report recommends the implementation of an Environmental Management Plan (EMP). The EMP proposes a number of measures to mitigate environmental impacts during the construction and implementation phases and establishes an organizational structure, set of procedures and a budget to implement activities under the EMP. The EMP has also identified a set of priority environmental activities that will enhance environmental conditions in Cartagena and will assure achievement of the project's environmental objectives. The EMP is divided in two parts: (i) management of construction activities; and (ii) environmental enhancement. The goal of these activities is to: (i) improve urban environmental quality; (ii) improve natural resources management, particularly in highly sensitive areas such as the wetlands of the Ciénaga; (iii) develop environmental education and public awareness programs for wastewater management and conservation of urban natural ecosystems. A consulting firm will be hired to implement the activities detailed in the EMP related to the construction phase. This phase will also include the implementation of an environmental baseline program to monitor oceanographic, biological and ecological indicators. After construction, this program will be converted to a long-term monitoring program.

The environmental and social component of the project would also include activities designed to improve the overall environmental quality of the city and the area to the city's North and ensure attainment of overall environmental objectives. The most important activities to be implemented include: (i) restoration, conservation and management of the Ciénaga de la Virgen wetland ecosystems, to ensure its long-term sustainability. The project will finance legal and technical feasibility studies to create a legally protected area, management plans, environmental education programs in surrounding communities, and awareness programs regarding solid waste disposal in water bodies, mangrove deforestation, and over-fishing; (ii) activities aimed at assisting in establishing the regulatory framework and providing technical assistance related to pretreatment of industrial and non-domestic wastes for the purpose of controlling existing and future toxic discharges into the sewage system and thereby in the outfall discharge. The project would finance an industrial pollution survey in the sewerage network, establishment of a database on industrial pollution to be updated by both ACUACAR (the water company of Cartagena) and CARDIQUE (the regional environmental authority), the preparation of regulations for industrial and non-domestic sewerage connections, and the definition and dissemination of pollution control and clean technologies for most significant sectors; and (iii) implementation of an institutional strengthening program, to ensure institutional capacity to implement BMP. The project would finance training workshops, study tours and specialization courses for DAMARENA (the environmental department of the District of Cartagena) and CARDIQUE in topics such as wetland management, pollution control, water quality monitoring and environmental audits.

Final engineering designs would include the preparation of detailed measures to deal with contingency plans (power black outs), additional site-specific environmental guidelines for construction, special construction practices for river and drainage crossing and ocean approach, demarcation of mix zone, undersea construction process and right of way restoration and management. These measures will be included in the bidding documents used in the project.

**REPORTING SCHEDULE:**

Category A environmental assessment: A full Environmental Assessment has been carried out and submitted to the Bank in March 1999.

Environmental Data Sheet  
Colombia - Cartagena Water Supply, Sewerage and Environmental Management Project

**REMARKS:**

The borrower has given permission to release the EA. A social assessment was conducted with broad community participation activities.

**Signature  
and Date:** \_\_\_\_\_  
Danny Leipziger  
Director, LCSFP

**Initials  
and Date:** \_\_\_\_\_  
Menahem Libhaber  
Task Manager

**Signature  
and Date:** \_\_\_\_\_  
John Redwood  
Director, LCSES

**Initials  
and Date:** \_\_\_\_\_  
Walter Vergara  
EA Review Coordinator

Caribbean Sea

COLOMBIA / COLOMBIA  
**CARTAGENA WATER SUPPLY, SEWERAGE,  
 AND ENVIRONMENTAL MANAGEMENT PROJECT**  
**PROYECTO DE ACUEDUCTO, ALCANTARILLADO  
 Y GESTION AMBIENTAL DE CARTAGENA**

MAIN WASTEWATER CONVEYANCE SYSTEM,  
 TREATMENT INSTALLATIONS, AND SUBMARINE OUTFALL  
 SISTEME DE IMPULSIÓN TERRESTRE, INSTALACIONES  
 DE TRATAMIENTO Y EMISARIO SUBMARINO

Wastewater Treatment Plant  
 Planta de Tratamiento de Aguas Servidas

PUNTA CANOA

MANZANILLO DEL MAR

LA BOQUILLA

CARTAGENA

Ciénaga de la Virgen

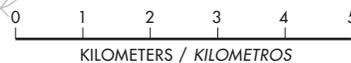
Cartagena Bay

Tierra Bomba Island

Paraiso Pumping Station  
 Estación de Bombeo Paraiso

submarine outfall  
 emisario submarino

-  SUBMARINE OUTFALL (72") CONSTRUCTED UNDER THE PROJECT  
 EMISARIO SUBMARINO (72") CONSTRUIDO COMO PARTE DEL PROYECTO
-  ON SHORE CONVEYANCE SYSTEM (72") CONSTRUCTED UNDER THE PROJECT  
 LINEA DE IMPULSION TERRESTRE (72") CONSTRUIDA COMO PARTE DEL PROYECTO
-  WASTEWATER TREATMENT PLANT CONSTRUCTED UNDER THE PROJECT  
 PLANTA DE TRATAMIENTO DE AGUAS SERVIDAS, CONSTRUIDA COMO PARTE DEL PROYECTO
-  PUMPING STATION UPGRADED UNDER THE PROJECT  
 ESTACION DE BOMBEO REHABILITADO COMO PARTE DEL PROYECTO
-  RIVERS / RIOS



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COLOMBIA  
COLOMBIA

CARTAGENA WATER SUPPLY,  
SEWERAGE, AND ENVIRONMENTAL  
MANAGEMENT PROJECT

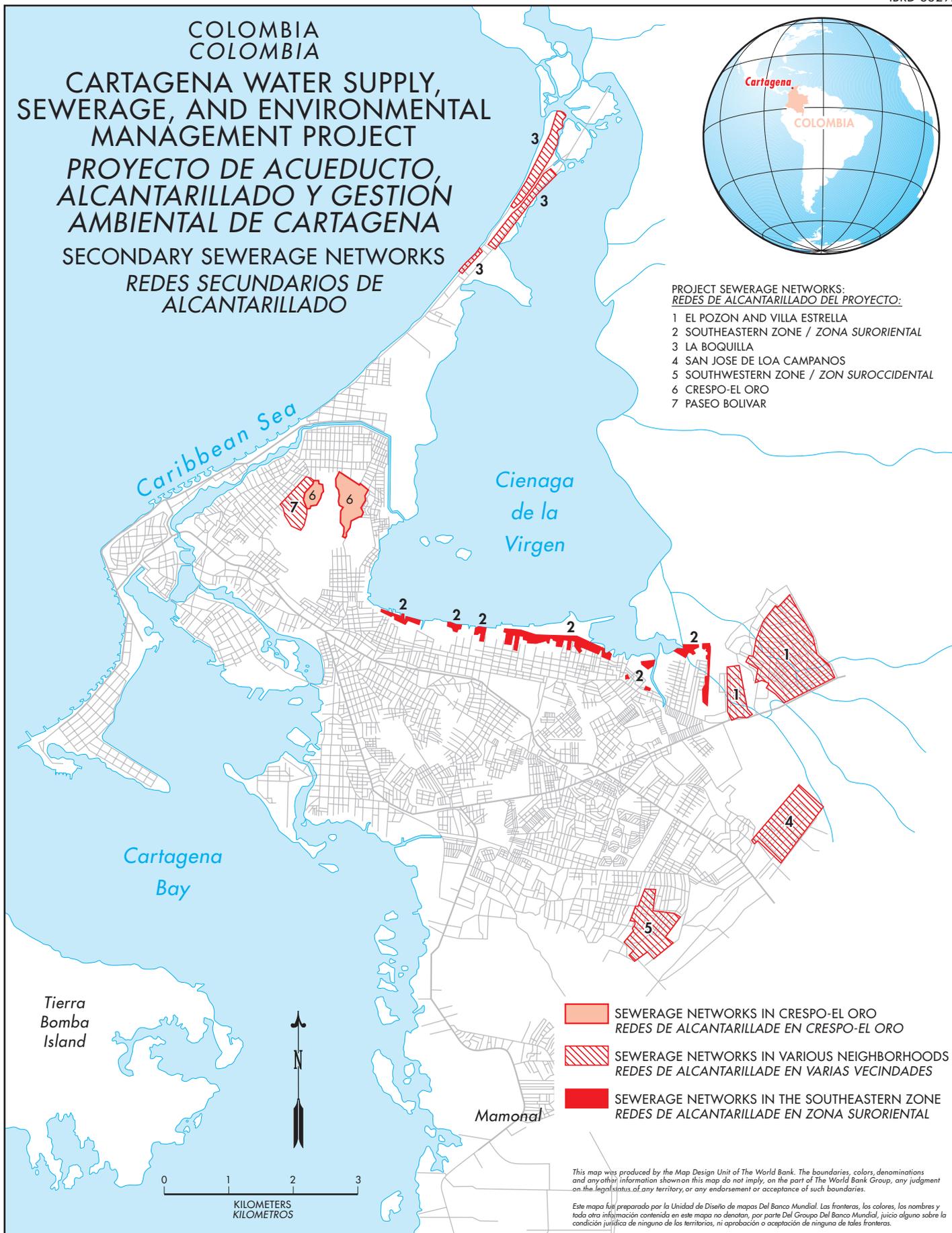
PROYECTO DE ACUEDUCTO,  
ALCANTARILLADO Y GESTION  
AMBIENTAL DE CARTAGENA

SECONDARY SEWERAGE NETWORKS  
REDES SECUNDARIOS DE  
ALCANTARILLADO



PROJECT SEWERAGE NETWORKS:  
REDES DE ALCANTARILLADO DEL PROYECTO:

- 1 EL POZON AND VILLA ESTRELLA
- 2 SOUTHEASTERN ZONE / ZONA SURORIENTAL
- 3 LA BOQUILLA
- 4 SAN JOSE DE LOA CAMPANOS
- 5 SOUTHWESTERN ZONE / ZON SUROCCIDENTAL
- 6 CRESPO-EL ORO
- 7 PASEO BOLIVAR



- SEWERAGE NETWORKS IN CRESPO-EL ORO  
REDES DE ALCANTARILLADO EN CRESPO-EL ORO
- SEWERAGE NETWORKS IN VARIOUS NEIGHBORHOODS  
REDES DE ALCANTARILLADO EN VARIAS VECINDADES
- SEWERAGE NETWORKS IN THE SOUTHEASTERN ZONE  
REDES DE ALCANTARILLADO EN ZONA SURORIENTAL

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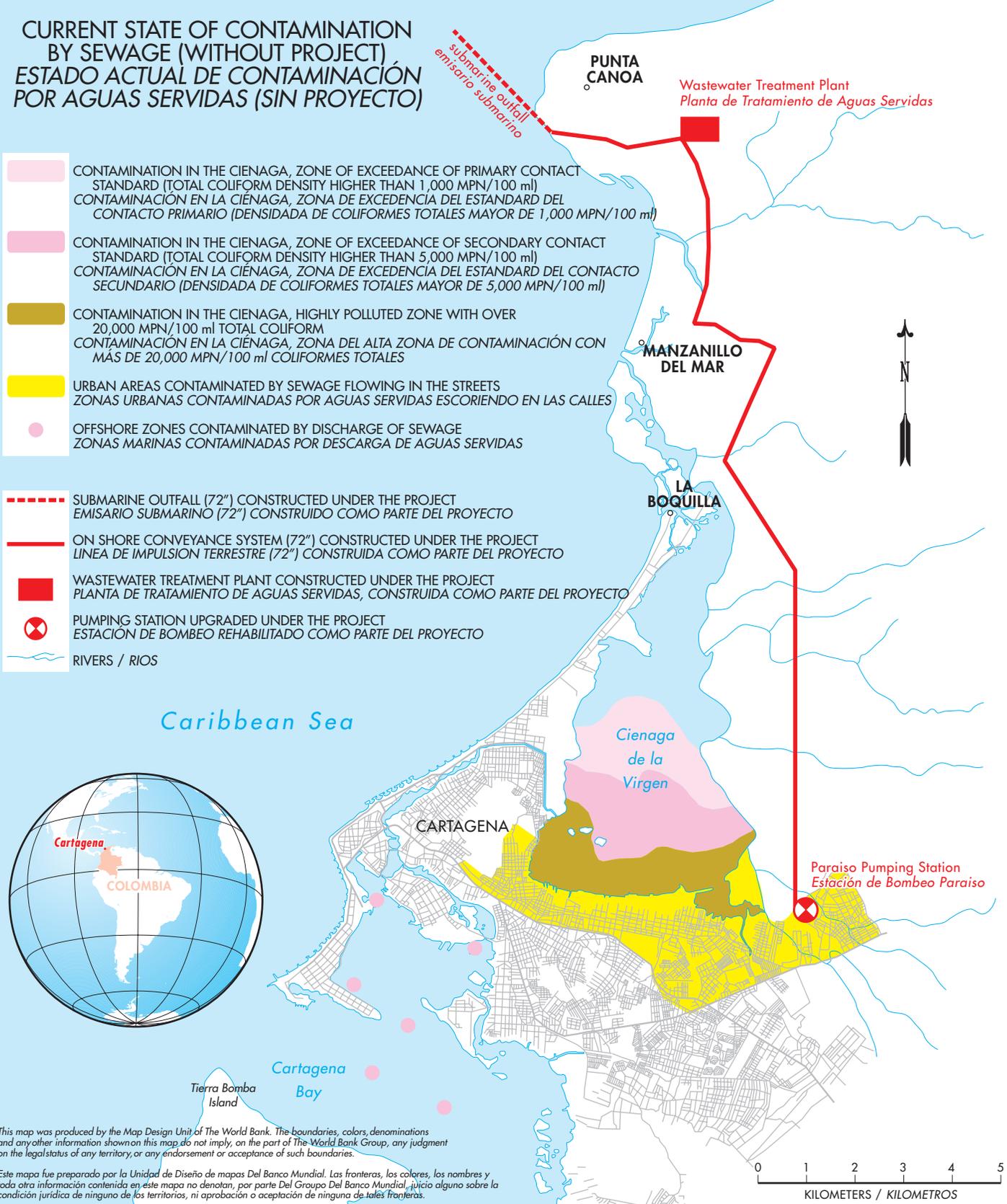
COLOMBIA / COLOMBIA

CARTAGENA WATER SUPPLY, SEWERAGE, AND ENVIRONMENTAL MANAGEMENT PROJECT  
 PROYECTO DE ACUEDUCTO, ALCANTARILLADO Y GESTION AMBIENTAL DE CARTAGENA

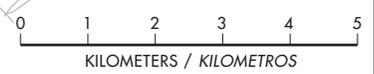
CURRENT STATE OF CONTAMINATION BY SEWAGE (WITHOUT PROJECT)  
 ESTADO ACTUAL DE CONTAMINACIÓN POR AGUAS SERVIDAS (SIN PROYECTO)

-  CONTAMINATION IN THE CIENAGA, ZONE OF EXCEEDANCE OF PRIMARY CONTACT STANDARD (TOTAL COLIFORM DENSITY HIGHER THAN 1,000 MPN/100 ml)  
 CONTAMINACIÓN EN LA CIENAGA, ZONA DE EXCEDENCIA DEL ESTANDAR DEL CONTACTO PRIMARIO (DENSIDAD DE COLIFORMES TOTALES MAYOR DE 1,000 MPN/100 ml)
-  CONTAMINATION IN THE CIENAGA, ZONE OF EXCEEDANCE OF SECONDARY CONTACT STANDARD (TOTAL COLIFORM DENSITY HIGHER THAN 5,000 MPN/100 ml)  
 CONTAMINACIÓN EN LA CIENAGA, ZONA DE EXCEDENCIA DEL ESTANDAR DEL CONTACTO SECUNDARIO (DENSIDAD DE COLIFORMES TOTALES MAYOR DE 5,000 MPN/100 ml)
-  CONTAMINATION IN THE CIENAGA, HIGHLY POLLUTED ZONE WITH OVER 20,000 MPN/100 ml TOTAL COLIFORM  
 CONTAMINACIÓN EN LA CIENAGA, ZONA DEL ALTA ZONA DE CONTAMINACIÓN CON MÁS DE 20,000 MPN/100 ml COLIFORMES TOTALES
-  URBAN AREAS CONTAMINATED BY SEWAGE FLOWING IN THE STREETS  
 ZONAS URBANAS CONTAMINADAS POR AGUAS SERVIDAS ESCORRIENDO EN LAS CALLES
-  OFFSHORE ZONES CONTAMINATED BY DISCHARGE OF SEWAGE  
 ZONAS MARINAS CONTAMINADAS POR DESCARGA DE AGUAS SERVIDAS

-  SUBMARINE OUTFALL (72") CONSTRUCTED UNDER THE PROJECT  
 EMISARIO SUBMARINO (72") CONSTRUIDO COMO PARTE DEL PROYECTO
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COLOMBIA / COLOMBIA

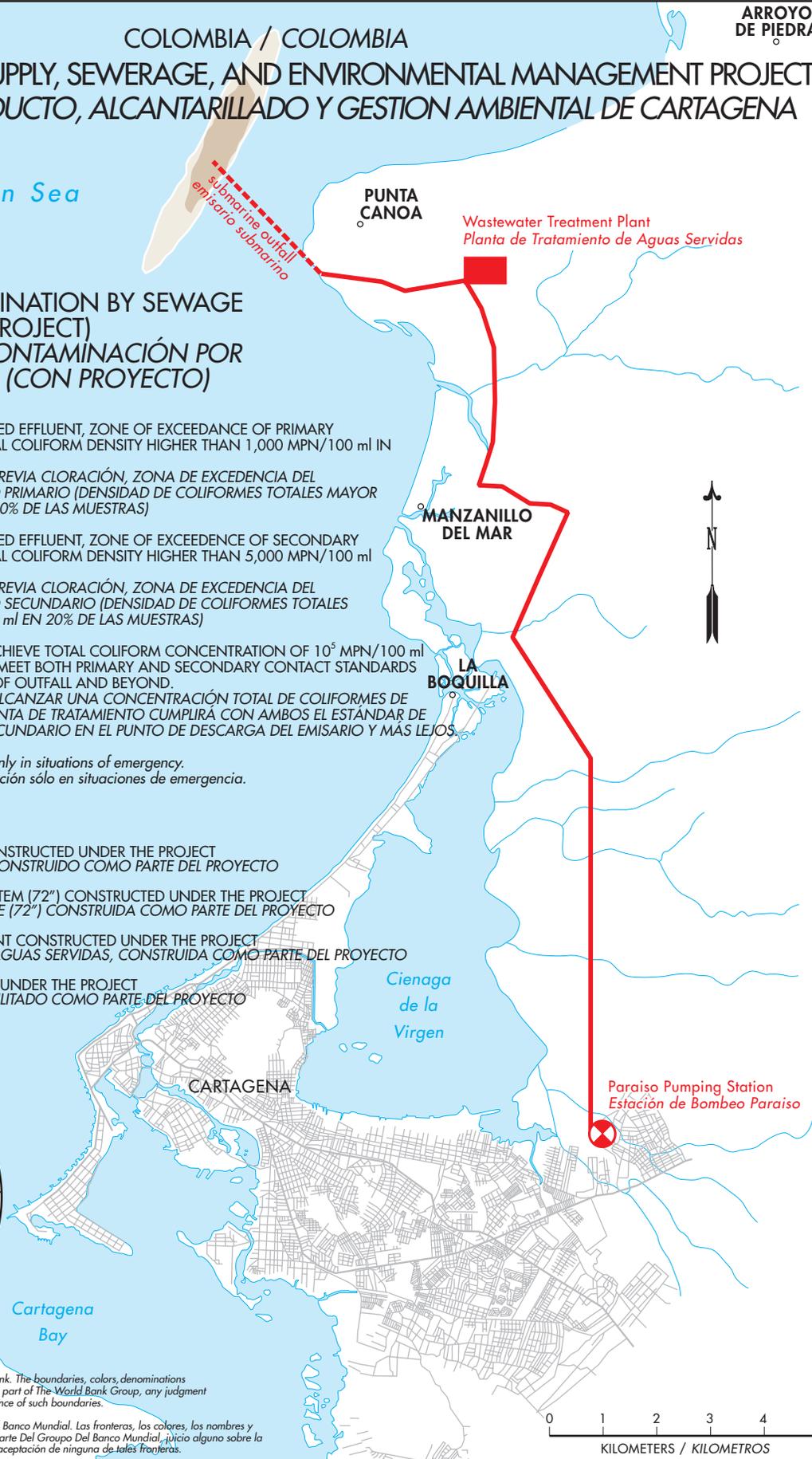
CARTAGENA WATER SUPPLY, SEWERAGE, AND ENVIRONMENTAL MANAGEMENT PROJECT  
 PROYECTO DE ACUEDUCTO, ALCANTARILLADO Y GESTION AMBIENTAL DE CARTAGENA

Caribbean Sea

EFFECT ON CONTAMINATION BY SEWAGE  
 (WITH PROJECT)  
 EFECTO SOBRE LA CONTAMINACIÓN POR  
 AGUAS SERVIDAS (CON PROYECTO)

-  DISCHARGE OF UNCHLORINATED EFFLUENT, ZONE OF EXCEEDANCE OF PRIMARY CONTACT STANDARD (TOTAL COLIFORM DENSITY HIGHER THAN 1,000 MPN/100 ml IN 20% OF THE SAMPLES)  
 DESCARGA DE EFLUENTE SIN PREVIA CLORACIÓN, ZONA DE EXCEDENCIA DEL ESTANDAR DE CONTACTO PRIMARIO (DENSIDAD DE COLIFORMES TOTALES MAYOR DE 1,000 MPN/100 ml EN 20% DE LAS MUESTRAS)
  -  DISCHARGE OF UNCHLORINATED EFFLUENT, ZONE OF EXCEEDANCE OF SECONDARY CONTACT STANDARD (TOTAL COLIFORM DENSITY HIGHER THAN 5,000 MPN/100 ml IN 20% OF THE SAMPLES)  
 DESCARGA DE EFLUENTE SIN PREVIA CLORACIÓN, ZONA DE EXCEDENCIA DEL ESTANDAR DE CONTACTO SECUNDARIO (DENSIDAD DE COLIFORMES TOTALES MAYOR DE 5,000 MPN/100 ml EN 20% DE LAS MUESTRAS)
  - Note\* EFFLUENT CHLORINATED TO ACHIEVE TOTAL COLIFORM CONCENTRATION OF 10<sup>5</sup> MPN/100 ml AT TREATMENT PLANT WILL MEET BOTH PRIMARY AND SECONDARY CONTACT STANDARDS AT THE DISCHARGE POINT OF OUTFALL AND BEYOND.
  - Nota\*\* EFLUENTE CLORINADO PARA ALCANZAR UNA CONCENTRACIÓN TOTAL DE COLIFORMES DE 10<sup>5</sup> MPN/100 ml EN LA PLANTA DE TRATAMIENTO CUMPLIRÁ CON AMBOS EL ESTANDAR DE CONTACTO PRIMARIO Y SECUNDARIO EN EL PUNTO DE DESCARGA DEL EMISARIO Y MÁS LEJOS.
- \* Chlorination will be activated only in situations of emergency.  
 \*\* Se activará el sistema de cloración sólo en situaciones de emergencia.

-  SUBMARINE OUTFALL (72") CONSTRUCTED UNDER THE PROJECT  
 EMISARIO SUBMARINO (72") CONSTRUIDO COMO PARTE DEL PROYECTO
-  ON SHORE CONVEYANCE SYSTEM (72") CONSTRUCTED UNDER THE PROJECT  
 LINEA DE IMPULSION TERRESTRE (72") CONSTRUIDA COMO PARTE DEL PROYECTO
-  WASTEWATER TREATMENT PLANT CONSTRUCTED UNDER THE PROJECT  
 PLANTA DE TRATAMIENTO DE AGUAS SERVIDAS, CONSTRUIDA COMO PARTE DEL PROYECTO
-  PUMPING STATION UPGRADED UNDER THE PROJECT  
 ESTACION DE BOMBEO REHABILITADO COMO PARTE DEL PROYECTO
-  RIVERS / RIOS



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