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STAFF APPRAISAL REPORT

BRAZIL

ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT

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Infracstructure Operations Division
Country Department I
Latin America and the Caribbean Regional Office

CURRENCY EQUIVALENTS

March 31, 1994

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WEIGHTS AND MEASURES

Metric System

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ABBREVIATIONS AND ACRONYMS

BNH	-	Banco Nacional da Habitação (National Housing Bank)
BOD	-	Biochemical Oxygen Demand
CEF	-	Caixa Econômica Federal (Federal Savings Bank)
CESAN	-	Companhia Espírito Santense de Saneamento (State Water Company)
COFIEX	-	Comissão de Financiamentos Externos
CONSEMA	-	State Environmental Council
CST	-	Companhia Siderurgica de Tubarão
CV	-	Contingency Valuation
CVRD	-	Companhia Vale do Rio Doce
CY	-	Calendar Year
DO	-	Dissolved Oxygen
EIB	-	European Investment Bank
FAE	-	Fundo de Água e Esgoto (State Water and Sewerage Fund)
FGTS	-	Federal Government Employees' Pension Fund
FY	-	Fiscal Year
IBAMA	-	Brazilian Institute of the Environment and Renewable Natural Resources
ICB	-	International Competitive Bidding
IDB	-	Inter-American Development Bank
IDC	-	Interest During Construction
IERR	-	Internal Economic Rate of Return
IFRR	-	Internal Financial Rate of Return
IPC	-	Consumer Price Index
LAF	-	Loss Adjustment Factor
LCB	-	Local Competitive Bidding
LRMC	-	Long Run Marginal Cost
MCC	-	Marginal Capacity Costs
MCL	-	Minimum Consumption Level
MMC	-	Minimum Monthly Charge
MOC	-	Marginal Operating Cost
MPN	-	Most Probable Number of Coliforms
MSW	-	Ministry for Social Welfare
NTL	-	National Tariff Law
O&M	-	Operation and Maintenance
OCC	-	Opportunity Cost of Capital
PLANASA	-	National Water Supply and Sanitation Program
PMU	-	Project Management Unit
PNMA	-	National Environmental Program
RIMA	-	Environmental Impact Assessment
SEAIN	-	Secretaria de Assuntos Internacionais (International Affairs Secretariat)
SEAMA	-	State Secretary for the Environment
SENAM	-	Environmental Secretariat
SIVIG	-	Global Feasibility Simulation
SNS	-	National Secretariat for Water Supply and Sanitation
SWC	-	State Water Company
TOR	-	Terms of Reference
UFW	-	Unaccounted-for Water
WTP	-	Willingness to Pay

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
STAFF APPRAISAL REPORT

TABLE OF CONTENTS

Page No.

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TABLE OF CONTENTS (continued) **Page No.**

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

TABLE OF CONTENTS (continued) Page No.

LIST OF MAPS

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
STAFF APPRAISAL REPORT

LOAN AND PROJECT SUMMARY

Borrower: State of Espírito Santo.

Beneficiaries: State Water Company of Espírito Santo (CESAN) and State Secretariat of the Environment (SEAMA).

Guarantor: The Federative Republic of Brazil.

Executing Agencies: CESAN and SEAMA.

Amount: US$154 million equivalent.

Terms: Repayment in 15 years, at the Bank's standard variable interest rate, with a grace period of five years and loan amortization based on level repayments of principal. Proceeds of the Loan will be on-lent by the State of Espírito Santo to CESAN on the same terms and conditions as those of the Loan. CESAN will bear the foreign exchange risk.

Project Objectives: The specific objectives of this project are: (i) to improve the efficiency of CESAN's water supply and sewerage systems by supporting the company's efforts to operate on a commercial basis with financial self-sufficiency; (ii) to increase the coverage level of CESAN's water supply and basic sanitation services (i.e., sewage collection, treatment, and disposal) in the urban areas of Grande Vitória, Guarapari, Castelo, Iúna, São Gabriel da Palha, Nova Venecia, and Conceição da Barra, and other towns located in the Santa Maria and Jucu river basins; and (iii) to provide appropriate water and sanitation infrastructure in low-income urban areas of Grande Vitória and Guarapari. By achieving these specific objectives, the project will allow to expect: (i) an improvement in the quality of life of about 1.2 million urban inhabitants of the State of Espírito Santo; (ii) a reduction in the incidence of oral-fecal diseases; and (iii) an improvement in the quality of water for human consumption and recreational uses through the restoration and protection of the environmentally deteriorated rivers that feed the urban areas of Grande Vitória and Guarapari, and the estuarine and coastal areas within and adjacent to these municipalities.

Project Description: The project comprises an investment component to help finance CESAN's 1994-1999 investment program and an institutional component to strengthen the institutional capabilities of both CESAN and SEAMA. CESAN's proposed investments in water supply will significantly improve systems operation, eliminate existing bottlenecks, incorporate low-income urban areas into CESAN's systems, and increase the service coverage level in the State by about two percent (to 93 percent). The sanitation subcomponent includes the construction of 12 sewerage systems and 10 sewage treatment plants, to increase the service coverage level in the State by about 32 percent (to 43 percent). CESAN's institutional strengthening component seeks to

improve the company's management capacity, operational efficiency, and financial performance through studies, technical assistance, and training in selected areas. SEAMA's institutional strengthening component seeks to reinforce its institutional capacity for water resources management and monitoring of water quality and pollution control; to design and implement environmental information systems and education programs; and to improve its operational and administrative capability.

Poverty Aspects: The water supply component of this project is mostly targeted towards the poor. By the end of project implementation, more than 358,000 beneficiaries (about 56 percent of total water component beneficiaries) will be urban poor earning less than two MS. In addition, about 33 percent of the population targeted to receive sewerage services under the project will consist of families earning less than 3 minimum salaries (MS).

Environmental Aspects: The project will have a significant positive impact on the environmental quality of the rivers, estuarine ecosystems, and tourist beaches of Grande Vitória and Guarapari. All project subcomponents are designed to upgrade the deteriorated environmental conditions and to set up efficient environmental management for the future. Existing and projected environmental quality conditions indicate that without the project, increasing pollution levels will have severe adverse impacts on health and welfare, arising from impaired water use in the project area. On the other hand, improved water quality conditions resulting from the project will have positive impacts on health, natural ecosystems, tourism, and quality of life--particularly of the poor. There are no land use conflicts at the proposed sites and no resettlement is involved.

Project Benefits: At the end of the implementation period (December 1999), the project will have directly benefitted about 640,000 people with potable water (395,000 with in-house connections and 245,000 with fewer hours of rationing) and about 770,000 people with sewerage and sewage treatment services. It is estimated that about 78 percent of the beneficiaries of water investments and 33 percent of the beneficiaries of sanitation investments are in the poverty group--households earning less than 3 Minimum Salaries (MS) per month. The principal project benefits will be: (i) better water quality in Espírito Santo rivers and marine areas, enhancing tourism activities and other water uses, and improving recreational areas for the urban poor; (ii) better quality of life and environmental conditions in the project area; (iii) better hygienic conditions that will in turn help to decrease infant mortality and to reduce the incidence of water-borne diseases; (iv) the preservation of water supply sources for the urban areas of Grande Vitória and Guarapari; (v) the preservation of water quality in coastal ecosystems such as mangroves and coastal lagoons; and (vi) a temporary but significant generation of employment.

Project Risks: The main project risks relate to Brazil's macroeconomic performance and political conditions. Sector and project priorities could change and the amount of State counterpart funds available for the project could be decreased accordingly. Other risks pertain to a lack of effective abatement of water pollution from industrial sources in specific areas, and a deterioration of CESAN's internal financing capacity resulting from operational inefficiency and inadequate tariff adjustments. The political uncertainty is already somewhat diminished by a broad consensus that the long-neglected basic sanitation sector urgently needs support and a fundamental reorientation of policies and practices. It is also minimized by the consistency between project objectives and the commitment of the federal and the State governments to improve the environment, to increase the efficiency of the public sector, and to strengthen public sector finances.

The risk of inadequate counterpart funding is largely reduced by the intention of the European Investment Bank to finance a large part of the State counterpart. In relation to CESAN's internal financing capacity, achieving the targeted tariff level and operational efficiency is crucial to the success of the project. Strong support from the State to help attain the projected tariff level and operational efficiency of CESAN and the institutional strengthening of both SEAMA and CESAN will help achieve expected benefits and avoid potential risks. To further minimize project risks: (i) a continuous dialogue will be maintained with the present and future authorities, both at the federal and local levels, to assure understanding of and support for the project; (ii) project implementation would be closely supervised; (iii) complementary actions in industrial pollution control, municipal solid waste collection and disposal, and management of water resources and protected areas will be developed through SEAMA's institutional strengthening program; and (iv) a mid-term review will assess project implementation performance.

Project Cost: (US$ million)

Component	Local	Foreign	Total
Water Supply	56.3	14.1	70.4
Sewerage	133.2	33.3	166.5
Operational Development	8.1	2.0	10.1
CESAN Institutional Development	6.3	1.6	7.9
SEAMA Institutional Development	6.4	1.6	8.0
Project Management & Supervision	3.8	1.0	4.8
• Total Base Cost	214.1	53.6	267.7
Physical Contingencies	10.7	2.7	13.4
Price Contingencies	21.5	5.4	26.9
• Total Project Cost	246.3	61.7	308.0

Financing Plan: (US$ million)

Source	Local	Foreign	Total
World Bank	92.4	61.6	154.0
State of Espírito Santo	92.5	0.0	92.5
CESAN	61.5	0.0	61.5
• Total	246.4	61.6	308.0

Estimated Bank Disbursements: (US$ million)

Bank Fiscal Year	1995	1996	1997	1998	1999	2000
Annual	41.4	30.6	32.6	30.0	15.0	4.4
Cumulative	41.4	72.0	104.6	134.6	149.6	154.0

Rate of Return: The internal economic and financial rates of return of CESAN total investment program are estimated at 33% and 15%, respectively.

Maps: IBRD No. 25606 and IBRD No. 25646.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
STAFF APPRAISAL REPORT

I. INTRODUCTION

1. The Brazilian water sector underwent a period of rapid expansion of infrastructure investment and achieved impressive results during the years following the establishment of the National Water and Sanitation Program (PLANASA) in 1971. Increased urban water supply coverage (45 percent in 1970) was assigned top priority and a 90 percent goal was set for 1985. The actual achievement was an impressive 83 percent by 1983 (84 percent by 1991). However, this gain was not matched by performance in other areas. As regards sewage collection, both the target and the actual result were modest. The percentage of people connected to urban public sewerage increased from 24 percent in 1970 to 37 percent in 1991, as compared to a target level of 50 percent in 1985. Sewage treatment is minimal as only 10 percent of total wastewater receives some form of treatment. In most locations, raw municipal and industrial sewage is discharged directly into rivers and coastal waters. While coverage of solid waste collection increased from 49 percent in 1981 to 60 percent in 1988, insufficient municipal solid waste collection and disposal remains a major problem, contributing to a combination of land, air and water pollution. Except in a few municipalities, most collected solid waste is disposed uncontrolled in open-air dumps or water courses; incineration or composting are seldom used; and recycling is rare. Action in treatment and proper disposal of sewage and solid wastes has been hampered by: (i) low and often misallocated investments, combined with inadequate and inappropriate cost recovery; (ii) low priority often given to environmental concerns by water companies; (iii) inadequate capacity to enforce environmental regulations and standards at all government levels; (iv) high turnover and instability in water companies' management and the resulting lack of continuity in sector policy making; and (v) insufficient coordination among different levels of Government.

2. The State of Espírito Santo, a border state between the impoverished northeast region and the relatively richer southeast region, exemplifies the constraints affecting Brazil's water and wastes sector. By 1992, Espírito Santo's urban water supply coverage level had reached an impressive 87 percent, despite the rapid rate of urban growth and industrialization over the last two decades. However, the increasing discharge of raw domestic and other untreated wastes into Espírito Santo's rivers, estuaries, and beaches has degraded the water quality of rivers and streams which serve as water supply sources, and has resulted in widespread coastal pollution. In Grande Vitória, the State's industrialized capital, streams have become open sewers and most beaches along the urbanized areas of the State coastline are polluted. Of an estimated urban population of 2.05 million, less than 230,000 (11 percent) are connected to the sewerage network, and less than 9 percent of total collected wastewater receives some form of treatment. Solid waste collection is below 70 percent and mostly disposed of in uncontrolled landfills, dumps, streams, and the ocean. The increasing level of water pollution is a permanent cause of water-borne diseases and infant mortality. Enteritis and diarrheal diseases constitute the major sanitation-related cause of death. Infant mortality is more than 60 per 1,000 live births, in almost one third of Espírito Santo's municipalities. Cholera has been reported in the state.

3. The proposed project seeks to improve environmental and health conditions in the urban areas of the State of Espírito Santo, recover and protect the quality of the State rivers and coastal waters, and improve the operational and commercial performance of the State Water Company (CESAN). To achieve these goals, the project will support CESAN's 1994-1999 investment program, as well as its efforts to operate on a commercial basis with financial self-sufficiency; support the institutional strengthening of both CESAN and the State Secretariat for the Environment (SEAMA); promote corporate autonomy and institutional accountability of sector agencies; and assist SEAMA in preparing and implementing complementary measures for industrial water pollution control, including the

development and consolidation of a water resources management system, solid waste collection treatment and disposal, and protection of coastal ecosystems.

4. The remainder of this report is structured as follows. Chapter II discusses water quality management in Espírito Santo--with special emphasis on institutional, pollution, and financial issues, as well as Bank experience and strategy in dealing with Brazil's water and wastes sector. Chapter III describes the project's scope, objectives, and rationale, and presents the results of its technical, economical, financial, environmental, and social assessment. Chapter IV describes the project's main implementation features, including supervision-related tasks. Finally, Chapter V summarizes the main agreements reached with Brazilian authorities.

II. WATER QUALITY MANAGEMENT IN ESPIRITO SANTO

A. Background

5. The explosive urban growth and industrialization that has taken place in Brazil over the past several decades have been accompanied by increasing urban environmental degradation. The discharge of raw domestic wastes and untreated industrial and agricultural wastes into water bodies has caused significant water pollution. The environment and the quality of life have deteriorated seriously in the larger metropolitan centers and heavily industrialized areas, and water pollution has become a major problem. Water pollution has resulted from two basic and interrelated reasons: the environmentally uncontrolled industrialization and the inability to create appropriate urban and sanitation infrastructure, particularly for the very poor who invade vacant areas close to the water bodies to establish *favelas*. Typically, the degradation process starts with industries and households discharging untreated wastes into the natural drainage system, and with *favelas* invading hazard-prone lands located mostly on river banks and steep slopes, generally ill-suited for provision of basic infrastructure. In addition, inadequate sectoral investments and unrealistic zoning practices have resulted in unmet demand for environmental infrastructure, especially for controlling floods and collecting and treating wastes.

6. Brazil's performance in the area of water pollution management has been very poor. A failure to institute sound pricing policies for both the provision of services and the use of resources has contributed to poor environmental management and inadequate provision of infrastructure. In general, pollution control has been seriously constrained by inadequate levels of investment, lack of appropriate cost recovery, ineffective technology, insufficient coordination between different levels of Government, inadequate capacity to enforce environmental regulations and standards, and limited involvement of users and NGOs.

B. Current Water Quality Conditions

7. Water quality remains in relatively good condition in the upper reaches of the Santa Maria, Jucu, Jabutí, Peroção, and Una river basins--the water supply sources for Grande Vitória and Guarapari. However, these rivers pick up a heavy load of domestic and industrial wastes as they flow through urban centers and industrial areas. Since the provision for sewerage and sewage treatment facilities has not kept up with urban growth, a large volume of raw sewage is discharged directly into urban drainage channels, rivers, bays, and beaches. Of an estimated urban population of about 1.2 million in Grande Vitória and Guarapari, less than 15 percent have their collected wastewater receiving some form of treatment. Organic waste assimilation in these rivers is generally good, but coliform levels exceed federal water quality standards. Certain areas of the estuarine ecosystems are heavily polluted and water use conflicts--especially for recreational purposes--are evident in most of the beaches of Grande Vitória and Guarapari. Mangrove ecosystems, coastal lagoons, and related aquatic ecosystems are affected by oxygen depletion and suspended solids. Furthermore, these ecosystems--

whether legally protected or not--are constantly under pressure from uncontrolled urban expansion. As a result, the quality of water resources in the project area has diminished markedly and does not meet the standards proposed by the State.

C. Sources of Pollution

8. Domestic and industrial wastewater and uncontrolled solid waste disposal are the main sources of pollution of the aquatic ecosystems of Grande Vitória and Guarapari areas. Pollution sources and estimated pollution loads--in terms of BOD and coliform--are presented in Annex 2. As shown in that Annex, domestic sewage is the main pollutant, although solid waste disposal on or near streams and other water bodies is also a significant source of pollution.

9. The current low coverage of CESAN's sewage collection and treatment system imposes loads of over 60 tons/day of Biochemical Oxygen Demand (BOD) and 10^{17} Most Probable Number of Fecal Coliforms (MPN) per day on receiving riverine and estuarine water bodies in the project areas. Coliform levels over 8,000 MPN/100 ml in the Vitória Bay and the Cariacica beach substantially exceed the 250 MPN/100 ml of federal standards for swimming and other water contact sports. The Passagem canal and the urban segments of the Formate/Marinho and Bubu rivers are also heavily polluted.

10. Industrial activities in Grande Vitória--mainly steel mills, beer, chocolate and soft drink factories, and meat processing plants--exert an organic load equivalent to 8 percent of the total. The industrial water pollution control program being implemented by SEAMA has addressed all major industrial polluters in the area with relatively good results, although enforcement of effluent standards is difficult because of SEAMA's institutional weaknesses. The National Industrial Pollution Control Project (L3480-BR) identified major water polluting industries eligible for financing of treatment systems. Most of these industries (Annex 3) have installed wastewater treatment systems, but very few have requested loans under the Project.

11. Although water pollution by major industries no longer represents a high percentage of the overall pollution load, there is still a significant number of medium- and small-size industries that could impair water quality recovery in specific regions located within the project's area of influence. Accordingly, the strengthening of SEAMA's industrial pollution control programs will be an important element of the project.

12. Uncontrolled solid waste disposal systems in most municipalities of the area represent an important potential source of pollution, particularly in the Cariacica beach, Bubu river, and Vila Velha areas (the estimated population contributing to the organic solid waste load is 950.000 inhabitants). A solid waste collection and disposal program for all municipalities in the area should be implemented to consolidate the environmental objectives of the project. This is incorporated into the project through the strengthening of SEAMA's solid waste program, which will allow SEAMA to assist the municipalities in carrying out feasibility and design studies for municipal solid waste collection and disposal systems.

D. Institutional Organization

13. The State of Espírito Santo has played a direct management role in operations of the water supply and sanitation sector through ownership and operation of the State Water Company of Espírito Santo (CESAN) and management of the State Water and Sewerage Fund (FAE). The federal government has had an important policy-making role in the sector in the past. It exercised responsibility for approval of overall sector investment levels and priorities, and through PLANASA and the National Housing Bank (BNH) and Caixa Econômica Federal (CEF), regulated sector activities by establishing tariff and cost recovery policies, credit terms, and other normative guidelines. The decentralization reforms brought about by the Brazilian Constitution of 1988 established that urban

development and, consequently, water and sanitation programs, would be managed by the municipalities under federal guidance. This decentralized approach to managing the sector has enhanced the role of state and municipal governments in sector organization and regulation. Tariff-setting, for example, was formally transferred from the federal authorities to the states--with so far very positive results for the financial health of most State Water Companies (SWCs).

14. The National Secretariat for Water Supply and Sanitation (SNS), created in 1988 within the present Ministry for Social Welfare (MSW), is responsible for: (i) setting national sector policies for water supply and sanitation; (ii) consolidating planning and investment priorities; (iii) coordinating federal activities with state and municipal initiatives; and (iv) supporting the MSW in its function as manager of the Federal Government Employee's Pension Fund (FGTS). To this end, SNS promotes, helps prepare and finance (mainly with federal budget and FGTS funds lent through CEF as financial intermediary), and supervises sector investment projects and operations.

15. The technical agency responsible for water quality planning and control in the State of Espírito Santo is the Secretaria de Estado para Assuntos do Meio Ambiente (SEAMA). SEAMA's functions include the enforcement of environmental regulations, the inventory of pollution discharges, the licensing of new industries, and water quality monitoring of State rivers. SEAMA is also responsible for supporting municipalities in setting up local institutions and controls for environmental protection. The constitution of the State of Espírito Santo stipulates that protection of the environment (especially water resources) is a public function of shared interest among municipalities, and falls under the purview of State management. Meanwhile, the State Council for the Environment is responsible for the implementation of the National Policy for the Environment.

16. Federal government responsibilities for water quality management are channeled through the Environmental Secretariat (SENAM) under the Presidency, and relate mostly to issues of water standards and quality criteria. The Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) is responsible for formulating and enforcing federal environmental regulations derived from the National Environmental Program (PNMA). The current PNMA, defined by a 1981 law that sought to make social and economic development compatible with the preservation and quality of the environment, provides four policy tools: (i) environmental standards; (ii) environmental zoning; (iii) environmental impact assessments (RIMAs); and (iv) environmental data bases. Licensing is required for all new investments and projects that could possibly cause environmental damage. This includes industries, housing developments and physical infrastructure. RIMAs have been mandatory since 1985 and are used by the states to impose a combination of technological and emission standards, through the licensing procedure. Environmental concern has become widespread at all governmental levels. State level responsibilities include the execution of programs and projects and the control of activities that could adversely affect the environment. States are also responsible for the preparation of norms and standards to complement those enacted by IBAMA.

E. Legal and Regulatory Issues

17. The sector has evolved from a situation of abundant financial resources and large untapped demand in congested and wealthy urban areas, to the present situation of constrained investment resources, new water demand primarily in less densely populated and poor urban areas, and increasing environmental concerns. Specific legal and regulatory concerns pertain to: (i) tariff policy design: in particular, cost recovery of sewage treatment and disposal facilities, and the extent to which externalities, such as sewage quality and environmental damage, are accounted for in the tariff; (ii) tariff policy enforcement; (iii) the creation of an independent expert regulatory commission to monitor and enforce license conditions, negotiate license modifications, and control prices; (iv) financial policy for sector companies, including availability and terms of financing for sector investments; (v) incentives and/or barriers to competition, including the possibilities of creating public or private regional companies; and (vi) quality, health, safety, and technical standards.

18. The State of Espírito Santo in particular would benefit considerably from a water law. Such a law should include a clear definition of responsibilities and functions of the State and municipalities; the definition of mechanisms to guarantee the financial and corporate autonomy of sector utilities; and general guidelines on tariff policy, cost recovery through non-tariff mechanisms, private sector participation, and mechanisms of surveillance and control. Strengthening the corporate autonomy of CESAN and other water and sanitation operating agencies in the State would be a key objective of such legislation.

19. Espírito Santo is perhaps the leader among Brazilian states in the use of Contract-Plans. Contract-Plans are public management tools that allow the government to grant corporate autonomy to the companies it commands, periodically evaluating their performance against carefully selected monitoring indicators. Contract-Plans were introduced in Espírito Santo's public administration in September 1991, and there is one now in effect between CESAN and the State. Nonetheless, this instrument should be strengthened to address the following issues: (i) monitoring indicators; (ii) system of penalties and incentives linked to the Contract's specific objectives; (iii) labor policy; (iv) CESAN's corporate autonomy and accountability; and (v) reasons for modifying and/or terminating the Contract. In addition, an effective implementation of this Contract would require a review of existing laws, a review of CESAN's statutes, the development and implementation of appropriate management information systems, and the institutionalization of regular and independent auditing.

20. The current environmental legislation relating to Espírito Santo's water and wastes sector should be revised to address the following priority areas: (i) the management of water resources in the State, including the establishment and operation of water basins, and the operation of ports; (ii) the promulgation of a State Code for the Environment; (iii) the creation of a State Fund for the Environment; and (iv) the functions, policies, instruments, responsibilities, financing and cost recovery mechanisms concerning solid waste collection and final disposal.

F. Investment Priorities

21. The lack of resources during the 1980s compelled BNH and CESAN to give priority to efficiency in investment and operations. Economic selection criteria for subprojects were introduced and water conservation programs were initiated. Despite these actions, inadequate levels of investment have led to deficiencies in the existing delivery systems. More than one-half of the population with access to public water systems receives less than fully satisfactory services, including some rationing. There is a clear need for: (i) investments with emphasis on more efficient maintenance practices, improved cost control, additional attention to the rehabilitation of existing networks, and operational efficiency--including a clearly defined program for reducing unaccounted-for water (currently at about 39 percent); and (ii) adherence to established economic, technical, environmental, and financial project selection criteria.

G. Sector Financing and Tariff Policy

22. Sector financing has traditionally been based almost completely on borrowing, with most of the funds derived from the earmarked FGTS. This financial policy of heavy dependence on public funds and subsidies has always been unsatisfactory. First, financing from the FGTS funds has been erratic because decisions are made on an annual basis, contract by contract, and not for complete projects. Second, neither CESAN nor the rest of the SWCs has been financially motivated and administratively able to explore other sources of financing. However, it has been only during the years of strong limitations on state borrowing and the fiscal constraints imposed by the federal government, that the negative effects of this policy on the sector's financial health have become apparent. Internal cash generation, through adequate tariff structures and levels such as those proposed under the project, should become a stronger and more reliable source of investment funding (see paras. 77 to 80).

23. The Bank has been closely involved with the Brazilian authorities in the design of water and sewerage tariffs over a long period of time, and participated in the formulation of the National Tariff Law (NTL). Although the NTL is a major step towards securing the financial health of the SWCs, it contains some deficiencies with regard to the tariff structure: (i) it does not necessarily convey the right economic signals because it is based on accounting costs; (ii) it gives inadequate guidance on the degree of cross-subsidies for the financing of services to the poor; (iii) it does not appropriately address the issue of cost recovery for water pollution and other externalities; (iv) it gives inadequate guidance on the relationship between water and sewerage charges; and (v) the suggested structure of charges to be applied to large and small consumers is not appropriate. In addition, the NTL has failed many times to achieve its financial objective (i.e., operational revenues high enough to cover all administrative, operation, and maintenance costs, plus a suitable return on fixed assets), because of the lack of appropriate asset valuation (the companies' margin for tariff increases has been substantially reduced by the legal 12 percent upper limit for return on net operating fixed assets), and, principally, by weak enforcement of the law.

H. Poverty Alleviation

24. For the past several decades, poverty in Brazil has become increasingly an urban problem. Although absolute numbers show the poor are about 47 percent urban and 53 percent rural, the rate of growth of the urban poor has increased, while that of the rural poor has declined[1/]. Reductions in public expenditures for infrastructure and increases in tariffs for infrastructure services are likely to worsen the situation of the poor in the short- to medium-term, as the country attempts to achieve stabilization and growth. Since the provision of infrastructure services is linked to poverty alleviation both indirectly (through growth) and directly (through access to, and targeted subsidies within, the provision of such services), additional effort needs to be made to link infrastructure policy and investment interventions to the needs of the poor.

I. Bank Experience and Strategy

Bank Experience

25. The Bank has actively participated in the development of the Brazilian water sector. Since 1971, 18 water and sanitation loans (US$2.03 billion) have been approved to support the objectives of federal and local governments. Although priority has been given to water supply, substantial investments have been recently approved for sewage collection, treatment and disposal. Basic data, including the current status of each operation, are summarized in Annex 1. These operations have helped to achieve: (i) effective decentralization of most water sector responsibilities to the states, including the establishment of strong SWCs; (ii) application of sound economic principles for project selection and investment; (iii) enactment and application of basic water tariff legislation; (iv) establishment of a uniform accounting system; and (v) standardization of financial, commercial, and administrative procedures in the SWCs.

26. Ongoing Bank projects in this sector in Brazil include the Water Project in the State of São Paulo (L3102-BR), the Water Sector Project for Low-Income Areas and Municipalities (L2983-BR), the Water Sector Modernization Project (L3442-BR), and the Water Quality and Pollution Control Projects for the federal government, São Paulo, Paraná, and Minas Gerais (Loans 3503, 3504, 3505, and 3554-BR). Several municipal development projects also include important components for water supply, sewerage, solid waste, and drainage. The Water Sector Modernization Project seeks to assist Brazil in the reformulation of the sector's organization and objectives, with primary emphasis on improving

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1/ See Fox, M. Louise (1990), Poverty Alleviation in Brazil, 1970-87, The World Bank, Internal Discussion Paper, Latin America and the Caribbean Region.

its economic efficiency through the use of commercial practices and regulatory arrangements that foster competition. The Water Quality and Pollution Control Projects, the Bank's first self-standing municipal water pollution control projects based on a comprehensive water basin management approach, seek to protect the Guarapiranga reservoir in the São Paulo metropolitan area, the upper Iguazu river in metropolitan Curitiba (Paraná), and the urban basins of the Arruda, da Onça, and das Velhas rivers in the State of Minas Gerais.

27. The need for effective autonomy for Brazil's water and wastes sector is perhaps the most important lesson that has been learned through the years of Bank involvement in this sector. While a satisfactory tariff policy has been in effect since 1978 and appropriate tariff adjustment proposals have been regularly prepared by the SWCs, the federal government's economic and political priorities have in the end been the main determinants of permissible tariff increases, irrespective of the financial situation and investment needs of the SWCs. The overall result has been uncertainty affecting investment planning and financial stability and the need for substantial subsidies in the form of equity contributions. The Bank has mounted a sustained effort to rectify this situation, but the federal government has repeatedly violated the loan covenants that urge full application of the NTL. The haphazard liquidation of BNH and the subsequent transition of its responsibilities to CEF also exemplify the sector's need for effective autonomy. Changes in institutional arrangements should not be externally imposed on the sector, especially when appropriate alternatives have not been carefully thought through and designed.

Bank Strategy

28. The Bank's assistance strategy in Brazil is to support policies and investments that will encourage economic growth and social development in the context of both macroeconomic and environmental sustainability. The emphasis is on efficient resource allocation, increased efficiency in the public sector, and the appropriate targeting and delivery of services to the poor. In this context, the ultimate goal for the water and wastes sector is to place sector operations on a commercial basis, with public funds explicitly directed to provide the poor with access to appropriate services, while protecting the environment. In summary, financial self-sufficiency, accountability of the sector agencies, effective pollution management, and poverty-targeting are the basic goals.

29. Measures to achieve these objectives include: (i) an adequate pricing policy for sector financing requirements that allows a reduction in the previous reliance on debt and/or federal or state government financing. Key issues to be addressed by this policy are cost recovery for sewage treatment and disposal, and externalities such as water pollution; (ii) an improvement of public sector management efficiency through operations founded on a sound commercial basis, the introduction of regulatory arrangements to foster competition and private sector involvement, and improved operational planning and marketing; (iii) a policy to direct scarce grant and subsidy resources to poverty-stricken and low-income areas, as a prerequisite for lasting structural reforms and the more immediate goals of maintaining service levels in the face of a rapidly growing urban population; and (iv) a consistent set of regulatory policies addressing the issue of water pollution control and prevention, to provide adequate incentives to prevent further pollution from industrial, municipal and agricultural sources. Besides designing appropriate policy instruments such as pollution taxes, quotas, and marketable permits, these policies should establish sector priorities and goals; assign institutional responsibilities; establish the extent and scope of coordination requirements among federal, state, and municipal entities; and define rules for bearing the costs of pollution control facilities and for monitoring compliance with established regulations.

III. THE PROJECT

A. Background

30. Early in 1990, the National Water Supply and Sanitation Secretariat (SNS) at the Ministry of Social Welfare (MSW) began discussing with the Bank the possibility of Bank support for a strategy aimed at economic efficiency, poverty alleviation, and water resources management and pollution control. In accordance with this strategy, and following Bank supported operations for water pollution control in São Paulo, Paraná, and Minas Gerais (para. 26), the State of Espírito Santo, CESAN, and SEAMA presented a proposal to the Comissão de Financiamentos Externos (COFIEX) in March 1992, seeking approval for Bank financing for a water and coastal pollution management project. COFIEX approved the proposal in May 1992. The project was identified in November 1992. Three more Bank missions--in February, April, and July, 1993--assisted CESAN, SEAMA, and other concerned State Secretaries in project preparation. The project was appraised in November 1993. On December 16, 1993, COFIEX approved the technical and financial modifications agreed by the Bank, the State, CESAN, and SEAMA during appraisal.

B. Objectives and Rationale

31. The specific objectives of this project are: (i) to improve the efficiency of CESAN's water supply and sewerage systems by supporting the company's efforts to operate on a commercial basis with financial self-sufficiency; (ii) to increase the coverage level of CESAN's water supply and basic sanitation services (i.e., sewage collection, treatment, and disposal) in the urban areas of Grande Vitória, Guarapari, Castelo, Iúna, São Gabriel da Palha, Nova Venecia, and Conceição da Barra, and other towns located in the Santa Maria and Jucu river basins; and (iii) to provide appropriate water and sanitation infrastructure in low-income urban areas of Grande Vitória and Guarapari. By achieving these specific objectives, the project will allow to expect: (i) an improvement in the quality of life of about 1.2 million urban inhabitants of the State of Espírito Santo; (ii) a reduction in the incidence of oral-fecal diseases; and (iii) an improvement in the quality of water for human consumption and recreational uses through the restoration and protection of the environmentally deteriorated rivers that feed the urban areas of Grande Vitória and Guarapari, and the estuarine and coastal areas within and adjacent to these municipalities.

32. To improve efficiency in the delivery of water supply and sanitation services, the project will: (i) support CESAN's efforts to operate on a commercial basis with financial self-sufficiency, through a gradual reduction of budgetary contributions from the State accompanied by a substantial increase in internally-generated funds[2/]; (ii) help use CESAN's scarce resources efficiently through improved investment planning, cost analysis, and pricing, reinforced by a Contract-Plan with the State government. This Contract-Plan will improve the one currently in effect, making explicit the expectations and responsibilities of each party in carrying out sector activities, including regulation and control, administration, investments, and tariffs; and (iii) promote CESAN's corporate autonomy and institutional accountability, strengthening its management capacity, operational efficiency, and financial performance through an institutional strengthening component. During Loan Negotiations, both the State and CESAN agreed to hold annual reviews of the Contract-Plan, not later than year-end.

33. To increase the coverage level of CESAN's water supply and basic sanitation services, the project will support the company's 1994-1999 investment program. The program consists of an efficient, economically justified, and financially sustainable set of investments for urgently needed extension and quality enhancement of water and sanitation services. In addition to its emphasis on

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[2/] CESAN is expected to contribute counterpart funds amounting to 17 percent of its total 1994-1999 investment cost (24 percent including interest during construction).

investments to expand CESAN's sewerage systems, sewage treatment plants, and outfall structures, the project will also build and reinforce water supply facilities to eliminate existing bottlenecks, to optimize the operation of CESAN's current delivery systems, to serve new demand resulting from expected population growth, and to give service access to low-income and *favela* populations living in Grande Vitória and Guarapari.

34. To provide water and sanitation infrastructure in low-income areas and *favelas* in the municipalities of Grande Vitória and Guarapari, the project will introduce and implement appropriate technical solutions. These technical solutions will make an important contribution to the improvement of public health and sanitary conditions in the low-income areas and *favelas* of the municipalities, while assuring that these water quality improvements are environmentally sustainable and socially equitable. The project will also help to improve the targeting of the State grants for water and sanitation projects to low-income urban areas.

35. The quality of life of the population living in the urban areas targeted by the project will improve as a result of: (i) the rehabilitation and expansion of water supply and, in particular, the substantial increase in the coverage level of basic sanitation infrastructure; (ii) the expected reduction in the incidence of oral-fecal diseases; and (iii) the expected improvement in the quality of water for human consumption and recreational uses that will result from restoring and protecting the water quality of State rivers and coastal ecosystems. To restore and protect the water quality of rivers and coastal waters, the project will address some key sectoral issues related to the need: (i) to implement water quality norms and standards for water resources (see Annex 4), compatible with the land use and development plans of the State; (ii) to develop and consolidate a state-wide water resources management system; (iii) to help SEAMA improve its management capacity through an institutional strengthening component; (iv) to review the adequacy of CESAN's current tariff structure and levels, with special emphasis on the issue of cost recovery of water pollution control facilities; and (v) to assist SEAMA in preparing complementary and compatible proposals for dealing with collection and final disposal of solid wastes.

C. Description

36. The proposed project comprises an investment component to help finance CESAN's 1994-1999 investment program and an institutional component to strengthen the capabilities of both CESAN and SEAMA, through studies, technical assistance, and training in selected areas.

37. The investment component will help finance CESAN's investment program. The proposed investments in water supply will expand the systems of Grande Vitória, Guarapari, Castelo, Iúna, São Gabriel da Palha, Nova Venecia, and Conceição da Barra (see IBRD Map 25606), eliminating existing bottlenecks; and significantly improve the operation of all CESAN's systems. The expansion of water supply systems will focus mostly on incorporating low-income urban areas into CESAN's systems, through the use of low-cost technologies and substantial community participation. The water supply subcomponent will increase the service coverage level in the State by about 2 percent (to 93 percent). CESAN's proposed investment in sanitation seeks to abate water pollution in Grande Vitória and Guarapari as well as in the water basins of the Santa Maria, Jucu, Jabutí, Peroção, and Una rivers (see IBRD Map 25646). Domestic wastewater which, at present, is mostly discharged without treatment into rivers, estuaries, bays, and coastal waters will be collected, intercepted, and conveyed to ten wastewater treatment plants located in various urban and rural sub-basins. Wastewater treatment technologies will include both anaerobic and aerobic processes, with additional coliform reduction processes in key units. The sanitation subcomponent will increase the service coverage level in the State by about 32 percent (to 43 percent). Project preparation is quite advanced--engineering designs are ready for nine subprojects accounting for about two thirds of estimated project costs.

38. CESAN's institutional strengthening component (Annex 9) seeks to improve the company's management capacity, operational efficiency, and financial performance. The component will include the following activities: (i) a managerial development program to improve CESAN's institutional capabilities to carry out its responsibilities under the project; (ii) a training program for CESAN's operational staff in the areas of planning, marketing, financial, and operational techniques; (iii) a program to institutionalize operational and financial planning; (iv) a sanitary education program; (v) a total quality program to improve CESAN's productivity and response to consumer complaints; (vi) acquisition and development of new management systems, including a restructuring of CESAN's data processing; and (vii) the renovation of laboratory equipment.

39. SEAMA's institutional strengthening component (Annex 9) will: (i) strengthen SEAMA's programs in water resources management, solid waste management, monitoring of water quality, industrial pollution control, and coastal ecosystem protection; (ii) design and implement environmental information systems, and environmental education programs (to be delivered through NGOs and community associations); and (iii) improve SEAMA's operational and administrative capability to identify, prepare, and establish norms, guidelines and procedures for environmental assessment and to review and upgrade SEAMA's organizational procedures and work programs. This component will finance major studies and technical assistance, water quality monitoring and laboratory equipment, information management systems and equipment, technical assistance, training programs, and other materials as needed.

D. The Borrower and the Executing Agencies

40. The State of Espírito Santo will be the Borrower. The State Water Company of Espírito Santo (CESAN) and the Secretaria de Estado para Assuntos do Meio Ambiente (SEAMA) will be the executing agencies. CESAN will execute the investment component and its institutional strengthening program. SEAMA will execute its own institutional strengthening program. CESAN participated as a beneficiary in the completed Water Supply and Sewerage Sector Project (L2249-BR); it performed satisfactorily and developed a good working relationship with the Bank. SEAMA, which has not directly executed a Bank project, is currently participating as a beneficiary of the National Environmental Project (L3173-BR), and is performing satisfactorily.

41. CESAN, created in 1967 by the State Laws 2282 of February 8 and 2295 of July 13, as Companhia Espírito Santense de Saneamento, is a corporation owned by the State government with its headquarters in Vitória, the State capital. CESAN--like all SWCs in Brazil--operates under 30 year concessions granted by the municipal governments. CESAN's current area of responsibility covers 49 of Espírito Santo's 72 municipalities (municipalities under CESAN's area of responsibility are shown in IBRD Map 25606). Within these 49 municipalities, CESAN serves 102 localities with water supply and 10 with sewerage service, with coverage levels of about 91 percent in water supply and about 11 percent in sewerage (see Annex 6). About 86 percent of the State's urban population lives in these localities. CESAN operates 84 water supply and 10 sewerage systems which, due to their relatively small size, are difficult and expensive to operate. Two water supply systems account for almost 80 percent of the total water production while 62 systems produce less than 5 percent. Similarly, one sewerage system collects almost 50 percent of the total sewage collected while 6 systems collect less than 9 percent of the total (see Annex 7).

42. As shown in its organization chart (see Annex 5), CESAN is governed by a Board of Directors appointed by the State Governor for a period of four years. The president of the Board of Directors is the Chief Executive Officer. Each of the other Directors is the working head of one of the operational departments. The Directors are responsible to an Administrative Council charged with such functions as ex-ante approval of investment programs and issuing of new shares. A Fiscal Council is responsible among other things for ex-post approval of all budgets and financial statements. This

structure is common to most Brazilian state-owned companies and is adequate for CESAN's needs. Institutional indicators for CESAN are presented in Annex 6, Attachment 1.

43. SEAMA, the most important institution in the State's Environmental System, was created in 1988 (Law 4126) as the executing agency for the State's environmental policies and programs. SEAMA is part of the State Environmental Council (CONSEMA), created in 1988, to set and supervise policies and regulations for environmental protection, conservation, and improvement. Other government and non-governmental institutions are also part of CONSEMA. SEAMA's organizational structure, together with the creation of a State Environmental Institute, was recently approved by the State Assembly (see Annex 5). Institutional indicators for SEAMA are presented in Annex 6, Attachment 2.

E. Demand Projections

44. Service demand projections for water supply and sewerage are made separately for each of the systems analyzed. The markets analyzed include Grande Vitória, Guarapari, Domingos Martins, Santa Maria de Jetibá, and Santa Leopoldina. The key independent variable used in the projection is the number of new connections CESAN expects to hook up to its systems in each market every year. Assuming a long-term price elasticity of -0.30[3/], total water consumption is estimated as the product of the urban population served and the estimated daily water consumption per capita, which is calculated as the weighted average of seasonal consumption[4/]. Total water production is computed as the sum of water consumed and unaccounted-for in the transmission and distribution networks[5/]. Total water production is equal to production capacity when the system is being rationed, and to water consumption plus unaccounted-for water when there is enough capacity to satisfy the demand. Urban population served with in-house sewerage connections is estimated as the product of total urban population and projected sewerage service coverage levels. The projected amount of sewage collected in each year is estimated based on the number of sewerage connections CESAN plans to install each year and the annual amount of sewage produced per connection[6/]. The methodology for projecting CESAN's population, water consumption and production, and sewage collection and treatment is presented in Annex 11. According to this projection, by the end of project implementation (December 1999), the project will have extended water supply and sewage collection to additional populations of about 0.39 and 0.77 million, respectively, increasing CESAN's service coverage from 91 percent to 93 percent in water supply and from 11 percent to 43 percent in sewerage.

F. CESAN's Investment Program

45. The project is conceived as an integrated water pollution control program for Grande Vitória, Guarapari, and other smaller localities (see IBRD Maps 25606 and 25646). The scale and timing of physical infrastructure is designed to obtain quantifiable results regarding water resources recovery and conservation in terms of water quality indicators. Project sustainability is assured by integrating the pollution control program with CESAN's six-year investment plan, which also includes increasing

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[3/] A long-term price elasticity of -0.30 was estimated from the results of a field survey performed as part of a Contingency Valuation (CV) study.

[4/] Seasonal water consumption is calculated based on CESAN's last three years of records of a sample of users who, during this period, have had meters and have not been subject to rationing. Seasonal variations are minor in Grande Vitoria but highly significant in Guarapari, where the population increases sharply during the tourist season.

[5/] The average unaccounted-for-water level is assumed to decrease during the project implementation period as a result of the actions to be taken under the institutional development program, and to remain steady at its 1998 level afterwards.

[6/] The volume of sewage produced per connection has been estimated at 85% of the volume of water consumed.

coverage of potable water supply in the area and an institutional strengthening program. Annex 8 contains CESAN's detailed investment program for 1994-1999. Environmental monitoring and achievement of environmental objectives will be guaranteed via SEAMA's institutional strengthening program, which will develop complementary actions in industrial pollution control, municipal solid waste collection, treatment and disposal, and management of water resources and protected areas. Annex 9 contains details of the institutional strengthening programs for CESAN and SEAMA over the 1994-1999 period.

Investment Priorities

46. Investment priorities were determined on the basis of technical, environmental, economic, financial, and political criteria. Technical factors include experience with proposed technologies and containment of construction and operating costs. Environmental considerations include potential pollution risks to water bodies (such as rivers, estuaries, and bays) receiving effluents. Economic and financial factors include the size of projected marginal revenues, expected net positive benefits, and affordability of tariffs. Taking all these factors into account, wastewater collection and treatment was given priority over water supply, as the service coverage is much lower for wastewater collection and treatment. Environmental, technical and financial evaluations assigned a high priority to unaccounted-for water (UFW) control and other programs that optimize existing systems over new water supply projects. A large part of the existing shortage of water is expected to be handled through the implementation of the UFW control program and other optimization activities which will be executed during the first two years of project implementation. Extending water supply service to low-income households was given priority over reinforcing current water supply systems.

Main Components

47. The **water supply component**--comprising about 42 percent of proposed investment costs--was designed to reinforce and rehabilitate current systems, to serve new customers resulting from expected population growth, and to incorporate low-income urban areas into CESAN's systems. Subprojects include optimization and expansion of existing water treatment plants, increases in the capacity of storage reservoir and pumping stations, expansion of water transmission and distribution systems, and a UFW control program. These components are expected to ensure effective cost recovery and the sustainability of the investments in sanitation and pollution control.

48. Beginning about 1983, BNH financed programs for operational development that were highly successful. CESAN, for example, was able to decrease its level of UFW to about 40.4 percent from 43.6 percent, in only one year. Since 1987, however, these programs have been drastically cut in almost all SWCs due to lack of financial resources, and UFW is again a very serious problem. In 1992, UFW was estimated at 37 percent in CESAN--a figure that is about equal to the national average (37.3 percent in 1989). A well-designed operational development program forms a prominent part of CESAN's investment program (see Annex 8) and will be financed by the project.

49. The **wastewater collection and treatment component**, comprising about 58 percent of proposed investment costs, is designed to restore and conserve water quality for the preservation and protection of water supply sources, aquatic ecosystems, and recreational beaches and other marine areas. Subprojects numbered 1 to 12 in Annex 8, Attachment 1, include a total of 823 km of sewerage pipes, 103,365 sewerage house connections, and 10 wastewater treatment plants. Subprojects 1 to 6 are in Grande Vitória and their objective is the protection of the Vitória Bay, the beaches of Camburi, Iate, Jurema, and Aterro, and the Passagem Channel, and improvement of the urban drainage system by intercepting wastewater discharges. Subprojects 7 and 8 will collect and treat domestic wastewater in Guarapari, protecting the recreational beaches of this municipality. Subprojects 9 and 10 will protect the water quality of the Jucu river and subprojects 11 and 12 will protect the water quality of the

Santa Maria river. The Jucu and Santa Maria rivers are the main sources of water supply for Grande Vitória.

50. Industrial activities in some river segments, urban run-off channels, and uncontrolled solid waste disposal sites near water courses may impose pollution loads that could impair water quality restoration in some specific locations in the area of influence of the project. Furthermore, coastal ecosystems, protected and un-protected, are subject to urban expansion pressures and lack effective protection. To address these potential problems, the project will utilize an integrated approach to water quality and natural resources management in the river basins and the estuarine ecosystems within the project's area of influence.

Technical Evaluation

51. Project siting, technology, and effluent discharge points were selected through comparisons of different water quality scenarios based on water quality modelling techniques. Water quality modelling efforts carried out by SEAMA and CESAN show that implementation of the project is crucial to reach the proposed water quality objectives in all key water bodies in the area. Water quality modelling methodologies and findings are discussed briefly in Annex 15. Projected 20 year scenarios with and without the project confirmed the need for sewage treatment, as well as complementary actions in industrial pollution and solid waste collection, treatment, and disposal.

52. Engineering designs have been completed for nine of the 12 wastewater collection and treatment schemes. Subprojects 2 to 4 and 8 to 12 in Annex 8, Attachment 1, have been appraised and found to be in compliance with all technical and engineering requirements. These subprojects amount to about 59 percent of the total cost of wastewater collection and treatment projects, and 33 percent of the total project cost. Sub-project 7, which also meets all technical and engineering requirements, is undergoing some minor least cost staging adjustments. All subprojects are based on simplified sewerage systems (minimum diameter 4") and anaerobic, aerobic, facultative, and aerated lagoon systems for wastewater treatment. Lagoon systems presented technical, economic and environmental advantages over other types of treatment. There is also sufficient experience with their construction, operation, and maintenance in Brazil. CESAN for example, has satisfactorily operated a pond system over the last several years.

53. Project design adjustments were made to address specific environmental concerns and now meet required coliform removal efficiencies in key areas of the aquatic ecosystems, as well as in recreational beaches. Projected water quality scenarios using mathematical models show that all recreational beaches will meet swimming standards for coliform.

54. Additional analysis of nutrient and algae production in wastewater treatment plants in certain areas of Vitória Bay showed low probabilities for potential eutrophication problems. Algae removal systems will not be needed for any wastewater treatment plant. However, monitoring programs will track nutrient loads, and additional research will be carried out into algae removal methods in photosynthetically active lagoon systems.

55. Urban drainage systems analysis determined the need for interceptors along major urban channels which currently function as open sewers. Operational and maintenance experiences in simplified sewerage systems in other localities in Brazil resulted in project design modifications related to minimum diameter, manhole distances, and manhole depths.

56. The water supply project for Grande Vitória was found to comply with all technical and engineering requirements. The Guarapari water supply project will need additional engineering and technical studies to be eligible for Bank financing (see Annex 11). The physical losses of water in Grande Vitória and Guarapari treatment plants (about 5.6 and 3.8 percent, respectively) were found

to be excessive due to lack of filtering capacity. Once the required additional filters are in place, these losses should go down to about 2.0 percent. The UFW program, which was found satisfactory, will therefore concentrate on physical losses in reservoirs and distribution systems in addition to commercial losses.

57. Works have been appropriately staged to obtain the least-cost solution. The flat economic-cost curve beyond the optimal stage point permitted the scaling of sub-projects to design periods of up to twenty years without significant economic losses, while introducing agreed environmental end engineering criteria. Subprojects, designed to conform with former BNH standards, are in accordance with proper management practices and the living conditions, expectations, and ability to pay of the beneficiaries. Service standards will consist of water supply by house connections and sewage disposal by public systems. As is customary in the Brazilian water sector, the project emphasizes the use of low-cost sewage disposal techniques. Consolidated service levels over the project implementation period are presented in Annex 20.

58. Engineering studies and design have been carried out competently by consultants. CESAN's engineering department would review designs and supervise construction during project implementation. Before BNH was abolished, the engineering departments of the SWCs were provided with advice and supervision by BNH's technical agents. After BNH's functions were transferred to CEF, this close supervision practically disappeared. This is another area where the project expects to have a significant impact, through a continuous, careful, and well-planned Bank supervision of the project.

G. Project Cost

59. The total cost of the project is estimated at about US$308 million equivalent: US$290 million for the investment component and US$18 million for the institutional strengthening component (US$8.8 million for CESAN and US$9.2 million for SEAMA). Project costs are summarized in Table 1. Direct and indirect foreign exchange requirements are estimated at about US$61.6 million (20 percent of total). Costs are expressed in prices as of June 1993, and include physical contingencies estimated on average as 5 percent of base costs--about US$13.4 million, and price contingencies estimated on the basis of an estimated international inflation of 2.8 percent per year for 1994 and thereafter--about US$26.9 million. Due to high domestic inflation rates, all project cost estimates are expressed in US$. Costs include direct taxes (about US$21.3 million). Interest during construction is not included. Changes in the value of Brazil's currency are expected to compensate for the projected domestic inflation over the life of the project.

60. The total cost of the project was determined on the basis of CESAN's 1994-1999 investment program (see Annex 8). The project cost represents about 87 percent of CESAN's investment and institutional strengthening programs and 100 percent of SEAMA's institutional strengthening program during the same period. During Loan Negotiations, CESAN agreed not to change annual investments during the project implementation period by more than 20 percent of the original agreed amounts, without prior Bank agreement.

61. Cost estimates for major subprojects are based on bills of quantities and unit prices prepared by CESAN. Estimates for other subprojects are based on unit costs of similar works. Costs of the institutional development programs are estimated in accordance with prevailing costs of goods and services. About 210 specialist-months of consulting services are included for the institutional strengthening component of SEAMA, 150 specialist-months for the institutional strengthening component of CESAN, and 185 specialist-months for the project management and supervision of the investment component.

Table 1
Project Cost Summary
(US$ millions)

Component	Local	Foreign	Total
Water Supply	56.3	14.1	70.4
Sewerage	133.2	33.3	166.5
Operational Development	8.1	2.0	10.1
CESAN Institutional Development	6.3	1.6	7.9
SEAMA Institutional Development	6.4	1.6	8.0
Project Management and Supervision	3.8	1.0	4.8
• Total Base Cost	214.1	53.6	267.7
Physical Contingencies	10.7	2.7	13.4
Price Contingencies	21.5	5.4	26.9
• Total Project Cost	246.3	61.7	308.0

H. Tariff Analysis

62. CESAN's tariffs are basically in accordance with former BNH guidelines for tariff design (see Annex 10 for a detailed assessment of CESAN's tariff structure and rate levels). Since 1987, the State government of Espírito Santo has made use of its right to set tariffs, authorizing regular tariff increases for CESAN (see Figure 1, Annex 10). The State, however, lacks a clear policy to be used as a guideline for tariff setting. Overall, CESAN's average water rates and the combined average rates for water and sewerage are distorted and do not reflect the company's actual economic costs; that is, the marginal cost of providing the services (see Annex 11 for a detailed analysis of CESAN's marginal cost structure). Average non-residential rates are higher and residential rates lower than the corresponding marginal costs (see Table 4, Annex 10). Departure from marginal cost pricing is slightly larger when both water and sewerage services are considered. This result reveals the existence of a cross-subsidization policy that favors sewerage customers. Given that sewerage coverage is substantially lower than water coverage, any subsidy favoring sewerage also favors the highest-income groups of the population.

63. To better serve society and meet the basic requirements of financial self-sustainability and social equity, CESAN needs to rationalize its tariff structure, taking the following eight points into consideration.

- First, marginal costs should be used as reference values in the definition of the tariff structure and rate levels. Sewerage rates, in particular, should be increased to approach the corresponding marginal costs.

- Second, the practice of applying differential rates to commercial, industrial, and public customers, based on the amount of water they consume, has negative impacts on the allocation of economic resources and should be abolished. A well-designed tariff structure should automatically take into account the consumption patterns of different customers. For instance, a household operating a small family business from its house should receive a clear tariff signal to request its reclassification as either commercial or industrial, once its water consumption exceeds abnormally high levels for residential standards.

- Third, CESAN's current socio-economic classification should be reviewed to achieve the social equity objective that both the State of Espírito Santo and CESAN pursue with the water supply and sewerage tariffs they apply. In addition, a fixed monthly charge, independent of the volume of water consumption, but increasing with the income level of households should replace the current minimum consumption level.

- Fourth, the number of consumption blocks contained in CESAN's residential tariff structure should be reduced to three. The range of these consumption blocks should be set in accordance with current consumption levels. The first consumption block should comprise the minimum amount of water required by a typical family. The upper limit of the second block should be close to the level that is still considered non-excessive, for instance, 45 m^3/month.

- Fifth, tariff rates should be set according to economic costs. Residential rates for consumption levels above the basic block but below what may be considered excessive levels (for instance, larger than 45 m^3/month) should be charged with tariffs close to marginal costs. Residential consumption levels considered excessive should not be subsidized for any customer and could be charged a tariff higher than its corresponding marginal cost.

- Sixth, the basic residential consumption block and poor households should be targeted as the only groups deserving a subsidy.

- Seventh, CESAN's tariff levels should be such that they will allow it to generate enough internal cash to cover its operating expenses, debt service, and investment requirements.

- And eighth, an automatic mechanism of adjusting rate levels to inflation should be selected and put in place, to keep tariff value constant in real terms in order to promote long-term financial planning and self-sufficiency for CESAN.

64. During Loan Negotiations, both CESAN and the State government agreed to put into effect the tariff modifications described above by December 31, 1994.

I. Financial Analysis

Project Financing

65. A Bank loan of US$154 million equivalent will finance 100 percent of direct and indirect foreign costs plus about 37 percent of local costs. The loan will have a term of 15 years, including five years of grace at the Bank's standard variable interest rate. The balance (US$154 million) will be provided by CESAN and the State of Espírito Santo. There are also good prospects for the European Investment Bank (EIB) to finance a major part of the State's counterpart requirements (see para. 82).

66. The financial success of the project depends largely on the self-financing capacity of CESAN. This is because one of the project's main objectives is to strengthen CESAN's financial discipline and independence, making it less reliant on government funds. This key departure from the past practice of heavy reliance on debt financing and government transfer continues the strategy initiated by the Water Sector Modernization Project (Loan 3442-BR). Under the proposed project, CESAN agreed to provide a counterpart cash contribution amounting to about 17 percent of the total investment cost. CESAN's counterpart increases to about 24 percent when interest during construction (IDC)--to be financed by CESAN from its internal cash generation--is included in the total investment cost. The remainder of CESAN's investment program will be financed directly by the State through capital subventions to CESAN. During Negotiations, the State agreed that up to 34 percent of the project cost will be made available according to the project schedule and be totally disbursed by December 1999.

67. Table 2 summarizes the investment and project financing plans of CESAN and SEAMA, including interest during construction amounting to US$31.5 million. Interest during construction will be entirely financed from CESAN's internal cash generation. The financing plan for CESAN is shown in detail in Annex 13. During Negotiations, CESAN agreed to submit to the Bank, not later than April 15 and October 15 of each year, general financial projections for the following six year period (see para. 108). The progress report to be submitted to the Bank by October 15 of each year should also include specific details on the investment plan for the upcoming year. The institutional strengthening component of this project includes a training program for CESAN's financial managers to comply with this requirement.

Table 2
1994-1999 Investment and Project Financing Plans of CESAN and SEAMA
(US$ million)

Source of Funds	Project Financing[a]		Investment Financing	
	Amount	%	Amount	%
World Bank (IBRD)[b]	154.0	45.4	154.0	37.6
Caixa Econômica Federal	-	-	36.7	9.0
Federal Government	-	-	1.3	0.3
State of Espírito Santo	92.5	27.2	122.9	29.9
CESAN	93.0	27.4	94.8	23.2
Total	339.5	100.0	409.5	100.0

[a] Includes interest during construction of US$31.5 million.
[b] Of which US$149.4 million corresponds to CESAN's investment program and institutional strengthening component.

CESAN's Past and Present Financial Performance

68. CESAN's financial performance has been largely affected by the country's unstable macroeconomic environment. Since 1983, the Brazilian economy has been suffering from high inflation (more than 1,000 percent in 1988, 1989, 1990, 1992, and 1993--see Annex 13) and frequent macroeconomic adjustment plans (1986, 1987, 1989, 1990, and 1991). In addition to Brazil's macroeconomic difficulties, CESAN's financial performance has deteriorated because of an excessive reliance on government financing and subsidies that fostered inefficiency, and a government policy that severely penalized CESAN's earning capability by attempting to curb inflation through frequent institutional tariff freezes. The first tariff freeze was imposed in 1985.

69. Reflecting this environment, CESAN's financial performance has deteriorated over the last several years. Net operating income decreased, as the average water and sewerage tariff slipped in real terms, while operating costs rose steadily (see Annex 12 for past and projected financial statements). From 1990 to 1992, CESAN's average water and sewerage tariff dropped from US$0.47/m^3 to US$0.43/m^3, decreasing on average 4 percent per year, a rather moderate decrease however compared with the 1982-1988 period. Although the average tariff was increased to US$0.51/m^3 in 1993 to make up for the past losses, a further tariff increase is necessary for CESAN to be able to generate sufficient internal resources to finance the larger investment needs foreseen in the future.

70. As CESAN's tariff revenue deteriorated, its operating cost rose steadily. The operating ratio rose from 0.71 in 1990 to 0.90 in 1992, while net operating income decreased from US$20.0 million

in 1990 to a mere US$6.6 million in 1992, not sufficient to comply with the National Tariff Law (NTL)[7]. The personnel cost rose to 67 percent of total operating cost in 1992, a level considerably higher than a sample of other Latin American water utilities (on average less than 40 percent) or a sample of Spanish and French water utilities (average 30 percent)[8]. Furthermore, adding the cost of third-party contract labor to the personnel cost, the total personnel and labor costs amounted to more than 83 percent of total operating cost in 1992.

71. As of September 30, 1993, CESAN had 1,557 permanent employees. Employee productivity, as measured by the number of water and sewerage connections per permanent employee, was 166 in 1990 and 194 in 1992, lower than Brazil's average for the sector (209 as of December 1990). However, labor productivity, as measured by the number of water and sewerage connections per permanent and temporary employee, is even lower: 152 connections in 1992[9]. This result underscores CESAN's operational inefficiency.

72. Another factor that could be attributed to CESAN's low productivity and inefficiency is the low turnover of its employees. CESAN does not have a clear remuneration policy based on performance, which has often led to unequal financial rewards to its employees, often favoring long-time employees. Moreover, the retirement pension system managed by the federal government discourages retirement. The maximum amount of pension paid by the federal government is 10 minimum salaries (about US$600 per month), considerably lower than the current salary (including benefits) of the employees. Because of this situation, water companies in other states of Brazil are providing incentives for early retirement by covering the difference between what the employee was earning at retirement and what the federal government pays. Before Negotiations, CESAN prepared and submitted to the Bank the results of a study to determine the medium- to long-term financial effects of adopting a policy of early retirement. Based on the positive implications of adopting the recommendations of this study, CESAN will now design a comprehensive plan to implement such a policy.

73. In addition to operating inefficiency, CESAN also faces billing and collection problems common to most Brazilian water companies: (i) inadequate metering (only 70 percent of the consumption is metered); (ii) long bill processing periods (until recently, the period from meter reading to due date was 33 days[10]); (iii) large accounts receivable (46 days of revenue) due to poor collection efforts; and (iv) financial losses resulting from CESAN's inability to cumulatively adjust consumer bills for inflation. These problems, together with CESAN's short-term oriented financial planning and administration practices, have contributed to the chronic liquidity problems of recent years. During Negotiations, CESAN agreed to adjust overdue accounts for inflation and take other measures to reduce the financial losses resulting from overdue bills. The company in turn delayed payments to its suppliers and contractors, its debt obligation accumulated, and its bill collection efforts faltered. Although CESAN's debt service was reduced substantially following a recent agreement with the State government (see Annex 13 for a more detailed discussion), and it no longer has liabilities in arrears, CESAN's financial management leaves much room for improvement.

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[7] To be in compliance with the NTL, CESAN's operating revenue should be equal to or larger than the sum of its operating cost, depreciation, and debt service. In 1992, this ratio slipped below 1 (to 0.98).

[8] See Yepes, G. (1989), **Management and Operational Practices of Municipal and Regional Water and Sewerage Companies in Latin America and the Caribbean**, The World Bank, Technical Department, LAC Region, August.

[9] CESAN's total number of permanent and temporary employees) has been calculated as the sum of CESAN's permanent employees (i.e., CESAN's regular staff) plus the equivalent number of employees hired through third party contracts. This equivalence has been calculated assuming that employees hired through third party contracts earn CESAN's average salary, including social benefits.

[10] CESAN recently instituted a 22 day bill processing period.

74. Reflecting the chronic cash shortage, uncertainty of the availability of other financing sources, and the absence of strategic investment planning, CESAN's average annual investment level has been low--about US$18 million in recent years, and not sufficient for investment requirements. While the water supply coverage level grew by 7 percent between 1990 and 1993 (from 84 percent to 91 percent), the sewerage coverage level increased only slightly, from 7 percent to 11 percent during the same period. Meanwhile, the quality of service gradually deteriorated, causing several areas served by CESAN to experience rationing.

75. The project's institutional strengthening component will address the financial and investment planning issues through training and consultancy. One of the tools to be introduced by the project is a realistic six-year rolling plan, to ensure efficient utilization of investment resources within the company. The plan is reinforced by the use of stronger criteria for economic analysis of subprojects and a Contract-Plan between CESAN and the State.

76. Although a basic accounting system is in place, CESAN's financial management, accounting, and information systems need improvement. CESAN does not have a computerized integrated information system, information is complied manually, and the preparation of its financial statements takes up to five months. The financial statements are subject to both external[11/] and internal auditing. Although the company has received qualified opinions from its external auditors during the last several years, remedial actions were taken only recently. In addition, CESAN's fixed assets are undervalued because of the insufficient revaluation index allowed by the government in the past. Hence, the institutional strengthening component of the project includes a program to review, develop, and improve CESAN's accounting, information, and auditing systems, as well as a study to revalue its fixed assets. Terms of reference (TOR) for studies of accounting, information, and auditing systems were presented to the Bank before Negotiations. TOR for a fixed asset revaluation study, as well as a draft contract for hiring a consultant to execute it, were submitted to the Bank before Negotiations. The recommendations of the study should be submitted to the Bank for comments not later than June 30, 1995, and incorporated into CESAN's audited financial statements of fiscal year 1995.

CESAN's Projected Financial Performance

77. CESAN's financial projections for the period 1994-1999 (presented in Annex 12) are based on the following assumptions: (i) the average water and sewerage tariff will increase by 5 percent in years 1994, 1995, and 1996, in real terms; (ii) the price elasticity of demand is -0.3; (iii) CESAN will gradually improve its productivity and efficiency; and (iv) the State will continue to provide contributions to CESAN at a level similar to the one observed in the last two years. More detailed notes and assumptions for CESAN's financial forecasts are presented in Annex 13.

78. The average water and sewerage tariff will increase from US$0.51/m^3 to US$ 0.61/m^3 by 1996, and stabilize thereafter. While revenue from water services increases at a moderate rate of 5.5 percent per year, the revenue from sewerage services grows tenfold, as sewerage service coverage increases from 11 percent to 43 percent. The revenue increase is enhanced by the project's operational development program which aims to reduce UFW by decreasing physical and commercial losses, and increasing consumption metering. Meanwhile, employee productivity, as measured by the number of water and sewerage connections per permanent employee, is expected to improve from 210 (4.8 employees per 1000 connections) in 1993, to 324 (3.1 employees per 1000 connections) in 1999. And labor productivity, as measured by the number of water and sewerage connections per permanent and temporary employee, is expected to increase from the current 168 (6.0 permanent and temporary employees per 1000 connections) to at least 253 (4.0 permanent and temporary employees

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[11/] The external auditing is mandatory and is regulated at the State level. The selection of the auditing firm is done every six months through public bidding among private companies--the firm may be re-appointed for consecutive periods for a maximum of two years.

per 1000 connections) by end-1999. The assumptions regarding employee and labor productivity result in an annual average productivity gain of 7.5 percent during the project implementation period. As a result, operating expenses (not including depreciation) will gradually decrease from 55 percent of operating revenue in 1993 to 42 percent of operating revenue in 1999. CESAN will also improve its financial resources management by reducing the period of accounts receivable (currently 46 days) to 43 days, and developing a system to adjust overdue accounts for inflation. With larger tariff revenues, improved operating efficiency, and better financial management, CESAN is expected to cover 17 percent of its total investment cost (24 percent including IDC) with its internal cash after fulfilling its debt service and tax obligations. Under this scenario--the so-called **Base Scenario** or A2 Scenario of Annex 13--CESAN would require a 32 percent (US$118.4 million) contribution from the State.

79. This scenario, however, could only be achieved by CESAN's firm commitment to raise the average tariff level and to improve its operational efficiency. Likewise, an adequate provision of the State's counterpart funds is crucial to the timely execution of the investment program. The sensitivity analysis presented in Annex 13, Section E, highlights the importance of the proposed tariff increases and productivity gains, as well as the adequate provision of counterpart funds, for a sound execution of the project. With no tariff increases and no productivity gains (the B3 Scenario), CESAN would only be able to cover 7 percent of the total investment cost with its internal cash, requiring a 43 percent contribution from the State (US$157.8 million). Under the assumption of no tariff increases, even a large productivity gain of 8.5 percent[12/] (the B1 Scenario) would not allow CESAN to cover more than 14 percent of its total investment cost with internal cash, requiring a 35 percent contribution from the State (US$130.2 million). Under the worst possible scenario of no tariff increases, no productivity gains, and the State's counterpart funds limited to US$15 million per year, the completion of CESAN's current investment program will be delayed by three years. Although CESAN's contribution to investment under this scenario (13 percent) is slightly better that under the B3 Scenario, as CESAN has three extra years of cash generation, its internal financial rates of return will be lower as net incremental cashflow is deferred. In summary, the sensitivity analysis shows that the tariff increase is crucial to the financial independence of CESAN, although expected gains in its employee productivity index would help substantially to achieve this goal. Moreover, an adequate provision of the State counterpart fund is essential in completing the investment program as scheduled with expected rates of return.

80. To further strengthen its financial condition during the project implementation period, CESAN agreed during Negotiations: (i) to generate sufficient internal cash to cover at least 3.5 percent of its 1994-95 total investment program--excluding IDC--by end-1995, 3.8 percent of its 1994-96 total investment program by end-1996, 8.1 percent of its 1994-97 total investment program by end-1997, 11.2 percent of its 1994-98 total investment program by end-1998, and 12.7 percent of its 1994-99 total investment program by end-1999[13/]; (ii) to substantially achieve the annual targets for its working ratio presented in Annex 20 and, under all circumstances, not to allow this ratio to fall below 60 percent; (iii) to revalue its fixed assets and incorporate the study's recommendations into 1995 end-year financial statements, and undertake subsequent studies every three years to determine the necessity of further physical revaluations; (iv) to increase its employee productivity, as measured by

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[12/] The employee productivity gain of 8.5 percent results from assuming that CESAN will keep the current number of permanent employees at its December 1993 level. The employee productivity gain of 7.5 percent which underlies the Base Scenario, results from assuming that CESAN will freeze the current number of employees in administration and water supply operations, and that one additional employee will be added to sewerage operations for every 1,500 new sewerage connections (see Annex 13).

[13/] The Bank expects CESAN to cover, under normal conditions, 17 percent of its total 1994-1999 investment program by end-1999 through its internal cash generation, that is, to have a financial performance along the lines contemplated by the Base Scenario presented in Annex 13. However, under macroeconomic conditions that may negatively affect CESAN's financial performance, the 13 percent resulting from the B2 Scenario will be acceptable. The B2 Scenario is responsible for the minimum required percentages.

the number of water and sewerage connections per permanent employee, to at least 242 by June 30, 1996, and to at least 324 by end-1999; (v) to keep salaries and other permanent employee costs below 70 percent of operating costs (excluding depreciation); (vi) to achieve a debt service coverage ratio no lower than 1.5; and (vii) to carry out an action plan satisfactory to the Bank, to achieve the commercial, physical, operational, environmental, and financial performance targets presented in Annex 20.

Financial Transfers of the State

81. The State of Espírito Santo is one of the few Brazilian states free of debts in arrears. Although it has recently experienced a slowdown in tax revenue, due to the sluggish economy and the lax collection efforts, it has had sufficient revenue to cover its administrative costs, debt service, and a stable level of investments. A summary of financial resources transferred by the State to CESAN is presented in Annex 14. The State has recognized the water and sanitation sector as one of its priority areas, and has been transferring larger amounts of financial resources to the sector during the last few years. The transfers to the sector increased from an annual average of about US$1 million before 1990 (about 0.2 percent of the State's total revenue) to about US$14 million in 1991 and US$11 million in 1992 (about 2 percent of the State's total revenue). These transfers were made either directly to CESAN--to increase its working capital and/or cover total or partial payments of its debt service--or indirectly as counterpart funds to FAE loans[14/]. State transfers to CESAN during the period 1994-1999 are forecast to average US$19.7 million per year (the Bank project and other projects already contracted), slightly above the 1991 and 1992 level. The State of Espírito Santo has given top priority to this investment project, as well as to three other projects that also require counterpart funds[15/], and budgeted the necessary resources to comply with the counterpart fund requirements during the project execution period.

82. During Negotiations, the State agreed to provide up to 34 percent of the project's direct cost as counterpart funds. The State's counterpart requirement would be much smaller if the projected tariff increases are realized, and CESAN succeeds in enhancing its productivity as discussed in the previous section. To that end, the State of Espírito Santo also agreed during Negotiations: (i) to allow CESAN to set water and sewerage tariffs at levels that allow it to cover operating costs, debt service, and to generate adequate internal cash consistent with the project's financial plan; and (ii) to promote and support any action that would improve CESAN's management and operational systems. Furthermore, the European Investment Bank (EIB) showed interest in financing a major part of the State's counterpart for the project. The preparation of the EIB loan is underway, and if successful, will largely facilitate the State's ability to fulfill its counterpart requirement.

J. Environmental Impact

83. The project will have a significant positive impact on the environmental quality of the rivers, estuarine ecosystems, and recreational beaches of Grande Vitória and Guarapari. All subcomponents are designed to upgrade the deteriorated conditions existing in these areas, especially in relation to water resources, and to set up efficient environmental management for the future. The project will help to extend sewerage and build ten sewage treatment plants, expanding sewerage coverage in Espírito Santo from 11 percent to 43 percent of its population. Water quality modelling efforts have shown that there is a potential for a substantial reduction of coliform levels in key sensitive points in

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[14/] The State Water & Sewerage Fund (FAE) is expected to be abolished and CESAN's existing debt obligation with FAE will be capitalized.

[15/] The other three projects that also require counterpart funds from the State between 1994-1999 are: the Bank-assisted Basic Education Project "SEDU" (US$22.5 million); BNDES "Transcol II" (US$27.6 million); and the already contracted IDB Transportation project (US$15.6 million).

the area of influence of the project. Existing and projected environmental quality conditions show that without the project, pollution levels will have severe impacts on health and natural resources and impair water use in the project area. On the other hand, improved water quality conditions resulting from project implementation will have positive impacts on health, natural ecosystems, tourism potential, and quality of life. Economic valuation of those positive environmental impacts proved to be of great importance for the area (see Annex 16). About 33 percent of the population to benefit from sewerage services has a household income of less than 3 MS. Furthermore, the contingent valuation study showed that improved water quality conditions of public beaches will especially benefit the poor populations of Grande Vitória and Guarapari, by making these beaches more accessible for recreation.

84. Negative environmental impacts due to project siting and construction are expected to be minimal. Careful environmental screening of proposed sites for wastewater treatment plants and effluent discharge points has resulted in project modifications and alternate sitings which have been incorporated into final designs. There are no land use conflicts at the proposed sites and there will be no need to relocate families. One proposed site with clay deposits presented some conflicts with traditional artisan communities which produce ceramic pots (*panelas*). Improved project siting and design, together with an adequate compensatory program incorporated in the project, will guarantee to these communities their livelihood. Residual impacts are related to local water quality and potential eutrophication problems in the area of influence of discharge points. Impacts during construction will be typical disturbances pertaining to this type of project. Mitigation plans to manage possible impacts due to treatment plant failures have been prepared.

85. To assess the project's environmental impact, CESAN was required by federal laws to prepare environmental impact reports (RIMAs) which follow State guidelines and are approved by SEAMA. The RIMA prepared for this project, in accordance with Bank guidelines, was approved by SEAMA and found satisfactory by the Bank. A summary of this report (available in Project Files) is presented in Annex 15. Future sub-projects eligible under this project should be subject to an environmental assessment (see Annex 18) and comply with the agreed environmental monitoring indicators presented in Annex 20.

K. Poverty Alleviation and Affordability

Urban Poverty Impact

86. The water supply component of this project is clearly targeted towards the poor. Households earning two Minimum Salaries (MS) or less will account for about 56 percent of project beneficiaries, while about 78 percent will be households earning three Minimum Salaries (MS) or less--the Brazilian definition of urban poor. Beneficiaries of the sewerage component have a broader income distribution: about 18 percent comprise households earning less than two MS and about 33 percent comprise households earning less than three MS. This apparent inconsistency results from the fact that, at present, 91 percent of the population served by CESAN is connected to a water supply system but only 11 percent is connected to a sewerage system. The project expects to increase service coverage levels to 93 percent for water supply and 43 percent for sewerage.

87. In addition to connecting new customers to CESAN's systems, the water supply component will also improve service quality. Almost two thirds of CESAN's customers are currently subject to rationing. Under the project, more than half of CESAN's customers will receive a 24 hour service, and the remainder will experience a considerable reduction in the number of hours of rationing. About 44 percent of the areas under rationing are in neighborhoods whose households earn less than 2 MS, and close to 32 percent of the people in these areas receive less than 4 hours of service a day (see Figure 1). The population currently receiving interrupted service has been forced to reduce consumption and resort to other means, such as storing water in permanent or semi-permanent containers. Figure 2 below demonstrates the impact of the project on the urban poor, who will comprise about 60 percent

of the beneficiaries from water supply improvements. As can be seen, the poor will benefit substantially from a greatly improved distribution of service hours. The number of poor households with less than 8 hours of rationing (78 percent without the project) will decrease to about 38 percent with the project.

88. By collecting and treating a large portion of the volume of sewage that is currently dumped untreated into the water bodies of Grande Vitória and Guarapari, the project will avoid serious health and environmental consequences. The poor suffer more from unhealthy environments as they live in areas where untreated sewage runs through street drains, and where the lack of sewerage facilities is more severe. This group, therefore, tends to benefit the most from investments in collection and treatment of sewage, even when they represent a small proportion of the population that will actually be connected to a sewerage system. In addition, the urban poor will also benefit from sewage collection and treatment in terms of cleaner beaches that they can easily access and an overall healthier and pleasant environment.

89. **Stated Priorities of the Poor.** Following the results of a field survey undertaken for the project, about 56 percent of the households earning less than 2 MS per month stated that water supply was their number one priority (see Annex 16). The second stated priority was health and the third was solid waste collection; all services related to the water supply and sanitation sector. Therefore, this project is correctly addressing the key needs of the urban poor in the State of Espírito Santo.

Figure 1. Current Distribution of Service Interruptions

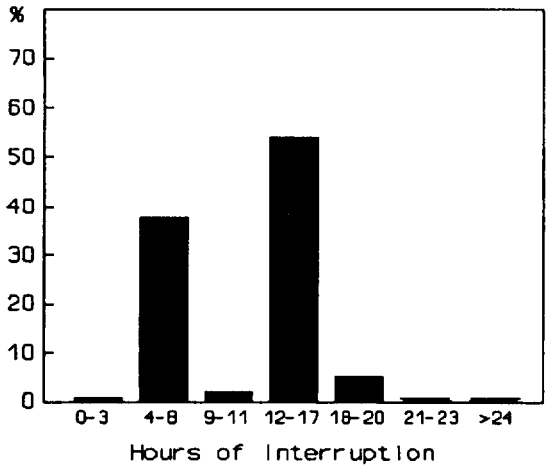
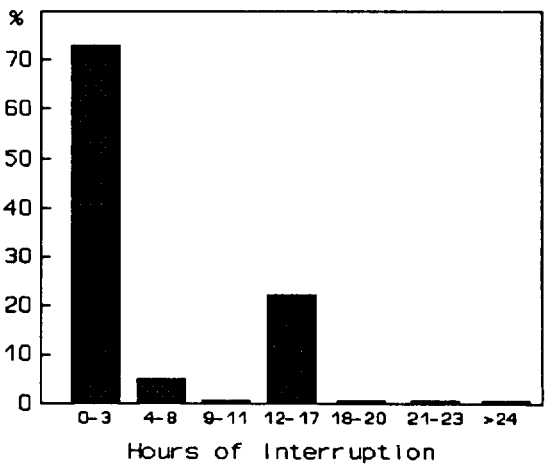


Figure 2. Expected Distribution of Service Interruptions After Project Implementation



Affordability

90. As discussed in Annex 10, CESAN applies a minimum consumption level (MCL) of 10 m3/month to its residential consumers, and charges differential tariffs in accordance with its own socio-economic classification (see paras. 95 to 97). The MCL, which is intended to provide enough water to satisfy basic needs and maintain minimum health and sanitary conditions, is charged a minimum monthly charge (MMC). The MMC for water consumption for residential customers varies from about 2.4 percent to 6.4 percent of one MS--US$85 as of November 1, 1993. The combined

MMC for both water and sewerage services for residential consumers varies from about 3.6 percent to about 9.6 percent of one MS. The combined MMC is well below the range of acceptability for Bank standards. (A standard commonly accepted in past Bank projects has been to keep water and sanitation charges under 5 percent of three minimum salaries or 15 percent of one MS).

91. Furthermore, the willingness to pay (WTP) for water supply and sewage collection was investigated using a WTP survey and contingency valuation (CV) methodology. The results indicate that the poor are willing to pay between 2.9 percent and 3.9 percent of their income for water supply services. In the case of sewerage, the results of the CV study indicate that WTP values for the poor amount to about 2.0 percent of their income. Current expenditures on water supply and sewerage by poor households already connected to the service are on the order of 3.8 percent to 5.1 percent of their family income, as estimated by the CV study. The demonstrated WTP values by the poor (combined water supply and sewerage), which are between 4.9 percent and 5.9 percent, are well above the range of present household expenditures.

92. **CESAN's Socio-Economic Classification.** The residential customers of CESAN are classified in accordance with the physical characteristics of their dwellings as follows: basic, popular, standard, superior, and special. Factors such as the size of the dwelling, the construction materials, and the overall appearance are used in this classification to allocate points to each residence. For example, a dwelling occupying less than 50 m^2 is awarded 10 points, while a dwelling occupying more than 250 m^2 is awarded 300 points. Similarly, a dwelling with one sanitary facility is awarded 10 points, while a dwelling with more than three sanitary units scores 250 points. A summation of the scores a dwelling receives from such a survey is then made and a final classification is awarded. The current distribution of CESAN's socio-economic classification is shown in Annex 10, Table 2.

93. The physical characteristics of dwellings does not approximate very well the income distribution at the household level (as indicated from survey results and regression analysis). They are, however, as CESAN indicates, a good proxy for income distribution at the aggregate level (e.g., at the level of a neighborhood or municipality). More work needs to be done to improve this classification scheme, making it a better tool for targeting.

94. A simplified classification system, that uses three categories instead of the current five, could make CESAN's tariff policy more appropriate for targeting purposes. Such a classification would distinguish between a poor dwelling (the current basic category), a moderate to average dwelling (currently popular) and an affluent dwelling (currently standard, superior, and special). During Loan Negotiations, both CESAN and the State agreed to incorporate suggested tariff policy modifications by December 31, 1994, to make CESAN's tariffs even more affordable to the poorest segment of the population (see para. 63).

L. Project Benefits

Economic and Financial Benefits

95. At the end of the implementation period (December 1999), the project will have directly benefitted about 640,000 people with potable water (395,000 people with in-house connections and 245,000 with fewer hours of rationing) and about 770,000 people with sewerage and sewage treatment services--mainly in the urban areas of Grande Vitória and Guarapari. After 1999, about 775,000 additional people will also benefit from water production and transmission subprojects, and 450,000 additional people from sewage collection and treatment subprojects. It is estimated that about 78 percent of the beneficiaries of water investments and 33 percent of the beneficiaries of sanitation investments are in the poverty group--households earning less than 3 Minimum Salaries (MS) per month.

96. The principal project benefits will include: (i) improved water quality in the Bay of Vitória and the Passagem Channel, and environmental recovery of beaches at Camburi, Iate, Jurema, Aterro, and Guarapari, enhancing tourism activities and other water uses and improving recreational areas for the urban poor; (ii) improvement of quality of life and environmental conditions of urban areas surrounding urban drainage channels and overall improvement and preservation of the urban environment; (iii) improved hygienic conditions--leading to decreased infant mortality and reduced incidence of water-borne diseases; (iv) the preservation of water supply sources for the urban areas of Grande Vitória and Guarapari; (v) the preservation of water quality in coastal ecosystems such as mangroves and coastal lagoons; and (vi) a temporary but significant generation of employment for unskilled labor. An additional project benefit will be the institutional strengthening of SEAMA and CESAN.

Rates of Return

97. The Internal Economic Rates of Return (IERRs) are calculated considering the Bank project as part of CESAN's overall investment program. The data used for the analysis include: (i) investment costs which consist of the Bank project, other CESAN investments, and all complementary works necessary to achieve the full benefits of the project; (ii) the projected operating and maintenance costs; and (iii) the economic benefits of the project. A project life of 30 years is used in all IERR calculations. The IERR for the water supply component is 35 percent, including the operational development program. The IERR for the sewage collection and treatment component is 13 percent considering only the benefits from sewage collection; 31 percent considering sewage collection, recreation, and environmental protection benefits; and 32 percent considering the entire group of benefits--sewage collection, recreation, environmental protection, tourism, and health. The weighted average IERR of CESAN's total investment program (water supply, operational development, and sewage collection and treatment) is estimated at 33 percent. The IERRs for the entire project and for each independent component are quite robust and compare favorably with the 10 percent opportunity cost of capital (OCC) assumed in the analysis. (See Annex 16, Section D, for a detailed discussion of the project's IERR.)

98. The Internal Financial Rates of Return (IFRRs) were also calculated for different regions and projects using future streams of investment and operating costs, as well as revenues, expressed in constant market prices (US$ as of June 1993). Investment costs include all complementary investments necessary to achieve the full benefits of the project. The life of the project was estimated at 30 years, and CESAN's average tariff was considered to increase 5 percent in 1994, 1995, and 1996. All IFRRs are calculated on a pre-tax basis. The IFRRs for Grande Vitória are estimated at: 18 percent for the water project; 12 percent for the sewage collection and treatment projects; and 15 percent for the combined water and sewerage project. The IFRR for Guarapari's sewage collection and treatment projects is estimated at 5 percent[16]. The IFRR for Guarapari's sewerage is lower than in Grande Vitória because the required initial investment is higher than in Grande Vitória. The weighted average IFRR for the entire project is 15 percent. These IFRRs compare favorably with the 10 percent opportunity cost of capital (OCC) utilized in the analysis, and are moderately sensitive to increases in costs or decreases in revenues. For example, an increase of 10 percent in investment and operating costs, combined with a 10 percent decrease in revenues, reduces the IFRR of the combined water and sewerage project of Grande Vitória to 11 percent.

M. Risk Assessment

99. The main project risks relate to Brazil's macroeconomic performance and political conditions. Other risks pertain to a lack of effective abatement of water pollution from industrial sources in specific areas, and a deterioration of CESAN's internal financing capacity resulting from operational inefficiency

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[16] The FRR for Guarapari's water projects is not presented here, as the engineering design of the projects are being revised.

and inadequate tariff adjustments. Furthermore, sector and project priorities could change as a result of the 1994 gubernatorial election, and the amount of State counterpart funds for the project could be decreased accordingly. The political uncertainty is already somewhat diminished by a broad consensus that the long-neglected basic sanitation sector urgently needs support and a fundamental reorientation of policies and practices. It is also minimized by the consistency between project objectives and the commitment of the federal and the State governments to improve the environment, to increase the efficiency of the public sector, and to strengthen public sector finances. In relation to CESAN's internal financing capacity, achieving the targeted tariff level and operational efficiency is crucial to the success of the project (see para. 79). Strong support from the State to help attain the projected tariff level and operational efficiency of CESAN and the institutional strengthening of both SEAMA and CESAN will help achieve expected benefits and avoid potential risks. The risk of inadequate counterpart funding is largely reduced by the intention of the EIB to finance a large part of the State counterpart (see para. 82)[17/]. To further minimize project risks: (i) a continuous dialogue will be maintained with the present and future authorities, both at the federal and local levels, to assure understanding of and support for the project; (ii) project implementation would be closely supervised; (iii) complementary actions in industrial pollution control, municipal solid waste collection and disposal, and management of water resources and protected areas will be developed through SEAMA's institutional strengthening program; and (iv) a mid-term review will assess project implementation performance.

IV. PROJECT IMPLEMENTATION

A. Implementation Arrangements

100. The borrower will be the State of Espírito Santo. CESAN and SEAMA will be the executing agencies. Bank funds will be transferred from the State, through a financial agent, to CESAN on the same terms and conditions as the Bank loan, including the foreign exchange risk. SEAMA will receive the proceeds of the Bank loan through direct disbursements from either the loan account or the special account. Implementation of the project will be coordinated by the same Project Management Unit (PMU) established within CESAN for project preparation. CESAN will agree on a Contract-Plan with the State Government, and both CESAN and SEAMA will comply with agreed-upon criteria, including evidence of adequate technical and financial capacity. Subprojects will be appropriately staged to obtain the least-cost solution, based on appropriate feasibility studies. Subproject justification will be based on a comparison of the project's long-run marginal cost (LRMC) vis-a-vis CESAN's average tariff. CESAN, in particular, will comply with a set of physical, environmental, operational, and financial indicators, including the generation of enough internal financial resources to cover all its operating and maintenance costs, depreciation, and debt service, as well as an increasing percentage of its multiyear investment program. Expanding the water supply and sanitation services to poor families will require the formulation of integrated sanitary solutions involving appropriate low-cost technologies and substantial community participation. Two workshops will be held for purposes of orientation and explanation of Bank procedures: the first not later than two months after Loan Signature and the second before mid-1995. The project's implementation period will be 1994-1999. The project completion date will be June 30, 1999.

101. The legal documents will be as follows: (i) a Loan Agreement between the Bank and the State; (ii) a Guarantee Agreement between the Bank and the federal Government; (iii) a Project Agreement between the Bank and CESAN; (iv) a Subsidiary Loan Agreement between the State and CESAN, through a commercial Bank; and (v) a Contract-Plan between CESAN and the State (see Annex 17).

[17/] The EIB's financing will be especially helpful if it is provided--as it is being planned, in the earlier years of project implementation, when the State counterpart fund requirement is significant.

Prior to Loan Negotiations: (i) the State renegotiated its debt with the Federal Government; (ii) CESAN and the State agreed on the content and presentation of an improved Contract-Plan; (iii) CESAN prepared a plan to improve the operation of its internal auditing; (iv) a copy of the agreement formalizing CESAN's exemption of amortization payments to the FAE, was submitted to the Bank; (v) CESAN agreed to revalue its fixed assets based on terms of reference satisfactory to the Bank; and (vi) both CESAN and the State agreed to have the Contract-Plan signed by September 30, 1994. And prior to Loan Effectiveness, CESAN should have signed with the State the Subsidiary Loan Agreement.

102. Financial resources will flow as follows: (i) Bank funds will be disbursed to a Special Account opened by the State in a commercial bank; (ii) both CESAN and SEAMA will submit to the PMU receipts as evidence of expenditures made; and (iii) upon request from the PMU, the Borrower will reimburse either CESAN or SEAMA as applicable (see Annex 17).

B. Subproject Selection Criteria

103. Each proposed subproject will correspond to the least-cost solution, and will be the object of a feasibility study prepared by CESAN or SEAMA in accordance with the guidelines for evaluation of subprojects presented in Annex 18. Each feasibility study will be reviewed by the PMU, which will submit it to the Bank for its comments. The analysis of a given subproject seeks to establish the priority of the proposed components, its consistency with sector policies, and its contribution to improve the delivery of services in a given locality. This analysis also aims to ascertain that neither the subproject nor its components would adversely affect the environment and that their benefits equal or exceed their costs. The justification of each individual subproject will be based on the LRMC vis-a-vis CESAN's average tariffs. LRMC will be calculated on the basis of the incremental demand it will satisfy, the estimated investment cost--including complementary works, and the estimated operation and maintenance costs (see Annex 11).

104. Subprojects satisfying the technical, environmental, and social conditions indicated in the guidelines presented in Annex 18, but not complying with the financial and economic conditions (i.e., presenting an average water/sewerage tariff lower than the specified percentage of the marginal cost of providing the service), may be accepted by the Bank on a case-by-case basis. The analysis should, however, explicitly address the following issues: (i) the lack of alternative and feasible solutions; (ii) the difficulty of recovering costs through tariffs; and (iii) the impact on poverty alleviation and health conditions. These subprojects are likely to be in towns where urban poverty prevails and large investments are needed to compensate for the lack of adequate investments in the past.

105. During Loan Negotiations, CESAN agreed to select and design subprojects outside the Bank-financed part of its investment program using the same eligibility criteria agreed for subprojects under the Loan.

C. Project Supervision

106. The project will require higher than normal supervision by the Bank, to ensure its successful implementation. Extensive project reviews, to be held each year, will focus on the execution of the institutional strengthening component, compliance with procurement issues, and CESAN's performance as measured by its compliance with agreed physical, operational, environmental, and financial monitoring indicators. CESAN has executed Bank-financed projects under sector loans made to, and directly supervised by, either BNH or CEF, but has not implemented a Bank-financed project. To ensure the timely procurement of goods and works and contracting of consultants' services, special attention will be given to procurement issues. Both CESAN and SEAMA agreed to use the Bank's Standard Procurement Documents. The supervision plan is presented in Annex 19.

107. A mid-term project review will: (i) assess progress made by CESAN and SEAMA in carrying out their institutional strengthening programs, as well as the extent of implementation of proposed recommendations; (ii) evaluate progress made by CESAN in carrying out plans to improve its commercial performance, as measured by their degree of compliance with agreed physical, operational, environmental, and financial monitoring indicators (see Annex 20); (iii) assess the effectiveness of the training and institutional strengthening to be provided to SEAMA and CESAN; and (iv) verify compliance with covenants of the Loan and Project Agreements. During the mid-term review, special importance will be given to progress made in the institutional restructuring of the water and wastes sector in the State, and to improvements achieved in reducing UFW and in the overall financial performance of CESAN. During Negotiations, agreement was reached with the State and CESAN, to hold the mid-term project review within two years after Loan Effectiveness.

D. Reporting and Monitoring

108. Progress reports will describe and compare past achievements to appraisal projections, review the compliance with the monitoring indicators detailed in Annex 20, and provide a critical assessment of problems and issues arising during project implementation. They will also propose adjustments and remedial actions in case of unsatisfactory progress. During Loan Negotiations, agreement was reached with the State and CESAN to ensure that the PMU will submit complete and partial progress reports, as well as a final report to the Bank. The complete progress reports, to be submitted to the Bank by April 15 and October 15 of each year, will include an assessment of the advancement of the physical works and other activities (such as those included in the project's institutional strengthening component) either completed or under execution by those dates, an analysis of CESAN's performance vis-a-vis the agreed monitoring indicators (Annex 20), a critical assessment of problems and issues arising during the period under analysis, proposals on adjustments and remedial actions required in case of unsatisfactory progress, and general financial projections. The complete progress reports to be submitted to the Bank by October 15 of each year will also include specific details on the investment plan for the upcoming year. The partial progress reports, to be submitted to the Bank by January 15 and July 15 of each year, will only include an assessment of the advancement of the physical works and other activities either completed or under execution by those dates. The final report, to be submitted to the Bank not later than six months after the loan closing date, will include an analysis of the project's key issues based on a retrospective assessment of project implementation from the perspective of the State and CESAN.

109. The set of physical, operational, environmental, and financial targets agreed during Appraisal (see Annex 20, Attachment 1) will be used as monitoring indicators and constitute the basis for project reviews and supervision, including the mid-term review. Five of those indicators (number of water and sewerage connections per employee; personnel costs as a percentage of operating costs--excluding depreciation; working ratio; debt service coverage; and internal contribution to investment) will be included as contractual obligations in the Legal Documents. CESAN's performance will be judged by comparing its actual results with the entire set of agreed indicators presented in Annex 20, including the complementary set of indicators selected for monitoring the expected long-term benefits of the project. In addition to the five indicators listed above, particular importance will be given during supervision and project reviews to the UFW percentage, the accounts receivable comparator, and the percentage of water connections with meters. Substantial compliance with the remaining group of monitoring indicators presented in Annex 20, will also be a contractual obligation under the Project Agreement. This set of monitoring indicators will also be incorporated into the Contract-Plan to be agreed between the State and CESAN.

110. As aquatic ecosystems response to domestic wastewater pollution load reduction is quite uncertain in time, and even more so when there are other sources of pollution as is the case of the project area, the environmental indicators will target measurable parameters, namely: wastewater

treatment plant efficiencies (to guarantee design goals and theoretical water quality model predictions); water quality monitoring points, frequency and parameters (to guarantee sufficient data to monitor environmental improvement and to establish long-term adjustments in the Espírito Santo's pollution control program); and industrial pollution load reduction from existing uncontrolled industries (to guarantee reduction of other sources of pollution in specific locations of the area of influence of the project).

E. Procurement

111. Civil works will represent about 60 percent of the total project cost, equipment and materials about 33 percent, and consultant services--including studies, technical assistance, training, completion of engineering designs, and project supervision and management--the remaining 7 percent. All contracts which can be packaged to exceed the equivalent of US$4 million for civil works and US$250,000 for equipment or materials will be procured on the basis of International Competitive Bidding (ICB). The Bank's Standard Bidding Documents will be used for procurement under ICB, with the necessary country and project changes agreed between the Bank and CESAN. For purposes of bid evaluation, domestic manufacturers will be given a margin of preference under ICB contracts for goods, in accordance with Bank Guidelines and following the special arrangements agreed between the Bank and the federal government of Brazil. All other contracts for civil works and equipment or materials not exceeding aggregate amounts of about US$60.4 million and US$0.8 million, respectively, will be procured under nationally advertised Local Competitive Bidding (LCB) procedures acceptable to the Bank. Procurement under LCB will use standard bidding documents under preparation by CESAN, based on a bidding document already discussed and agreed between the Bank and the company for the purpose of contracts to be considered for retroactive financing. The standard document submitted to the Bank before Loan Negotiations, reviewed in accordance with Bank comments, will be used for all remaining LCB. Under these assumptions, 78 percent of works and materials will be procured under ICB. Foreign firms will be allowed to participate in LCB.

112. Project costs by procurement method are presented in Table 3. Procurement planning was given a high priority to ensure a smooth and successful implementation of the project. In this regard, a detailed analysis of individual contract values and packaging was undertaken during project preparation and appraisal. Although CESAN has considerable experience in carrying out procurement, it is not fully familiar with Bank procedures. However, CESAN was fully involved during the analysis of procurement planning, gaining considerable experience and understanding of Bank procurement procedures. In addition, during the project launching seminar special attention will be given to clarifying and finalizing procurement implementation details. Annex 21 presents a summary of the detailed packaging of bids agreed for procurement purposes.

113. Consultants for detailed engineering and training, project management and supervision of construction, and the various studies and technical assistance planned under the institutional strengthening component, will be selected and hired in accordance with the Bank's **Guidelines for the Use of Consultants** (August 1981). When provided by firms, consulting services below the equivalent of US$100,000 will be subject only to the Bank's prior review of the terms of reference and the qualification of the selected consultant. When provided by individuals, consulting services below US$50,000 will also be governed by the same procedures.

114. All procurement under ICB (about 72 percent of total project costs) will be subject to the Bank's prior review of advertising, bidding documents, bid evaluation, and contract awards. In the interest of expediting project execution, all procurement under LCB will be subject to ex-post review by sampling. However, to ensure that adequate procurement procedures are followed, the Bank will review and approve--irrespective of the amount, the first two contracts under LCB for goods and for works. With these arrangements, the Bank's prior review of procurement procedures and documents will cover more than 80 percent of total Bank financed contracts. All procurement documents will be

subject to periodic and selective ex-post review by the Bank and external auditors. If the Bank determines in the review by sampling that procurement is inconsistent with agreed procedures, no expenditures for such items will be financed out of the proceeds of the Loan, and the Bank may cancel an equivalent amount of the Loan.

Table 3
Project Costs by Procurement Method [a]
(US$ millions)

PROJECT ELEMENT	ICB	LCB	OTHER	TOTAL
Civil Works	122.9 (49.2)	60.4 (24.2)		183.3 (73.4)
Equipment and Materials	99.4 (59.7)	0.8 (0.3)		100.2 (60.0)
Consulting Services			24.5 (20.6)	24.5 (20.6)
Total	222.3 (108.9)	61.2 (24.5)	24.5 (20.6)	308.0 (154.0)

[a] Figures in parentheses are the respective amounts financed by the Bank loan.

F. Disbursement

115. The loan will be disbursed as follows: (i) 100 percent of foreign expenditures for civil works and imported equipment and materials; (ii) 45 percent of local expenditures for civil works, equipment, and materials; (iii) 100 percent of expenditures for services of foreign consultants; and (iv) 85 percent of expenditures for services of consultants domiciled in Brazil. To expedite project execution, a Special Account in the amount of US$8 million will be established in a commercial bank, acceptable to the Bank, to cover project expenditures. Loan disbursements against contracts for civil works below the equivalent of US$4 million, for goods below the equivalent of US$250,000, for consultant services provided by firms below the equivalent of US$100,000, and for consultant services provided by individuals below the equivalent of US$50,000 will be made under the Statements of Expenditure procedure prepared and certified by the PMU. Detailed documentation will be retained by CESAN and SEAMA for inspection during supervision missions and for audit by their external auditors. No force account works are envisaged. The estimated schedule of disbursement provides for loan disbursement in six years (see Annex 22). The Closing Date will be December 31, 1999.

G. Advanced Contracting and Retroactive Financing

116. The Bank loan will finance works to be carried out during the period 1994-1999. Some of the works are urgently needed, for instance to rehabilitate and expand systems and to begin UFW control programs, and these are scheduled to start early in 1994. Other works are parts of annual investment programs with expenditures spread over the agreed investment period. In view of these needs, the project will provide for the following: (i) advanced contracting as of January 1, 1994, and amounting to US$20 million; and (ii) retroactive financing up to US$8 million for eligible expenditures made not more than 12 months prior to the Loan Signing date. Advance contracting and retroactive financing will be subject to the following conditions: (i) the subproject should comply with the agreed eligibility criteria; (ii) Bank procurement guidelines should have been followed; and (iii) disbursements claims

against retroactive financing should be submitted no later than 90 days after the Loan Effectiveness date.

H. Accounting and Auditing

117. Prior to Loan Negotiations, CESAN should have terms of reference ready for an assessment of its accounting and financial system, including an evaluation of its internal audit procedures. It was agreed, during Loan Negotiations, that external independent auditors will carry out an audit of the following: (i) project accounts; (ii) financial statements of CESAN; (iii) Statement of Expenditures; and (iv) the Special Account. It was also agreed at Loan Negotiations that audit reports corresponding to each year will be submitted to the Bank no later than June 30 of the following year.

V. AGREEMENTS TO BE REACHED AND RECOMMENDATION

118. Prior to Loan Negotiations the State submitted to the Bank a copy of the agreements between: (i) the State and CESAN on the capitalization of CESAN's debt with FAE (para. 101); and (ii) the State and the federal government on the renegotiation of Espírito Santo's debt (para. 101).

119. Prior to Loan Negotiations CESAN submitted to the Bank:

(a) TOR for studies on financial administration and internal auditing, information systems, and total quality (para. 101);

(b) a copy of the agreement between CESAN and the Association of *Paneleiras* (Annex 15);

(c) a complete program to comply with the conditions required in the environmental licenses issued by SEAMA (Annex 15);

(d) a study on the financial effect in the medium-term of the introduction of a voluntary retirement program (para. 72);

(e) TOR for a fixed assets revaluation study and a draft contract for hiring a consultant to execute it (para. 76); and

(f) complete information on tariffs and service costs for 1993.

120. Prior to Loan Negotiations the State and CESAN submitted to the Bank a draft of the Contract-Plan with general policies, objectives, and operational and financial indicators that covers the whole project period (1994-1999), and a draft of a specific Contract-Plan that covers the first year of the project (para. 101).

121. During Loan Negotiations, the State of Espírito Santo agreed:

(a) to authorize, permit, or promote necessary improvements in CESAN's management and operational systems, and if necessary, any adjustment in the company's tariff rates to ensure continual compliance with the agreed financial performance indicators, including the generation of adequate internal cash consistent with financial plans for the project (para. 82);

(b) to ensure timely provision of counterpart funds as envisaged in the financing plan of the project (paras. 66 and 82);

(c) to take any administrative action required to support CESAN to adjust both current and overdue accounts cumulatively for inflation, and to eliminate overdue bills (para. 82);

(d) to have the Contract-Plan signed by September 30, 1994 (para. 101);

(e) to hold a Mid-Term Review within two years after loan effectiveness to assess completion of studies and degree of implementation of proposed recommendations; to evaluate progress made by CESAN in carrying out plans to improve its commercial performance; to assess the effectiveness of the training and institutional strengthening to be provided to SEAMA; and to verify compliance with covenants of the Loan and Project Agreements (para. 107); and

(f) to submit to the Bank progress reports by January 15, April 15, July 15, and October 15 of each year (paras. 67 and 108);

(g) to have independent audits of project accounts, CESAN's financial statements, statement of expenditures, and the Special Account, and submit the results to the Bank not later than June 30 of the following year (para. 117).

122. During Loan Negotiations, CESAN agreed:

(a) to select all individual subprojects, including those outside the Bank-financed part of its investment program, based on agreed subproject selection criteria (para. 80);

(b) to substantially achieved the annual targets for its working ratio presented in Annex 20 and, under all circumstances, not to allow this ratio to fall below 60 percent (para. 80);

(c) to take all measures necessary to generate sufficient internal cash to cover at least 3.5 percent of its 1994-95 total investment program--excluding IDC--by end-1995, 3.8 percent of its 1994-96 total investment program by end-1996, 8.1 percent of its 1994-97 total investment program by end-1997, 11.2 percent of its 1994-98 total investment program by end-1998, and 12.7 percent of its 1994-99 total investment program by end-1999 (para. 80);

(d) to refrain from changing annual investments during the project implementation period by more than 20 percent of the investment amounts originally agreed, without prior Bank agreement (para. 60);

(e) to gradually reduce personnel costs by: (i) improving employee productivity, as measured by the number of water and sewerage connections per employee, which should increase to at least 254 by end-1996, and at least 324 by end-1999 (para. 80); and (ii) maintaining salaries and other permanent employee costs below 70 percent of operating costs (excluding depreciation), through December 31, 1999, and thereafter (para. 80);

(f) to maintain a debt service coverage ratio not less than 1.5 (para. 80);

(g) to carry out programs satisfactory to the Bank to improve its performance vis-a-vis agreed physical, operational, environmental, and financial targets (paras. 80 and 109, and Annex 20);

(h) to prepare and submit to the Bank not later than September 30, 1994, a tariff proposal based on Bank recommendations and an action plan for its implementation, and to put into effect the agreed recommendations by December 31, 1994 (paras. 64 and 94);

(i) to adjust overdue accounts for inflation or take other measures which will reduce the financial losses resulting from overdue bills by December 31, 1994 (para. 73);

(j) to prepare a detailed study on the amounts and likely fiscal implications of a fixed asset revaluation before June 30, 1995, and incorporate the results into the audited financial statements of fiscal year 1995. This study should be repeated every three years to determine the necessity of further physical revaluations (paras. 76 and 80); and

(k) to have the Contract-Plan signed by September 30, 1994 (para. 101), and to annually review it with the Bank and the State, not later than year-end (para 35).

123. Prior to Loan Effectiveness, CESAN should have signed with the State the Subsidiary Loan Agreement (para. 101).

124. **Recommendation.** Subject to the above conditions, the project is suitable for a Bank loan of US$154 million equivalent, to be repaid over a period of 15 years at the Bank's standard variable rate, with a five-year grace period and a loan amortization schedule based on level repayments of principal. Advanced contracting for up to US$20 million and retroactive financing for up to US$8 million for expenditures incurred after January 1, 1994, is also recommended (para. 116).

BRAZIL

ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT

STAFF APPRAISAL REPORT

ANNEXES

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BANK LOANS TO BRAZIL FOR WATER SUPPLY AND SEWERAGE

YEAR	LOAN No.	AMOUNT US$ Million	BORROWER	PURPOSE	Status as of 04/30/94		COMMENTS
					Commit.	Disburs.	
1971	757-BR	22.0	City Water Co.	Sao Paulo water distribution and storage.	100%	100%	Project Performance Audit Report (PPAR) dated 04/04/80.
1971	758-BR	12.0	City Water Co.	Sao Paulo sewage collection and disposal.	100%	100%	Idem. Loan amount reduced from US$15.0 million.
1974	1009-BR	36.0	BNH	Water supply and sewerage in the state of Minas Gerais.	100%	100%	Project Performance Audit Report dated 06/30/83.
1976	1309-BR	40.0	BNH	Water supply and sewerage in the state of Minas Gerais.	100%	100%	Project Completion Report (PCR) dated 04/22/85.
1978	1525-BR	52.5	BNH	Sewerage collection & disposal in metropolitan São Paulo.	100%	100%	US$57.5 million canceled 1/85. PCR dated 11/18/87.
1979	1656-BR	100.0	BNH	Water supply and sewerage in the states of Bahia, Ceará, and Pernambuco.	100%	100%	Project Completion Report dated 02/27/87.
1980	1823-BR	130.0	BNH	Water supply and sewerage in the states of Paraná, Santa Catarina and Rio Grande do Sul.	100%	100%	Project Performance Audit Report dated 01/14/88.
1980	1850-BR	139.0	BNH	Third Minas Gerais Water supply and sewerage.	100%	100%	Project Completion Report dated 02/23/90.
1981	1970-BR	180.0	BNH	Multi-state water supply & sewerage project in the states of Amazonas, Goias, Mato Grosso do Sul, Pará, Paraiba, and the Federal District.	100%	100%	Project Completion Report dated 07/27/90.
1983	2249-BR	302.3	BNH	Water supply and sewerage sector project.	100%	100%	PCR dated 10/24/91.
1985	2532-BR	16.3	Govt. of Brazil	Technical assistance to develop national rural water and sanitation policies, and a pilot rural sanitation project in one state.	100%	100%	Unused funds amounting to US$5.22 million canceled. PCR dated 10/21/91.
1988	2983-BR	80.0	CEF	Water Sector Project for municipalities and low-income areas.	100%	34%	Implementation of Low-Income component (US$50 million) is just beginning.
1989	3102-BR	280.0	SABESP	Water Supply and Sewerage Sector Project in São Paulo.	99%	34%	Loan became effective on 07/06/90. After some delays due to procurement problems, implementation advances now at a better pace.
1992	3442-BR	250.0	Govt. of Brazil	Institutional strengthening of the water supply & sewerage sector. Specific investments in the states of Santa Catarina, Mato Grosso do Sul and Bahia.	38%	2%	Loan became effective on 06/08/93. Implementation of the institutional component advances at a satisfactory pace and the investment component is beginning to improve after the three SWCs became eligible for Bank financing.
1992	3504-BR	119.0	St. of São Paulo	Water Quality and Pollution Control.	39%	9%	Loan became effective on 05/17/93.
1992	3505-BR	117.0	St. of Paraná	Water Quality and Pollution Control.	41%	2%	Loan became effective on 05/17/93.
1992	3503-BR	9.0	Govt. of Brazil	Water Quality and Pollution Control.	40%	0%	Loan signature expected for second quarter-1994.
1993	3554-BR	145.0	State of Minas Gerais	Water Quality and Pollution Control.	42%	0%	Loan became effective on 09/08/93.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
POLLUTION SOURCES

1. Domestic and industrial wastewaters and uncontrolled solid waste disposal are the main sources of pollution of the aquatic ecosystems of the Grande Vitória and Guarapari areas. The following matrices summarize the estimates of pollution loads from these sources. Organic loads (expressed as Biochemical Oxygen Demand, BOD) exert great oxygen demands on receiving water bodies which might affect aquatic life and other uses. Bacterial loads (expressed as Most Probable Number of Coliforms, MPN) can impair water uses such as water supply and recreation. The project is intended to reduce these loads, mainly from domestic sources, and will improve mechanisms and complementary actions for industrial pollution control and municipal solid waste collection and treatment.

2. Domestic pollution loads are based on population estimates and per-capita organic load potential (0.054 kg of BOD/capita/day). These estimates correspond to design parameters of all wastewater treatment systems carried out by CESAN.

3. Industrial pollution loads are taken from existing files in SEAMA's industrial pollution control program. Only major polluters are included as medium- and small-size industries are not yet fully controlled by SEAMA. The matrix shows potential and remaining loads after installed industrial wastewater treatment systems. Population equivalent estimates are based on remaining loads (after treatment) divided by the per-capita organic load potential (0.054 kg of BOD/capita/day). The existing wastewater treatment system in each major industry is also included.

4. The water pollution potential of uncontrolled solid waste disposal is taken from data from SEAMA's solid waste program using population estimates, per-capita solid waste production, and factors for contents of dry solid waste, organic matter, and BOD/organic matter ratios in total solid wastes for the municipalities in the area of influence of the project. However, these loads are not exerted directly on water bodies unless solid wastes are disposed near or directly in them. The real and effective pollution loads from this source is therefore very difficult to estimate.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
DOMESTIC POLLUTION SOURCES
1993

SOURCES	POPULATION	RECEIVING WATER BODY	WASTE WATER FLOW (m3/day)	POTENTIAL BOD LOAD (kg/day)	POTENTIAL COLI LOAD (MPN/day)
1. JUCU RIVER BASIN					
- Marechal Floriano	9,715	JUCU RIVER	1,220	525	1.2×10^{15}
- Domingos Martin	11,452	CORREGO DO GORDO	2,525	618	2.5×10^{15}
Subtotal	21,167		3,745	1,143	3.7×10^{15}
2. Sta MARIA RIVER BASIN					
- Sta. Maria de Jetiba	16,824	CORREGO SAO LUIZ	3,959	908	3.9×10^{15}
- Sta. Leopoldina	4,067	Sta. MARIA	976	220	1.0×10^{15}
- Cariacica	184,000	BUBU/MARINHO BAIA	22,080	9,936	N.A.
Subtotal	204,991		27,015	11,064	4.9×10^{15}
3. GUARAPARI BASIN					
- Guarapari Downtown	94,058	OCEAN	22,550	5,059	22.5×10^{15}
- Morro Beach	152,344	OCEAN	24,572	8,227	24.6×10^{15}
Subtotal	246,402		47,122	13,286	47.1×10^{15}
4. VITORIA BAY					
- Costa Beach	258,806	VICTORIA BAY	40,090	13,975	40.0×10^{15}
- Paul District	46,000	VICTORIA BAY	13,238	2,484	N.A.
Subtotal	304,806		53,320	16,459	40.0×10^{15}
5. ESPIRITO SANTO BAY					
- Praia do Canto Beach/Environ	212,000	PASSAGEM CHANNEL	29,290	11,448	29.3×10^{15}
- Fatima District	14,928	PASSAGEM CHANNEL	6,912	806	6.9×10^{15}
- Vitoria Downtown	182,000	VITORIA BAY	21,168	7,128	N.A.
Subtotal	408,928		57,370	19,382	36.2×10^{15}

BOD: Biochemical Oxygen Demand
MPN: Coliform Most Probable Number (MPN/day)
BOD LOAD: (population) x (BOD/person/day) = (population) x 0.054 Kg/day
COLI LOAD: (MPN Coli Concentration) (Waste Water Flow)
SOURCE: CESAN
NA: Not Available

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
INDUSTRIAL POLLUTION SOURCES
1993

SOURCES	EQUIVALENT POPULATION	RECEIVING WATER BODY	BOD LOAD (kg/d)		TREATMENT EFFICIENCY	TREATMENT TYPE
			POTENTIAL	REMAINING		
1. JUCU RIVER BASIN						
- INDUSTRAS DE BEBIDAS ANTARTICA	635	JUCU RIVER	1,617	34	97.9	ANAEROBIC LAGOON + ACTIVATED SLUDGE
- C.C.P.L.	370	JUCU RIVER	400	20	95.0	ACTIVATED SLUDGE
- REAL CAFE	577	FORMATE RIVER	690	31	95.5	AERATED LAGOONS
- CHOCOLATES VITORIA	8,411	FORMATE RIVER	454	454	0.0	DESIGN APPROVED BY SEAMA
- FRIGORIFICO HAROLDO	106	FORMATE RIVER	58	6	90.0	EMSCHER TANK + ANAEROBIC
- DUMILHO	23,148	JUCU RIVER	1,250	1,250	0.0	LAGOON + FACULTATIVE LAGOON
- PESSA	27,666	MARINHO/BAY	1,494	1,494	0.0	DESIGN APPROVED BY SEAMA
- CHOCOLATES GAROTO	1,300	NETWORK/BAY	70	70	0.0	DESIGN APPROVED BY SEAMA
- LUIGI	2,888	NETWORK/BAY	156	156	0.0	DESIGN APPROVED BY SEAMA
- REFRIGERANTES IATE	2,235	MARINHO/BAY	121	121	0.0	DESIGN APPROVED BY SEAMA
- BRASEPEROLA	4,694	FORMATE RIVER	643	254	60.6	PHYSICAL-CHEMICAL TREATMENT
Subtotal	72,030		6,953	3,890		
2. Sta MARIA RIVER BASIN						
- FRINCASA	833	ITUANGA CREEK	1,300	45	96.7	ANAEROBIC AND FACULTATIVE LAGOON
- FRIGORIFICO PALOMA	685	BUBU RIVER	1,208	37	97.0	ANAEROBIC AND FACULTATIVE LAGOON
- FRIGORIFICO SERRA GRANDE	10,074	ITUANGUA CREEK	544	544	0.0	DESIGN APPROVED BY SEAMA
- FRIMACAL	685	BUBU RIVER	1,208	37	97.0	ANAEROBIC AND FACULTATIVE LAGOON
- FRIGORIFICO CINCO PONTOES	9,259	PIRANEMA CREEK	500	500	0.0	DESIGN APPROVED BY SEAMA
- REFRIGERANTES VITORIA	55	BUBU RIVER	127	3	0.0	UPFLOW DIGESTER AND ACTIVATED SLUDGE
Subtotal	21,591		4,887	1,166	0	
3. ESPIRITO SANTO BAY						
A) Companhia Vale Do Rio Doce-CVRD						
- Superintendencia de Estradas	430	OCEAN	23	23	0.0	N.A.
- Superintendencia de Pelotizacao	N.A.	OCEAN	N.A.	N.A.	N.A.	N.A.
- Superintendencia de Portos	1,033	OCEAN	55	55	0.0	N.A
B) Companhia Siderurgica de Tubarão CST - Carboquimica	3,003	OCEAN	5,002	161	97.0	ACTIVATED SLUDGE
Subtotal	4,466		5,080	239		
TOTAL	98,087		16,920	5,194		

BOD: Biochemical Oxygen Demand
BOD Load: BOD concentration x Wastewater Flow
Equivalent Population: Industrial BOD Load/BOD/capita/day = 0.054 Kg/capita/day
Source: SEAMA Industrial Pollution Program
NA: Not Available

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
SOLID WASTE PRODUCTION AND WATER POLLUTION POTENTIAL
1993

City	Population	Solid Waste Production (Kg/day)	Potential BOD Load (Kg/day)	Equivalent Population	Current Situation		Potential Water Pollution	Disposal System
					Collection	Disposal		
SERRA	239,705	119,853	11,475	212,507	Good	Good	None	Controlled Landfill
VITORIA	272,907	136,454	13,065	241,942	Good	Acceptable	Great	Recycling Plant
CARIACICA	284,783	142,392	13,633	252,471	Erratic	Bad	Great	Open Dumps
VILA VELHA	283,766	141,893	13,586	251,587	Erratic	Bad	Great	Open Dumps
VIANA	44,357	22,179	2,124	39,324	Good	Bad	Great	Open Dumps
GUARAPARI	58,343	29,169	2,793	51,723	Good	Bad	Great	Open Dumps
TOTAL	1,183,881	591,940	56,675	1,049,554				

BOD: Biochemical Oxygen Demand
SOLID WASTE PRODUCTION: Population x 0.5 Kg/person/day
BOD load: Solid Waste Production x DC x OM x C1
DC: Fraction of dry solid waste = 0.78
OM: Fraction of organic matter = 0.21
C1: BOD/organic matter ratio = 0.57

Source: SEAMA's Solid Waste Program

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
STATE OF INDUSTRIAL POLLUTION CONTROL IN ESPIRITO SANTO[1]

COMPANY	AIR POLLUTION	WATER POLLUTION
CVRD [2]	- Partially controlled - There are 3 electrostatic precipitators to be installed in the pellet factories before December 1993	- Totally Controlled
CST [2]	- Partially controlled - Installation of disulphur of kiln gas (without time limit), and substitution of kiln door and other small particle systems is 95% completed as of January 31, 1994 - CTS is asking for US$30 million	- Partially controlled (activated sludge) - A system for the removal of ammonia to be installed before September 1995
COFAVI [2]	- Partially controlled - Installation of second phase of iron undusting system required before January 1994	- Treatment system needing improvement
CBF	- Project under analysis	
DUMILHO	- Company requested to present a project	- Company requested to present a project
TERCON	- Controlled	- Controlled
ORNATO	- Controlled	- Control system being implemented
LOGASA	- Controlled	
INCOSPAL	- Installed control system needing improvement	- Controlled
SOBRITA	- Control system being implemented	- Controlled
SIDEPAR	- Uncontrolled	
CONCREVIT	- Controlled	- Controlled
ANDRADE E FREITAS	- De-activated factory	- De-activated factory
SERVICO CONCRET. GRANDE VITORIA	- De-activated factory	- De-activated factory
CARBO INDUSTRIAL	- Control project under analysis	- Controlled
REAL CAFE	- Installed control system needing improvement	- Controlled
CHOCOLATES VITORIA	- Uncontrolled	- Control system project approved

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
STATE OF INDUSTRIAL POLLUTION CONTROL IN ESPIRITO SANTO[1] (Cont.)

COMPANY	AIR POLLUTION	WATER POLLUTION
BRASPEROLA [2]	- Controlled	- Physical/chemical treatment system installed - Biological treatment system to be installed before March 1994
CCPL	- Controlled	- Control system beginning operation
ABATEDOURO SAO SEBASTIAO	- De-activated factory	- De-activated factory
ALBERTO P. LEIROZ	- De-activated factory	- De-activated factory
FRIMACAL	- Uncontrolled	- Implemented treatment system with operational problems
PALOMA	- Uncontrolled	- Implemented system with operational problems
SERRA GRANDE		- Control system project approved and under implementation
CORTUME DO NORDESTE	- De-activated factory	- De-activated factory
IPESSA	- Controlled	- Treatment system approved and under implementation
CHOCOLATES GAROTO	- Controlled	- Partially controlled
DPI	- De-activated factory	- De-activated factory
VENNER LINE	- De-activated factory	- De-activated factory
GINCAL		- Controlled
CASSARO		- Uncontrolled
GINCAL (SS)	- De-activated factory	- De-activated factory
RAMIRO		- Uncontrolled
ARACRUZ CELULOSE [2]	- Controlled - The company is showing improvement in already installed control systems, to obtain approval for an operating license - The company requested US$30 million for air and water projects	- Controlled - The company is installing an emergency lake for rain water storage

[1] As of July 31, 1993. Major pollutants only.
[2] Industries which have asked for financing under the Industrial Pollution Control Project (PRONACOP).

Source: SEAMA Industrial Pollution Control Program

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
WATER QUALITY MATRIX

1. The water quality matrix presented in this Annex summarizes the current and desired water quality levels for the project area. The current and desired water quality conditions are given for the Santa Maria da Vitoria river basin, the Jucu river basin, the Guarapari river basin, and the coastal waters in the area of influence of the project. The water quality models which are discussed in Annex 15 (Environmental Assessment), are based upon the Pollution Sources Matrix (Annex 2) as organic load inputs and the current water quality conditions as a model calibrating tool. The projected water quality conditions for a time horizon of twenty years, forecasts future conditions without wastewater treatment, and under different wastewater collection and treatment strategies. The water quality objectives act as points of reference or goals to be achieved for the water pollution management program.

2. The current water quality conditions are taken from the results of sporadic water quality monitoring campaigns carried out by SEAMA. The selected water quality parameters are Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), and Coli-fecal concentration (expressed as Most Probable Number of Coliforms, MPN/100ml). These parameters have a direct correlation with the project as the proposed treatment systems are intended to reduce organic (as BOD) and coliform (as MPN) loads from domestic sources, and the expected results will be measured as reduction of BOD and MPN, and as improvement of dissolved oxygen (DO) levels in receiving water bodies. Water quality objectives and water use classifications are taken from the proposed water quality objectives legislation prepared by SEAMA and currently being promoted through the State's legal process. The proposed legislation is included in project files. The proposed legislation includes water use class and water quality limits for fresh waters (inland rivers and creeks), brackish waters (mainly estuaries and coastal lagoons and other waters with intermediate salinity), and coastal waters (beaches and the open sea).

3. Proposed water use categories and water quality limits for selected parameters are summarized at the end of the matrix.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
WATER QUALITY MATRIX

River/Segments	Current Category	CURRENT WATER QUALITY *			Proposed Category
		BOD mg/l	DO mg/l	MPN/100ml	
SANTA MARIA DA VITORIA RIVER BASIN					
1.0 SANTA MARIA RIVER					
River Head	AA				AA
to S. Sebastião River	B				A
to S. Sebastão Baixo Creek	D	2.0	7.3	$>2.2 \times 10^4$	B
to S. Leopoldina	B	2.0	8.5	3.4×10^2	B
to Mangarai River	D	2.0	2.8	2.4×10^4	B
to Tide Influence Area	B	2.0	7.0	1.6×10^3	B
to River Mouth	I				F
1.1 Tributaries to Santa Maria River					
Duas Bocas, Prata, and Mangarai Rivers, and S. Sebastião Baixo & D'Ouro Creeks	B	NA	NA	NA	B
2.0 BUBU RIVER					
River Head	AA				AA
to Areinha Creek	B	2.0	5.0	2.8×10^3	B
to Monitoring Point 1CO15	D	64.0	5.0	$>2.4 \times 10^3$	B
to Tide Influence Area	E	296.0	0.9	$>2.4 \times 10^4$	C
to River Mouth	J	NA	NA	NA	G
2.1 Tributaries to Bubu River					
Tanque Creek	B	NA	NA	NA	B
Areinha Creek	E	21.0	1.9	$>2.4 \times 10^4$	C
Cahoeiro Creek	D	NA	NA	NA	B
JUCU RIVER BASIN					
1.0 JUCU RIVER					
River Head	AA	NA	NA	NA	AA
to Jucu North Arm	AA	NA	NA	NA	AA
1.1 Jucu North Arm					
River Head to Pedra Azul Creek	B	NA	NA	NA	A
to Tijuco Preto Creek	B	NA	NA	NA	B
to Confluence with South Arm	D	2.0	7.9	2.0×10^3	B
1.1.1 Tributaries to North Arm					
Tijuco and S. Vicente Creeks, and Melgaço and Galo Rivers	B	NA	NA	NA	B
1.2 Jucu South Arm					
River Head to S. Floriano Creek	A	NA	NA	NA	A
to Fundo River	B	NA	NA	NA	B
to Confluence with North Arm	D	2.0	7.6	$>2.4 \times 10^4$	B
1.3 From Confluence of North & South Arms					
to Tide Influence Area	D	2.0	7.5	3.5×10^3	B
to River Mouth	I	NA	NA	NA	F

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
WATER QUALITY MATRIX (cont.)

River/Segments	Current Category	CURRENT WATER QUALITY *			Proposed Category
		BOD mg/l	DO mg/l	MPN/100ml	
JUCU RIVER BASIN					
1.2.1 Tributaries to South Arm					
S. Floriano Creek	A	NA	NA	NA	A
Fundo River	B	NA	NA	NA	B
2.0 FORMATE RIVER					
River Head	AA				AA
to Jaquita Creek	A	NA	NA	NA	A
to Montanha Creek	B	NA	NA	NA	B
to Marinho River	D	30.0	3.0	$>2.4 \times 10^4$	B
2.1 Tributaries to Formate River					
Jaquita Creek	B	NA	NA	NA	B
Roda D'Agua Creek	B	NA	NA	NA	B
Montanha Creek	B	NA	NA	NA	B
Areinha Creek	D	NA	NA	NA	B
Tanque Creek	D	NA	NA	NA	B
3.0 MARINHO CREEK					
River Head	AA	NA	NA	NA	AA
to Tide Influence Area	E	40.0	0.4	$>2.4 \times 10^4$	C
to River Mouth	J	NA	NA	NA	F
GUARAPARI RIVER BASIN					
1. JABUTI RIVER HEAD	AA	NA	NA	NA	AA
to Tide Influence Area	A	NA	NA	NA	A
to River Mouth	F	NA	NA	NA	F
1.1 Tributaries to Jabuti River Conceição River	A	NA	NA	NA	A
2. PEROÇÃO RIVER					
to Oratorio River	A	NA	NA	NA	A
to Tide Influence Area	B	NA	NA	NA	B
to River Mouth	I	NA	NA	NA	F
3. UNA RIVER					
to Amarelo Creek	B	NA	NA	NA	B
to tide influence area	D	NA	NA	NA	C
to River Mouth	I	NA	NA	NA	F
COASTAL WATERS					
From Maringa Creek Downstream					
to Praia Mole	K	K	K	K	K
to Costa Beach	M	NA	NA	NA	K
to Barra Jucu Upstream	K	NA	NA	NA	K
to Jucu River Mouth	M	NA	NA	NA	K
to Setiba	K	NA	NA	NA	K
to Guarapari Downtown	M	NA	NA	NA	K
to Meaipe Downtown	K	NA	NA	NA	K

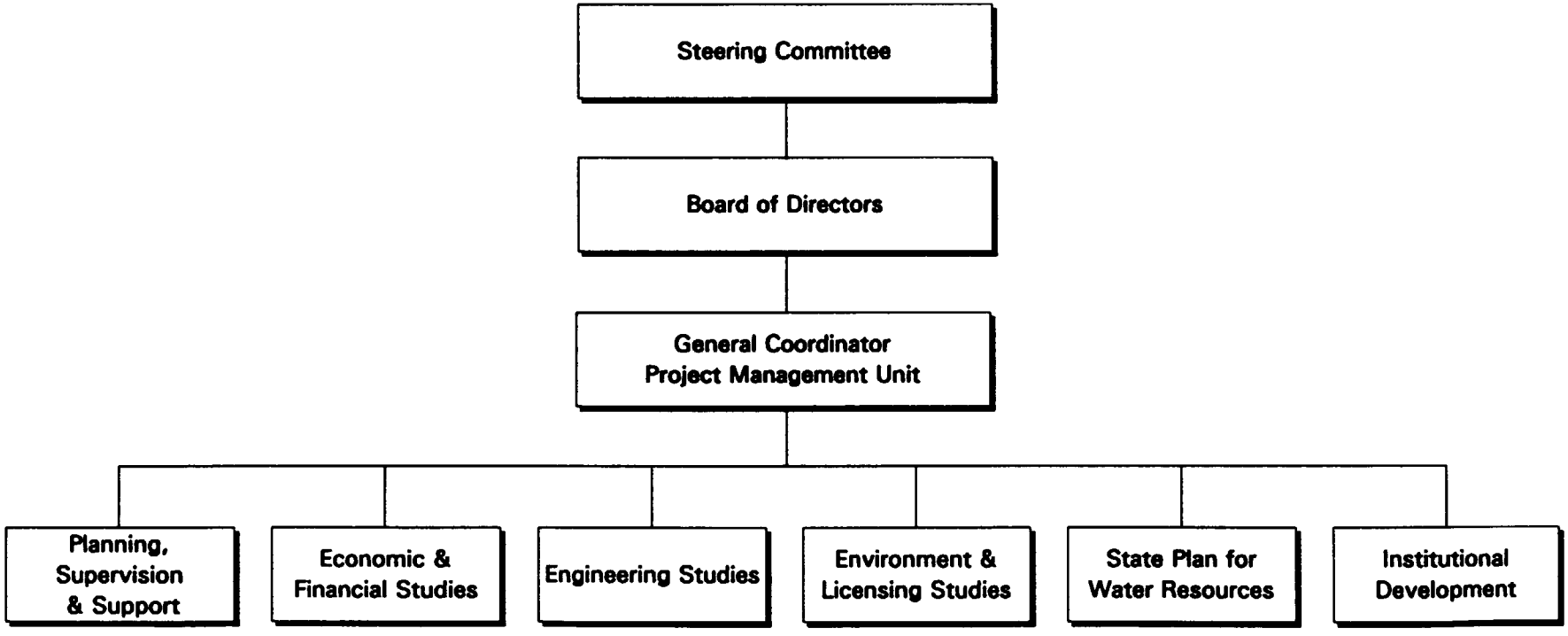
BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
PROPOSED WATER QUALITY CATEGORIES

Water Uses	Water Quality Categories/Class																
	Fresh Water						Brackish Water						Coastal & Sea Water				
	AA	A	B	C	D	E	FF	F	G	H	I	J	KK	K	L	M	N
Public Supply w/w.o. Disinfection	X				D	H	X				D	H				D	H
Preservation of water communities	X				O	I	X	X			O	I	X			O	I
Scientific/educational purposes	X	X			E	G					E	G	X	X		E	G
Public supply after treatment		X	X		S	H		X	X	X	S	H				S	H
Flora & fauna protection		X	X		N	L		X	X		N	L		X	X	N	L
Recreation through direct contact		X			O	Y		X		X	O	Y		X		O	Y
Grazing/agricultural uses		X			T			X	X	X	T				X	T	
Fishing		X	X		M	P			X	X	M	P		X	X	M	P
Navigation		X	X	X	E	O				X	E	O				E	O
Recreation through indirect contact			X	X	E	L				X	E	L			X	E	L
Landscape preservation			X	X	T	L					T	L				T	L
Energy generation			X	X		U				X		U					U
Industrial supply				X	B	T		X			G	T				K	T
Shellfish/aquatic life/raw consumption					O R	E D					O R	E D	X			O R	E D
Conservation of reefs/sea ecosystem					C								X				
Breeding of species											H		X			L	

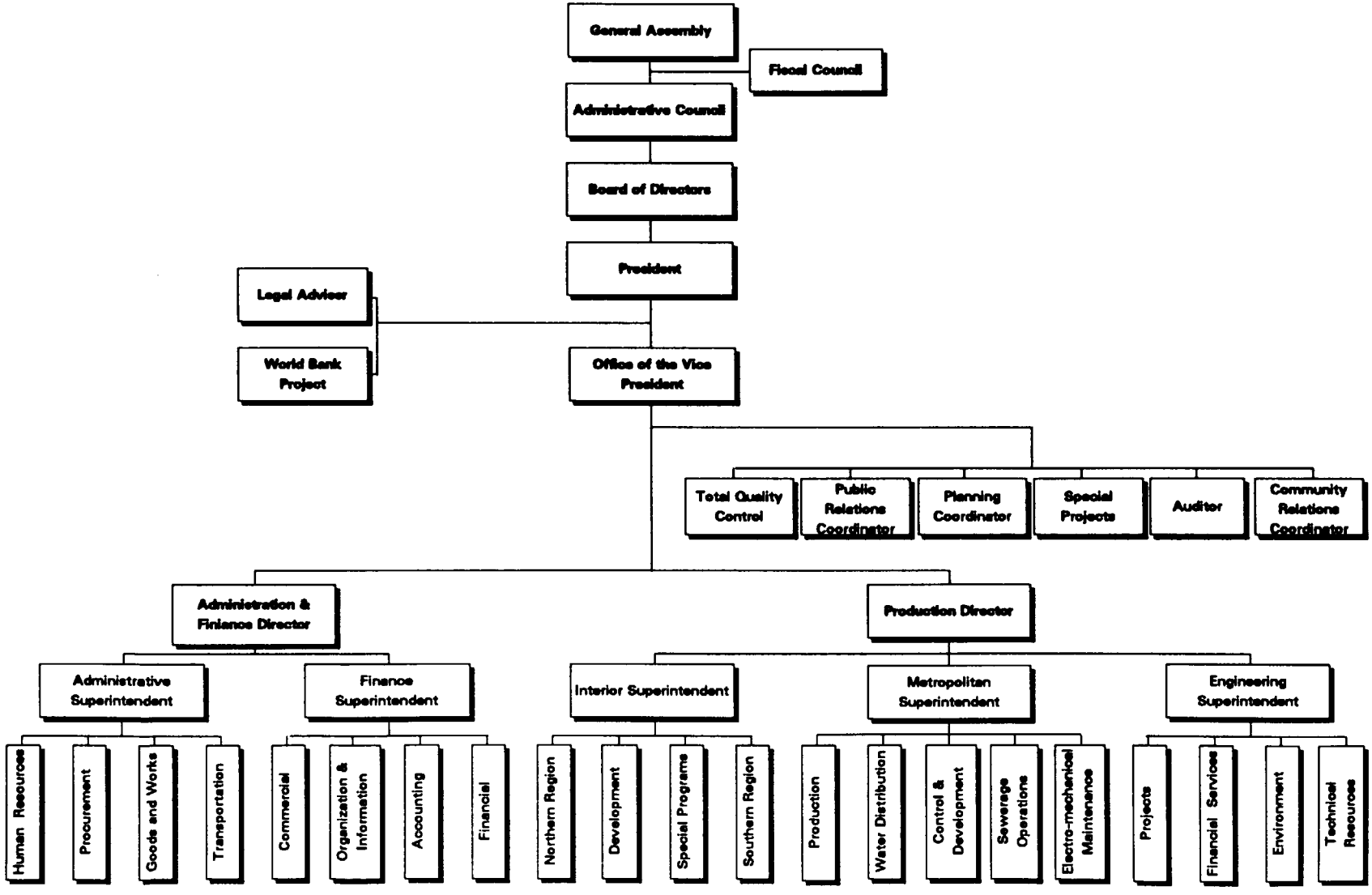
Water Quality Limits			
Class	BOD mg/l	DO mg/l	MPN/ 100 ml
AA,FT,KK	<3	>6.5	Absent
A, F, K	<3	>6.5	<250
B,G,	<5	>6.0	<1000
C,H	<10	>5.0	<4000
L	<10	>6.0	<4000
D,I	Does not meet B/C, G/H		
M	Does not meet L		
E, J, N	Highly polluted		

BOD : Biochemical Oxygen Demand
DO : Dissolved Oxygen
MPN/100 ml : Most Probable Numbers of Coliforms
* : Worst conditions found during most recent water quality monitoring campaign

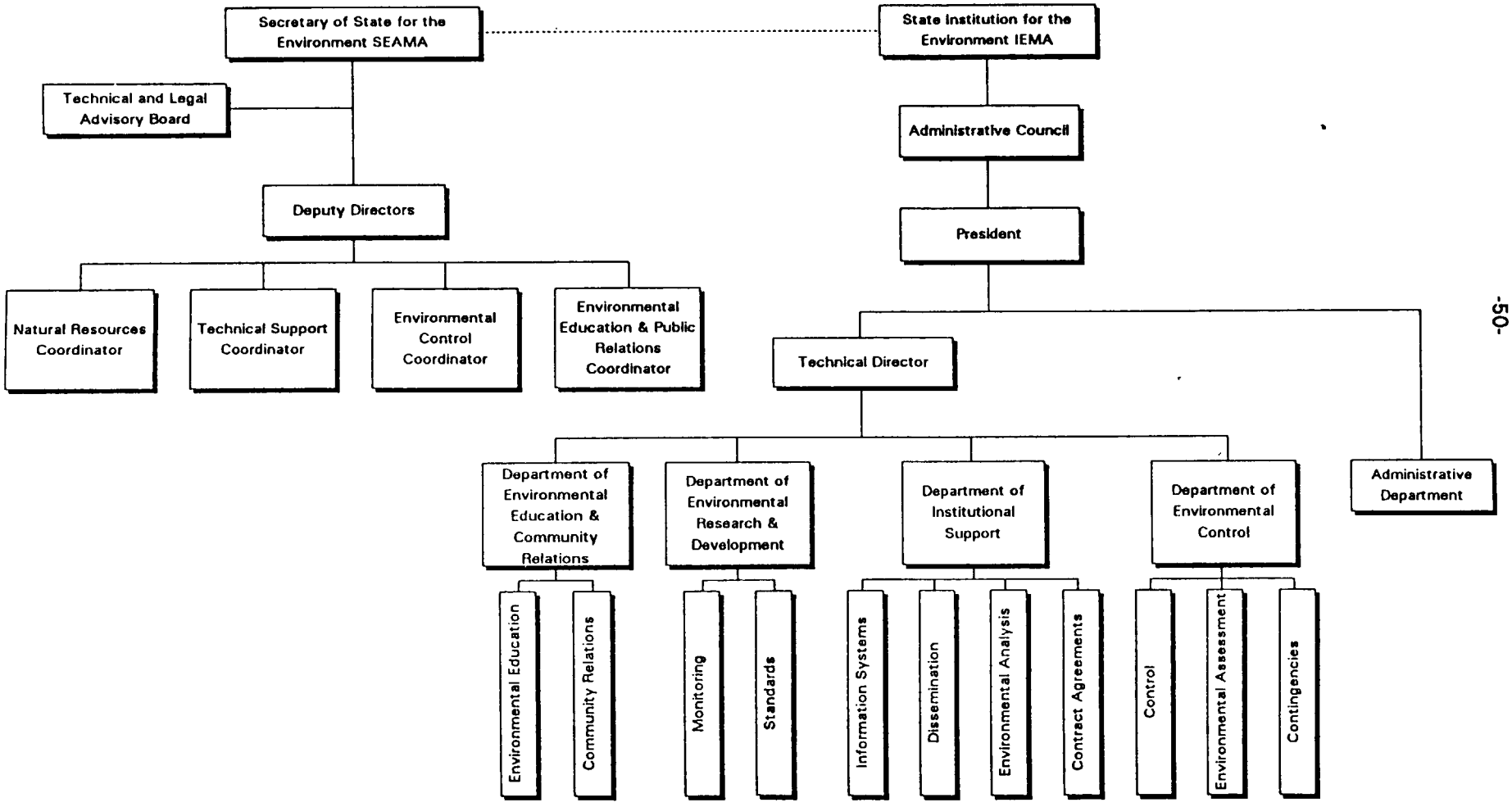
BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN PROJECT MANAGEMENT UNIT
ORGANIZATION CHART



BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
COMPANHIA ESPIRITO SANTENSE DE SANEAMENTO - CESAN
ORGANIZATION CHART



BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
ENVIRONMENTAL INSTITUTIONS
PROPOSED ORGANIZATION CHART



BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN INSTITUTIONAL DATA
December 1993

INDICATOR	UNIT	CESAN
A. SOCIO-ECONOMIC		
Average Monthly Household Income	MS1/	5.9
Households Earning 1MS or Less per Month	%	15.7
Households Earning 2MS or Less per Month	%	32.5
Households Earning 5MS or Less per Month	%	61.4
Electricity Coverage	%	89.2
Infant Mortality	#/000	38
Life Expectancy	years	64
B. OPERATIONAL		
State Urban Population	#(000)	2,048
Urban Population in Concession Area	#(000)	1,512
Urban Population in Concession Area	%	74.0
Municipalities Served with Water Supply	#	49
Localities Served with Water Supply	#	102
Water Coverage Level	%	91
Water Systems in Operation	#	86
Water Connections	#	296,256
Water Customers	#	443,387
Per Capita Production (Annual Average)	lpd	269
Per Capita Consumption (Annual Average)	lpd	145
Water Billed per Customer (Annual Average)	m3/month	26.9
Municipalities Served with Sewerage	#	9
Localities Served with Sewerage	#	10
Sewerage Coverage Level	%	11
Sewerage Systems in Operation	#	10
Sewerage Connections	#	29,320
Sewerage Customers	#	55,199
C. ADMINISTRATIVE		
Total Number of Employees	#	1,557
- Administrative Employees	#	644
- Water Operations Employees	#	840
- Sewerage Operations Employees	#	73
Number of Professionals	#	214
Annual Average Salary per Employee	US$	21,164
Annual Employees Turnover	%	1
Average Staff Trained in Last 5 years	#/yr	331
Administrative Regions	#	5
Regional Offices	#	46

1/ MS = Minimum Salaries.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
SEAMA INSTITUTIONAL DATA
December 1993

INDICATOR	UNIT	SEAMA
A. OPERATIONAL		
Industries Controlled (from July 1992 to July 1993)	#	173
Inspections in 1993	#	1,044
Environmental Licenses Issued in 1993	#	400
Environmental Impact Reports (RIMAs) Issued in 1993	#	2
B. ADMINISTRATIVE		
Number of Employees	#	325
Total Number of Professionals	#	140
Annual Average Salary per Employee	US$	7,000
Annual Employees Turnover	%	34
Average Staff Trained in Last 5 years	#/yr	108

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
WATER SUPPLY AND SEWERAGE SYSTEMS DISTRIBUTED BY SIZE
December 1993

ANNUAL AVERAGE VOLUME PER SYSTEM (000 m3)	WATER SUPPLY				SEWERAGE			
	Systems		Annual Production		Systems		Sewage Collected	
	#	%	m3(000)	%	#	%	m3(000)	%
Up to 100	30	35.7	1,562	0.8	4	22.2	275	1.9
From 101 to 500	33	39.3	8,850	4.5	6	33.3	1,746	12.2
From 501 to 1,000	12	14.3	7,398	3.7	3	16.7	1,761	12.3
From 1,001 to 5,000	7	8.3	9,741	4.9	5	27.8	10,567	73.6
From 5,001 to 10,000	1	1.2	7,995	4.0	0	0.0	0	0.0
From 10,001 to 15,000	0	0.0	0	0.0	0	0.0	0	0.0
From 15,001 to 50,000	0	0.0	0	0.0	0	0.0	0	0.0
From 50,001 to 100,000	0	0.0	0	0.0	0	0.0	0	0.0
More than 100,000	1	1.2	163,216	82.1	0	0.0	0	0.0
Total Systems	84	100.0	198,762	100.0	18	100.0	14,349	100.0

SYSTEMS: 02/24/94

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN'S 1994-1999 INVESTMENT PROGRAM

1. The 1994-1999 investment program of CESAN (Attachments 1 and 2) has been designed mainly to reduce the water pollution levels of rivers and coasts in the area of Grande Victoria and Guarapari (see IBRD Maps 25606 and 25646). To achieve this objective, CESAN will improve the operational efficiency of its water supply and sanitation system, improve the quality of its water supply and sanitation services, and increase current coverage levels of both services. At the end of the implementation period (December 1999), about 550,000 people will have gained access to water supply and more than 770,000 people to water-borne sewerage services. After 1999, a significant number of additional people will also benefit from subprojects that, although being the least-cost solution, will be exhibiting varying degrees of spare capacity during the first operational years. Other important physical objectives are included with the agreed monitoring indicators presented in Annex 20.

2. CESAN's total investments for 1994-1999 will be about US$305.5 million (excluding physical and price contingencies, and interest during construction) of which US$251.9 million will be the Bank project. About US$70.4 million of projected investments under the IBRD project (28%) will be directed to optimize, reinforce, and expand its water supply systems; about US$166.5 million (66%) to expand its sewerage systems through the construction of new systems that will include treatment and appropriate final disposal of sewage; about US$10.1 million (4%) to optimize and control unaccounted-for water (UFW); and the remaining US$4.9 million (2%) to manage and supervise the investment programs.

A. WATER SUPPLY

3. The water supply component of the Bank project covers three specific geographical areas: Grande Vitória (US$40.6 million), Guarapari (US$19.4 million), and other cities and towns of the interior (US$7.5 million). The additional US$10.1 million CESAN plans to invest in optimizing and controlling UFW will be distributed among these areas, proportionally to the current number of connections in each area.

Grande Vitória

4. In this geographic area, US$40.6 million will be invested in water treatment plants, pumping stations, transmission pipelines, reservoirs, distribution pipelines, and connections. The most important works are described in the following paragraphs.

5. **Treatment Plants.** The treatment plant of Carapina will be expanded to cover an additional population of about 141,000 inhabitants. Works will include a raw water pumping station of 1,250 CV and two filters of 293.5 l/s each.

6. **Transmission and Sub-Transmission Pipelines.** The total length of the transmission and sub-transmission network will be increased by about 33.8 km. New transmission pipelines will be built for the systems of Garoto (10.0 km), Ibes (12.2 km), Setor Civit (3.5 km), Setor Jacaraipe (3.1 km), and between Santa Clara-Santo Antonio (1.5 km) and to connect ETA I-Argolao (2.5 km). The sub-transmission network of Cariacica will be expanded 1.0 km.

7. **Reservoirs.** Storage capacity will be increased by about 30,890 m^3. Additional storage capacity will be built in the following systems: Planal (10,000 m^3), Santa Clara (1,390 m^3), Vale Esperança (5,000 m^3), Garoto (5,000 m^3), Ibes (6,000 m^3), and Setor Civit (3,500 m^3).

8. **Pumping Stations.** Pumping stations in Centro/Vitória-Santa Clara (60 HP), Carapina/Serra-Setor Civit (three pumps of 700 HP and one of 350 HP), Carapina/Serra-Setor Jacaraipe (200 HP), Nova Almeida/Serra-Setor Nova Almeida (100 HP) will be constructed.

9. **Distribution System.** To expand the service, CESAN will build the Anel Sotema/Itaquari (2.6 km), and new distribution networks for ETA Carapina/Cidade Continental (10.3 km) and Castelo Branco/Cariacica (4.5.km). And to respond to expected population growth, CESAN will build 680.7 km of new distribution pipes and 59,041 new connections in Grande Vitória.

Guarapari

10. In the area of Guarapari, an investment of US$ 19.4 million in water supply will be divided into the following items:

11. **Treatment Plants.** A complete new treatment system will be built. This system will cost about US$10.3 million and comprise a new water intake, pumping stations (three of 450 CV, three of 175 CV, and three of 350 CV), a transmission pipeline for raw water (14.7 km of 700 mm in diameter), and the treatment plant for 560 l/s.

12. **Reservoirs.** Five new reservoirs with a total capacity of about 13,544 m^3. will be built. One of these reservoirs will have a capacity of 7,500 m^3, two of 2,372 m^3, one of 1,000 m^3, and one of 300 m^3.

13. **Transmission Pipes.** One transmission pipe of 18.4 km in length will be built.

14. **Distribution.** There will be a construction of 100.6 km of distribution pipelines, and 2,831 connections with meters and 318 without meters.

Other Cities and Towns

15. Other cities of the interior will be served with the following systems: Iuna (49.2 l/s treatment plant), Nova Venecia (interceptor, transmission pipelines, and a 82.3 l/s treatment plant), Castelo (interceptor, transmission pipelines, and a 79.2 l/s treatment plant), Conceicao da Barra (reservoir of 1,400 m^3 and sedimentation tank), Sao Gabriel de Palma (interceptor, transmission pipelines, and reservoir). Additionally, attention will be given to expected population growth by building 185.6 km of new distribution networks, and 8,276 connections with meters and 921 without meters.

Investments Outside the Bank Project

16. Investments of about US$47.2 million (excluding physical and price contingencies and IDC) will be implemented outside the Bank project (see Attachment 2). These investments are for expanding the water supply production system of Grande Vitória. Most of these projects are already under construction with financing by CEF and the State government. The investments seek to increase water intake in about 1,300 l/s; to build the water treatment plants of Vale Esperança (1,800 l/s) and Cobi (100 l/s); to add 1.65 CV of pumping capacity; and to build a 34.5 KV power transmission line of 11.0 km, a new water transmission pipeline of 2.0 km (1,500 mm in diameter), and a new reserve pumping station.

B. SEWERAGE AND SANITATION

17. The sewage collection and treatment component of the Bank project covers the same three geographical areas adopted for water supply: Grande Vitória (US$129.8 million), Guarapari (US$25.9 million), and other cities and towns of the interior (US$9.5 million). The sub-projects of this component are of major importance in the Bank project, and will determine the real innovation in the

services provided by CESAN. The principal data are presented in Attachment 1. These sub-projects consist of connections, systems of collection and transportation, residual water treatment, and final disposal.

Grande Vitória

18. The sub-projects for Grande Vitória were design to protect the Bay of Vitória and the beach of Camburi, and to strengthen urban infrastructure. They are the following:

- Vitória/Centro (50 km of sewerage collectors and interceptors, two pumping stations, and one treatment plant for activated sludge);
- Praia do Canto (168.6 km of sewerage collectors and interceptors, ten pumping stations, and one system of ponds);
- Serra/Bairro de Fatima (18.1 km of sewerage collectors and interceptors, and two pumping stations);
- Vila Velha/Praia da Costa (197.9 km of sewerage collectors and interceptors, 13 pumping stations, and one facultative pond);
- Vila Velha/Paul (68.7 km of sewerage collectors and interceptors, and five pumping stations); and
- Cariacica/Campo Grande (142.8 km of sewerage collectors and interceptors, seven pumping stations, and one system of ponds).

Guarapari

19. The objective of sewerage and sanitation works to be built in Guarapari is to protect the beaches and the urban infrastructure of this important tourist center. The subprojects contemplated are the following:

- Praia do Morro (78.9 km of sewerage collectors and interceptors, 9 pumping stations, and one system of ponds); and
- Guarapari/Centro (46.9 km of sewerage collectors and interceptors, 4 pumping stations, and one aerated lagoon).

Other Cities and Towns of the Interior

20. These projects are primarily directed to the protection of the basins of the Jucu and Santa Maria rivers, which are the sources of potable water for Grande Vitória. These projects are:

- Domingo Martins (10.5 km of sewerage collectors and interceptors, two pumping stations, and one system of ponds);
- Marechal Floriano (12.8 km of sewerage collectors and interceptors, six pumping stations, and one system of ponds);
- Santa Maria do Jetiba (18.6 km of sewerage collectors and interceptors, four pumping stations, and one system of ponds); and

- Santa Leopoldina (6.6 km of sewerage collectors and interceptors, five pumping stations, and one system of ponds).

Investments Outside the Bank Project

21. Investments of about US$6.4 million (excluding physical and price contingencies and IDC) will be built outside the Bank project (see Attachment 2). A part of these investments are for building a sewerage and sanitation system in the area of Jardim Camburi (Grande Vitória). The project, already under construction, is being financed by IDB and the Federal Government under the PROSEGE program. About US$1.7 million (of a total cost of about US$6.4 million) is the project's remaining cost. The project includes: 3,345 connections, 39.9 km of collectors, a pumping station for raw sewage of 66 CV, and an outfall pipe of about 1.4 km.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
PROPOSED SEWERAGE AND WASTEWATER TREATMENT SYSTEMS

No.	SYSTEM	CITY	POPULATION[1]	CONNECTIONS[2] (#)	SEWERAGE SYSTEM Km	WASTE WATER TREATMENT TYPE	COST US$ (1000)	PER CAPITA COST US$/hab.	ENGINEERING DESIGN as of 10/93
01	Vitória-Centro	Vitória	78,660	11,386	50	Activated Sludge	12.139	158	NO
02	Pria do canto e Adjacéncias	Vitória	212,000	22,633	169	Aerated Pond	40,534	202	YES
03	Bairro de Fátima e Adjacéncias	Serra	18,119	4,256	18	Aerated Pond Facultative Pond[4]	2,989	171	YES
04	Praia da Costa e Adjacéncias	Vila Velha	207,045	24,490	198	Facultative Pond	41,498	203	YES
05	Paul e Adjacéncias	Vila Velha	39,258	6,836	69	[3]	8,273	216	NO
06	Campo Grande e Adjacéncias	Cariacica	143,393	20,078	143	Facultative Ponds	20,887	154	NO
07	Praia do Morro e Adjacéncias	Guarapari	152,344	6,265	79	Anaerobic Pond Facultative Pond	15,235	110	YES
08	Guarapari - Centro	Guarapari	84,724	4,291	47	Aerated Pond	10,547	129	YES
09	Domingos Martins - Sede	Domingos Martins	11,452	868	11	Imhoff + Biofilter Facultative Pond	1,466	165	YES
10	Marechal Floriano - Sede	Marechal Floriano	9,374	881	13	Anaerobic Pond Facultative Pond	3,532	410	YES
11	Santa Leopoldina - Sede	Santa Leopoldina	4,067	481	7	Facultative Pond	1,090	299	YES
12	Sta. Maria Jetibá - Sede	Santa Maria de Jetibá	16,824	900	19	Imhoff + Biofilter Facultative Pond	3,231	277	YES
TOTAL			977,260	103,365	823		161,421	165	

[1] Total beneficiaries at end of design period
[2] Total connections at beginning of project
[3] Sewage treatment in another system
[4] Existing

ANNEX 8
Attachment 2

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN'S INVESTMENT PROGRAM
US$ Thousands as of June, 1993

	DESCRIPTION	1994	1995	1996	1997	1998	1999	TOTAL
I	IBRD PROJECT							
A	WATER SUPPLY	4,645	5,019	5,205	34,957	15,643	4,887	70,356
A.1	GRANDE VITORIA	3,240	3,394	3,553	21,736	4,586	4,092	40,601
	Raw Water Intake, Transmission & Pumping	0	0	0	606	0	0	606
	Treatment	0	0	0	852	0	0	852
	Treated Water Transmission & Pumping	0	0	0	11,326	0	0	11,326
	Reservoirs & Distribution	2,165	2,251	2,337	7,657	3,205	2,618	20,233
	Connections	1,075	1,143	1,216	1,295	1,381	1,474	7,584
A.2	GUARAPARI	51	53	50	9,616	9,619	57	19,446
	Raw Water Intake, Transmission & Pumping	0	0	0	2,922	2,922	0	5,844
	Treatment	0	0	0	1,578	1,578	0	3,156
	Treated Water Transmission & Pumping	0	0	0	2,370	2,370	0	4,740
	Reservoirs & Distribution	0	0	0	2,694	2,694	0	5,388
	Connections	51	53	50	52	55	57	318
A.3	OTHER SYSTEMS	604	629	658	3,445	1,438	738	7,512
	Raw Water Intake, Transmission & Pumping	0	0	0	533	175	0	708
	Treatment	0	0	0	1,160	291	0	1,451
	Treated Water Transmission & Pumping	0	0	0	268	148	0	416
	Reservoirs & Distribution	467	487	505	1,325	659	567	4,010
	Connections	137	142	153	159	165	171	927
A.4	ENGINEERING	750	943	944	160	0	0	2,797
B	SEWERAGE	25,199	38,003	47,046	15,246	26,578	14,461	166,533
B.1	GRANDE VITORIA	17,672	29,286	35,923	6,020	26,497	14,378	129,776
	Connections	2,631	3,257	3,701	1,807	6,106	3,695	21,197
	Collectors & Interceptors	9,297	11,630	13,179	2,642	13,764	6,938	57,450
	Pumping Stations & Raw-Sewage Pressure Pipes	2,166	3,792	4,611	397	2,689	1,419	15,074
	Treatment & Outfall Pipes	3,578	10,607	14,432	1,174	3,938	2,326	36,055
B.2	GUARAPARI	7,109	8,126	5,720	4,878	46	47	25,926
	Connections	538	615	449	387	46	47	2,082
	Collectors & Interceptors	3,128	3,575	1,645	1,401	0	0	9,749
	Pumping Stations & Raw-Sewage Pressure Pipes	1,484	1,696	794	677	0	0	4,651
	Treatment & Outfall Pipes	1,959	2,240	2,832	2,413	0	0	9,444
B.3	OTHER SYSTEMS	18	19	5,018	4,348	35	36	9,474
	Connections	18	19	347	282	35	36	737
	Collectors & Interceptors	0	0	1,934	2,084	0	0	4,018
	Pumping Stations & Raw-Sewage Pressure Pipes	0	0	659	439	0	0	1,098
	Treatment & Outfall Pipes	0	0	2,078	1,543	0	0	3,621
B.4	ENGINEERING	400	572	385	0	0	0	1,357
C	OPERATIONAL DEVELOPMENT	3,769	2,287	1,965	1,055	907	160	10,143
D	PROJECT MANAGEMENT & SUPERVISION	700	900	1,000	1,000	850	400	4,850
	IBRD PROJECT BASE COST	34,313	46,209	55,216	52,258	43,978	19,908	251,882
	Physical Contingencies	1,716	2,310	2,761	2,613	2,199	995	12,594
	Price Contingencies	1,137	2,755	5,008	6,409	6,837	3,429	25,574
	TOTAL IBRD PROJECT COST	37,166	51,275	62,984	61,279	53,014	24,332	290,050

ANNEX 8
Attachment 2

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN'S INVESTMENT PROGRAM
US$ Thousands as of June, 1993

	DESCRIPTION	1994	1995	1996	1997	1998	1999	TOTAL
II	**OTHER INVESTMENTS**							
A	WATER SUPPLY	13,211	25,851	0	0	0	11,131	47,193
A.1	GRANDE VITORIA	13,211	25,851	0	0	0	8,131	47,193
A.2	OTHER SYSTEMS	0	0	0	0	0	3,000	3,000
B	SEWERAGE	1,715	0	0	0	0	9,706	6,421
B.1	GRANDE VITORIA (PROSEGE)	1,715	0	0	0	0	4,706	6,421
B.2	OTHER SYSTEMS	0	0	0	0	0	5,000	5,000
	OTHER INVESTMENTS BASE COST	14,926	25,851	0	0	0	20,837	53,614
	Physical Contingencies	746	1,293	0	0	0	1,042	3,081
	Price Contingencies	495	1,541	0	0	0	3,589	5,625
	OTHER INVESTMENTS COST	16,167	28,685	0	0	0	25,468	70,319
III	**TOTAL INVESTMENT PROGRAM**							
	TOTAL INVESTMENT BASE COST	49,239	72,060	55,216	52,258	43,978	40,745	305,496
	Physical Contingencies	2,462	3,603	2,761	2,613	2,199	2,037	15,675
	Price Contingencies	1,631	4,296	5,008	6,409	6,837	7,017	31,198
	TOTAL INVESTMENT COST	53,332	79,959	62,984	61,279	53,014	49,800	360,369

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
INSTITUTIONAL STRENGTHENING PROGRAM

A. CESAN

1. The implementation of CESAN's institutional strengthening program will improve its technical, administrative, financial, and operational capacity. This component will provide technical assistance, training, and equipment to design and implement: (i) a managerial development program to improve CESAN's institutional capabilities; (ii) an information systems program including acquisition and development of new management systems; and (iii) a sanitary education program targeting the communities in the project's area of influence. This component will also finance the construction of CESAN's new headquarters. The total cost of the program is estimated at about US$8.8 million. Engineering design, project management and supervision, and CESAN's operational development program will complement the company's strengthening program.

Technical Assistance

2. Technical assistance will provide: (i) consultant services to help prepare a new Contract-Plan between CESAN and the state government and carry out major studies in re-evaluation of fixed assets, financial management and auditing, demand for water and sewerage services, information systems, environmental studies, total quality, and design of educational materials; and (ii) individual specialists to assist CESAN's technical, administrative, financial, environmental, and social divisions to implement the programs.

Training

3. The technical training and personnel development program will include: (i) post-graduate courses leading to Master of Science degrees in sanitary engineering and business administration for 4 staff members; (ii) technical visits in Brazil and other countries; and (iii) local, national and international short courses, workshops and seminars in waste treatment plant design and operation, project planning and evaluation, financial and auditing systems, marketing, water quality analysis, water quality models, water quality monitoring systems, environmental assessment, information analysis, and community programs.

Equipment

4. The project will provide the necessary equipment to implement the programs. The equipment will include: (i) renovation of water and wastewater quality laboratories; (ii) information systems, hardware and software; (iii) vehicles for the Project Management Unit; and (iv) sewerage maintenance equipment.

B. SEAMA

5. Industrial activities in some minor river segments and urban run-off channels and uncontrolled solid waste disposal sites near water courses will exert pollution loads that will impair water quality recovery in some specific locations in the project's area of influence. Furthermore, coastal ecosystems, protected and un-protected, are subject to urban expansion pressures and lack effective protection. Therefore, an integrated approach to water quality and natural resource management in the river basins and the estuarine ecosystems of the project's area of influence will guarantee the attainment of proposed environmental objectives. This and other opportunities for environmental quality enhancement in the area have been identified and will be addressed by SEAMA's institutional

strengthening program. The total cost of the program is estimated at about US$8.7 million. This component will strengthen SEAMA's operational, administrative, and institutional capabilities through studies, technical assistance, equipment, and training in the areas of water resource management, industrial pollution control, collection and disposal of solid waste, conservation of ecosystems, and environmental information and education.

6. **The Water Resource Management Program** will include water quality monitoring of inland and coastal ecosystems, hydrological data base management, and a study for the design of a State Water Resources Plan.

7. **The Industrial Pollution Control Program** will include industry surveys, industrial toxic waste studies, updating and implementation of industrial pollution control and licensing programs, design of industrial effluent standards, and the design of manuals for pollution control for small industries.

8. **The Municipal Solid Waste Program** will be strengthened to assist Espírito Santo's municipalities in the preparation of solid waste collection and disposal projects. The program includes the preparation of guidelines for solid waste management; landfill siting; assistance during project implementation; and design of solid waste recollection, treatment, and disposal systems for key municipalities in the area of influence of the project, especially near Grande Vitoria.

9. **The Ecosystems Conservation Program** will include the preparation of management plans for state natural conservation units within the project area which are not included in the National Environmental Plan. The coastal lagoon ecosystem of the Setiba State Park, managed by SEAMA, and the mangrove ecosystem of the Lamirao Reserve, managed by the municipality of Vitoria, will be primary targets of this program.

10. **The Environmental Information Systems Program** will strengthen SEAMA's work in the fields of ecological and economic zoning, design and implementation of geographical information systems for selected sub-basins in the project area, design and implementation of data bases for industrial pollution control, and water quality monitoring and hydrological data. This program will also improve and/or establish SEAMA's water quality models for major rivers, estuaries, and bays in the State.

11. **The Environmental Education Program**, to be designed and implemented with local NGO participation, will support and assist the environmental education programs of the associations of municipalities, prepare and disseminate environmental education materials, and provide environmental training to local NGOs, municipalities, and associations of municipalities.

12. The strengthening of SEAMA's operational and administrative capability will enable it to establish a comprehensive legal and regulatory framework for water quality objectives and effluent standards; to improve its work at identifying, preparing, and adopting norms, guidelines and procedures for environmental assessment; to increase NGO and community organization participation; and to update and improve existing water quality laboratories and field sampling equipment. A comprehensive training program for SEAMA's staff will be developed, including seminars, short courses, technical visits and study tours. In addition, SEAMA's organizational procedures and work programs will be reviewed and upgraded. This component will also include the construction of the headquarters for the State Institute for the Environment, to be built within an urban park in Vitoria.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
INSTITUTIONAL STRENGTHENING COMPONENT
US$ Thousands as of June, 1993

	DESCRIPTION	1994	1995	1996	1997	1998	1999	TOTAL
I	SEAMA							
A	STUDIES	400	500	350	100	0	0	1,350
A.1	Legal and Regulatory Framework Review	100	0	0	0	0	0	100
A.2	Environmental Information Systems	100	100	0	0	0	0	200
A.3	Solid Waste Collection and Disposal	100	200	200	0	0	0	500
A.4	Industry Survey	50	0	0	0	0	0	50
A.5	Water Quality Modelling	50	0	0	0	0	0	50
A.6	Water Resources Management	0	100	0	0	0	0	100
A.7	Management Plan for Protected Areas	0	100	50	0	0	0	150
A.8	Other Studies	0	0	100	100	0	0	200
B	TECHNICAL ASSISTANCE	100	150	150	150	150	50	750
C	TRAINING	50	150	150	200	200	200	950
D	EQUIPMENT	400	1,000	1,000	0	0	0	2,400
E	OTHER SERVICES	100	200	200	50	50	0	600
F	HEADQUARTERS	50	200	850	850	0	0	1,950
	SEAMA'S BASE COST	1,100	2,200	2,700	1,350	400	250	8,000
	Physical Contingencies	78	156	191	96	28	17	566
	Price Contingencies	35	125	237	163	59	6	625
	SEAMA'S COST	1,213	2,481	3,128	1,609	487	273	9,191
II	CESAN							
A	STUDIES	450	150	100	50	0	0	750
A.1	Contract Plan	30	0	0	0	0	0	30
A.2	Fixed Assets Revaluation	150	0	0	0	0	0	150
A.3	Financial Management and Auditing	100	0	0	0	0	0	100
A.4	Information Systems	50	0	0	0	0	0	50
A.5	Demand	50	0	0	0	0	0	50
A.6	Total Quality	50	50	0	0	0	0	100
A.7	Environmental Studies	20	50	50	0	0	0	120
A.8	Other Studies	0	50	50	50	0	0	150
B	SANITARY EDUCATION PROGRAM	100	130	130	130	130	130	750
C	TRAINING	100	150	150	100	50	50	600
D	EQUIPMENT	100	700	500	250	250	0	1,800
D.1	Water and Wastewater Quality Analysis	0	300	300	0	0	0	600
D.2	Information Systems, Computers, Plotters & Software	100	400	200	0	0	0	700
D.3	Sewage Cleaning Equipment	0	0	0	250	250	0	500
E	HEADQUARTERS	0	0	0	0	2,000	2,000	4,000
	CESAN'S BASE COST	750	1,130	880	530	2,430	2,180	7,900
	Physical Contingencies	0	0	0	0	100	100	200
	Price Contingencies	24	64	76	62	375	58	659
	CESAN'S COST	774	1,194	956	592	2,905	2,338	8,759
III	TOTAL COST	1,987	3,675	4,084	2,201	3,392	2,611	17,950

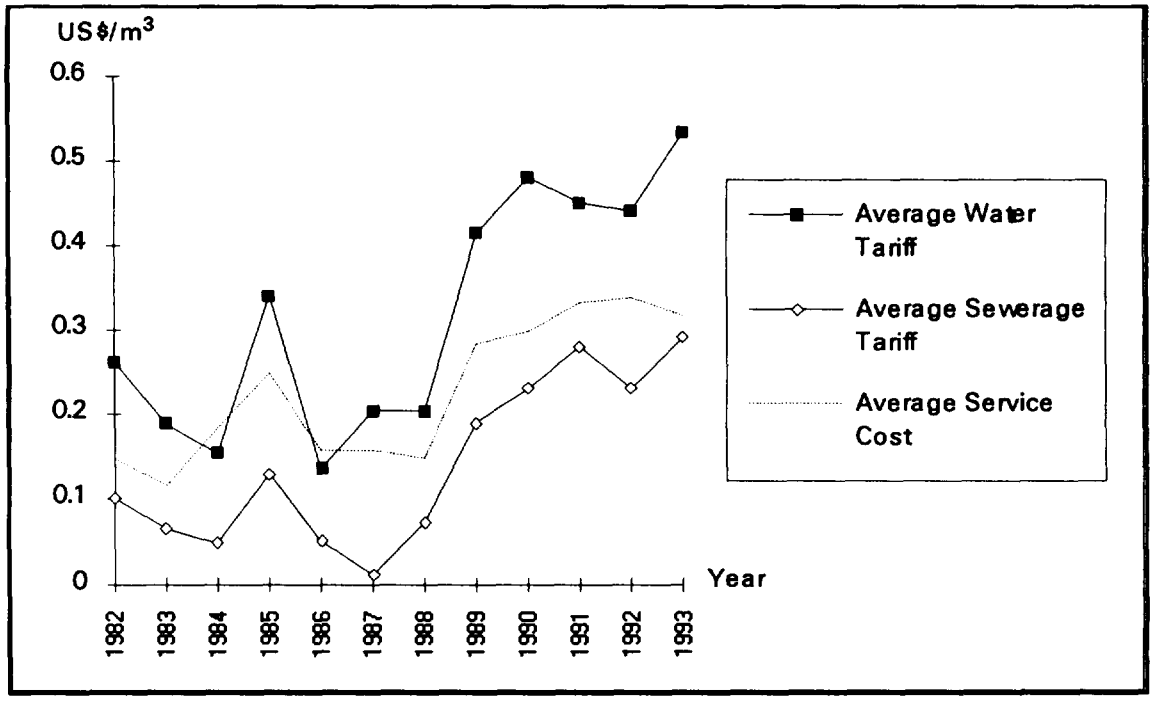
BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN WATER SUPPLY AND SEWERAGE TARIFFS

Legal Framework

1. Brazilian State Water Supply and Sewerage Companies (SWCs) began applying in 1978 a uniform tariff structure known as the National Tariff Law (NTL). The NTL was established by Law No. 6,528 of May 1978, and was further defined by Decree No. 82,587 of November 1978. The NTL was conceived by the National Water Supply and Sanitation Program (PLANASA) as the major underpinning framework of sector regulation and implemented under the direction of the former Banco Nacional da Habitação (BNH).

2. In January 1987, as a part of the Cruzado Plan, the federal government gave autonomy to state and municipal governments to set their own water and sewerage tariffs. As shown in Figure 1, the State of Espírito Santo has since 1987 used this provision to authorize major tariff increases to CESAN. The State however, lacks a clear tariff policy to be used by CESAN and other municipal companies as a guideline for tariff setting. The Bank project will provide technical assistance to the State to prepare a law for regulating its water and sanitation sector, that will include a well-defined tariff policy.

Figure 1. CESAN's TARIFFS AND SERVICE COSTS



General Principles

3. CESAN's water and sewerage tariffs (see Table 1) continue to be defined by the two main principles established by the NTL: financial equilibrium for the SWCs and social equity for residential customers. The financial equilibrium principle maintains that the combined average tariff[1/] for water supply and sewerage should be high enough to generate a revenue equal to CESAN's service cost (SC). SC is defined as the sum of operating expenses--personnel, materials, electricity and other third party services, general, and fiscal expenses (DEX); annual allowances for depreciation, doubtful accounts, and amortization of expenses (DPA); and a remuneration for investment (RI) that should be at least equal to the debt service--interest payments and capital amortization due in a given period of time, but not larger than 12% of the acknowledged investment in operating fixed assets.

4. The social equity principle maintains that tariff setting should take into account the ability to pay of households. CESAN's tariff structure classifies residential customers into five categories, depending on their socio-economic level. The socio-economic level assigned to each household depends on the type of housing, as measured by physical standards such as area, materials, location, and access to utilities. The residential tariff structure is then defined using minimum consumption levels and increasing block tariffs for each socio-economic category. The assumption underlying this structure is that household income is positively correlated with the type of housing as well as its water consumption level. This tariff structure allows cross subsidies between socio-economic categories.

Residential Tariffs

5. **Minimum Consumption Level.** The minimum consumption level (MCL) corresponds to the minimum volume of water that should be billed to a household each month. The MCL, currently set at 10 m^3 per household per month, claims to represent the minimum volume of water a family requires for maintaining basic health and sanitary conditions. As of September 1993, the minimum bill resulting from the MCL ranges from US$2.06 per month for the "rustic" category to US$5.41 for the "superior" and "special" categories (see para. 7). The monthly consumption of about 25% of CESAN's households is below the minimum level of 10 m^3.

6. Establishing an MCL is equivalent to setting a fixed rate with a right to consume the minimum level free of charge. Usually, the main reason for including MCLs in a rate schedule is that it allows utilities a full or partial recovery of customer-related fixed costs. Establishing MCLs for accommodating low-income households does not generally accomplish its purpose; on the contrary, it may contribute to significant departures from the objective of improving poor families' welfare when handled aggressively. This case is what seems to be occurring in Espírito Santo. Therefore, the adoption of a fixed monthly charge independent of water consumption but increasing with the income level of the household would be a significant improvement in CESAN's tariff structure.

7. **Socio-Economic Categories.** Residential customers are classified in one of the following five socio-economic groups: basic, popular, standard, superior, and special. As of September 1993, 16.4% of CESAN's residential customers were classified as basic, 40.3% as popular, 40.3% as standard, 2.2% as superior, and 0.8% as special (see Table 2). CESAN's assumption behind its current classification of residential customers is that the socio-economic category assigned to each household is positively correlated with its income level. More precisely, CESAN assumes that the average monthly income per household is: less than one minimum salary (MS) for the basic category, 2 MS for the popular category, 3 MS for the standard category, 10 MS for the superior category, and 20 MS for the special category. In the State of Espírito Santo, the average monthly income is 3.4 MS per household.

[1/] Average tariffs are defined dividing operational revenue by volume sold. Required average tariffs are defined dividing service cost by volume sold.

Table 1. CESAN'S TARIFF STRUCTURE AS OF SEPTEMBER 1993 1/

CATEGORY and SYSTEM	MINIMUM MONTHLY BILL		MONTHLY WATER CONSUMPTION m3/Customer-month										ESTIMATED AVERAGE TARIFF		ESTIMATED AVERAGE BILL	
			10<MWC<15		15<MWC<20		20<MWC<30		30<MWC<45		45 < MWC					
	WTR	SWG	WTR	SWG	WTR	SWG	WTR	SWG	WTR	SWG	WTR	SWG	WTR	SWG	WTR	SWG
	US$/Cust-mo.		US$/m3		US$/m3		US$/m3		US$/m3		US$/m3		US$/m3		US$/Cust-mo.	
Residential													0.48	0.23	7.88	3.77
- Basic	2.06	1.03	2.92	1.46	4.00	2.00	4.76	2.38	5.41	2.71	6.06	3.03	0.26	0.10	3.42	1.28
- Popular	3.03	1.51	4.22	2.11	5.84	2.92	6.82	3.41	7.79	3.90	8.76	4.38	0.39	0.18	6.01	2.77
- Standard	3.90	1.95	5.41	2.71	7.57	3.79	8.76	4.38	10.06	5.03	11.25	5.63	0.54	0.24	9.56	4.22
- Superior	5.41	2.71	7.57	3.79	10.39	5.19	12.12	6.06	13.85	6.92	15.58	7.79	0.93	0.44	25.93	12.27
- Special	5.41	2.71	7.57	3.79	10.39	5.19	12.12	6.06	13.85	6.92	15.58	7.79	1.06	0.49	41.12	19.01
Small Commercial	8.66	4.33	8.66	4.33	13.63	6.82	13.63	6.82	13.63	6.82	13.63	6.82	1.09	0.46	18.45	9.23
Other Commercial	12.23	6.11	13.63	6.82	13.63	6.82	13.63	6.82	13.63	6.82	13.63	6.82	1.38	0.69	345.18	172.59
Industrial	12.77	6.38	14.17	7.09	14.17	7.09	14.17	7.09	14.17	7.09	14.17	0.70	1.41	0.70	578.68	287.29
Public	8.22	4.11	12.01	6.01	12.01	6.01	12.01	6.01	12.01	6.01	12.01	6.01	11.58	4.54	800.69	314.29
Special Contracts																
- CST													0.24	NA	2/	NA
- CVRD													0.52	NA	2/	NA
CESAN													0.50	0.28		
GRANDE VITORIA													0.53	0.28		
GUARAPARI													0.54	NA		
OTHER SYSTEMS													0.30	NA		

TARIFFS:CESAN

1/ The rate levels presented in this Table are applicable to the systems of Grande Vitoria and Guarapari. Rate levels applicable in other systems are 80% of these values.
2/ CST and CVRD were billed US$626,096 and US$526,937 during September 1993, based on the special contracts they have with CESAN.

Table 2. CESAN's WATER CUSTOMERS AND CONSUMPTION
September 1993

Tariff Category	Water Customers		Water Sold per Month		
	#	%	m^3(000)	%	m^3/customer
Residential	394,032	91.6	6,467	55.5	16.41
- Basic	64,746	15.0	852	7.3	13.15
- Popular	158,707	36.9	2,444	21.0	15.40
- Standard	158,846	36.9	2,812	24.1	17.70
- Superior	8,734	2.0	244	2.1	27.88
- Special	2,999	0.7	116	1.0	38.79
Small Commercial	29,027	6.7	491	4.2	16.93
Other Commercial	1,652	0.4	413	3.5	250.13
Industrial	890	0.2	365	3.1	410.41
CVRD and CST	2	0.0	3,576	30.7	1,788,000.00
Public	4,776	1.1	330	2.8	69.16
TOTAL	430,379	100.0	11,644	100	27.05

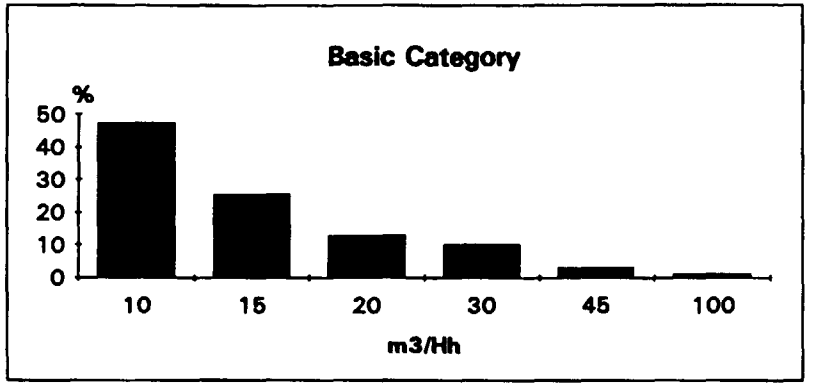
8. **Socio-Economic Classification and Household Income.** CESAN's current residential classification aims to alleviate poverty conditions of poor families, making water and sewerage services affordable to them. CESAN's assumption of a positive correlation between the income level and the socio-economic classification allows a cross-subsidization in favor of those households without ability to pay the actual cost for service. However, an analysis based on a sample of users taken from a recent contingency valuation study[2/], revealed that household income: (i) is actually different from the one assumed by CESAN for each category; and (ii) is not closely correlated with the socio-economic level determined by the residential categories--the average monthly income was 3.6 MS for rustic customers; 3.9 MS for popular customers; 2.3 MS for standard customers; 8.5 MS for superior customers, and 18 MS for special customers. Even though the sample was not selected for income purposes, it is clear that the current classification should be reviewed to achieve the social equity objective that both the State of Espírito Santo and CESAN pursue with the water supply and sewerage tariffs.

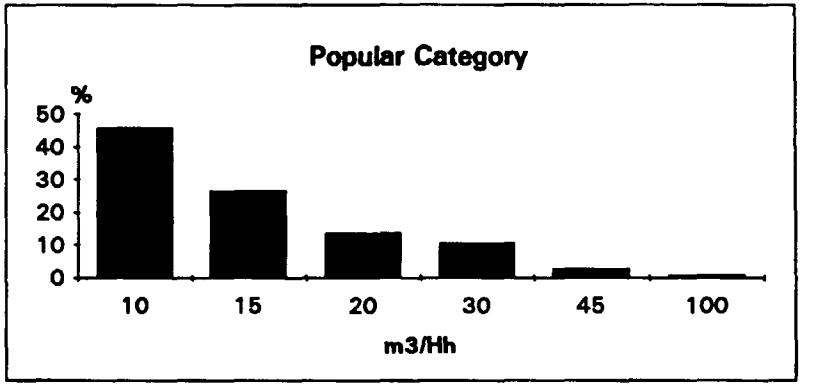
9. **Consumption Blocks.** Water consumption by residential customers is also charged in accordance with an increasing block tariff system. The consumption blocks are determined as follows: less than 10 m^3 (equal to the MCL), from 10 to 15 m^3, from 16 to 20 m^3, from 21 to 30 m^3, from 31 to 45 m^3, and from 45 m^3 onwards. Different rate levels are then set for each socio-economic category as follows: the rates applicable to basic households (presumably those families with lower incomes) are 2.6 times lower than those applicable to special and superior households (presumably those families with higher incomes), 1.9 times lower than those applicable to standard households, and 1.4 times lower than those applicable to popular households (see Table 1).

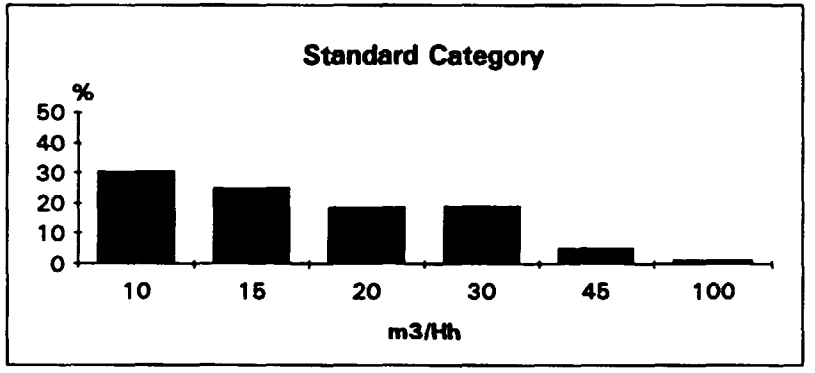
10. **Water Consumption and Household Income.** CESAN's use of an increasing block tariff system aims to encourage a reasonable consumption of water and to allow cross-subsidization in favor of poor families. To practice a cross-subsidization policy is possible because, as shown in Figure 2, CESAN's average household water consumption distribution is positively correlated with household income level--as measured by the socio-economic classification. The basic and popular categories concentrate almost half of their households (47% and 46%, respectively) in the range below 10 m^3 per month.

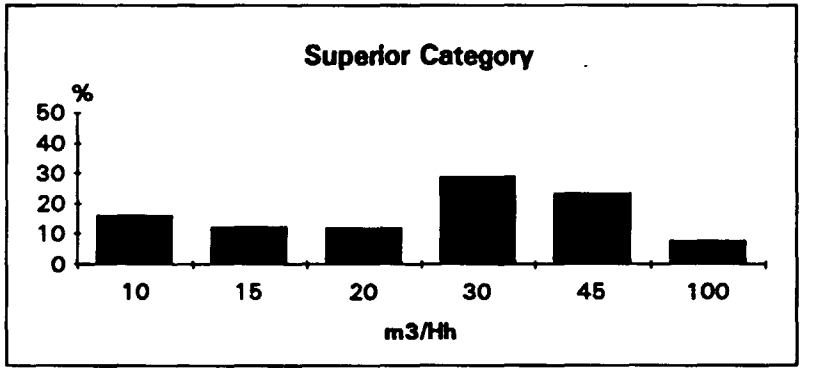
[2/] Ampla Visao Asesoria e Servicos (1993), **Programa de Despoluicao dos Ecossistemas Litoraneos do Estado do Espirito Santo: Quantificacao dos Beneficios**, July.

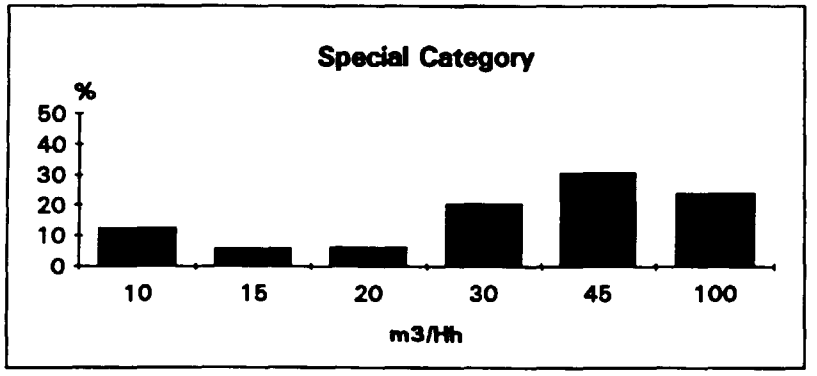
Fig 2. CESAN's HOUSEHOLD (Hh) WATER CONSUMPTION DISTRIBUTION

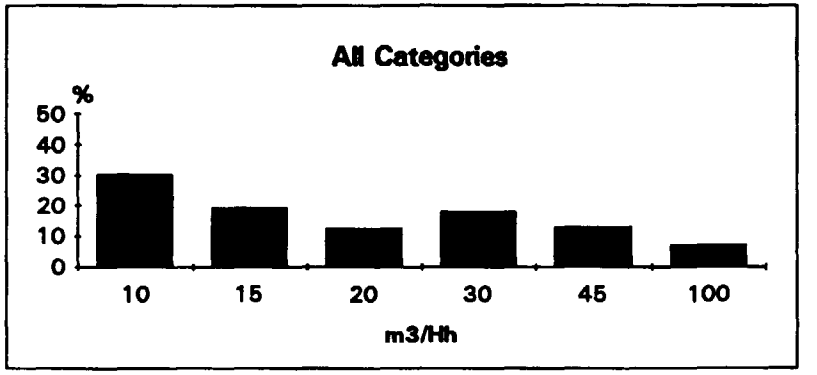












Meanwhile, more than half of the households of the special category (55%) consume more than 30 per month. On the other hand, the basic and popular categories have a very small number of households (4%) consuming more than 30 m^3 per month. But almost one-quarter of special households (24%) consume more than 45 m^3 per month. However, the small differences observed among the average values of the first three categories, as well as the large standard deviation exhibited by all income categories, suggest that this policy could be somewhat regressive. A large group of residential households is paying average and marginal tariffs well below the marginal cost of providing the service (see Annex 11). It is clear, for instance, that consumptions higher than 45 m^3/month are excessive and should not be subsidized to any customer. In addition, some very poor households could be paying bills higher than what they can afford. These facts allow CESAN ample room for increasing revenues just by eliminating unnecessary subsidies now being granted to high-income families, and for maintaining and even increasing the subsidies granted to very poor families. However, to achieve the results being pursued will required a revision of the current socio-economic classification to assure an appropriate targeting of subsidies.

11. **Monthly Bills.** Average monthly water bills vary from US$3.42 for basic households, to US$41.12 for households in the "special" category. Accepting CESAN's assumption in relation to the average monthly income per socio-economic category (para. 7) and estimating the MS at about US$85 per month, the water bills correspond on average to about 4.0%, 3.5%, 3.7%, 3.1%, and 2.4% of the family income of each socio-economic category.

Non- Residential Tariffs

12. **Non-Residential Classification.** The non-residential classification distinguishes between commercial, industrial and public customers. A set of lower rate levels applies to small commercial customers, and specific tariffs apply to those industries with special contracts (para. 13). In addition, commercial, industrial, and public customers without meters are divided into four sub-categories based on the number of staff employed, level of consumption of water, diameter of their connections, and final usage.

13. **Special Contracts.** Special contracts regulate CESAN's relationship with the Companhia Siderurgica de Tubarao (CST) and the Companhia Vale do Rio Doce (CVRD). These contracts guarantee a minimum amount of water to both companies and the tariffs to be charged. CESAN currently guarantees 0.254 m^3/s of treated water at US$0.52/$m^3$ to CVRD, and 1 m^3/s of untreated water at US$0.24/$m^3$ to CST. As of September 1993, the water consumption of these two companies represented 31% of CESAN's total volume of water billed (91% of total industrial consumption). In the terms of revenues these two companies account for 20% of CESAN's total invoices.

14. **Non-Residential Tariff Structure.** CESAN's current non-residential tariff structure defines minimum consumption levels for each non-residential type of customer, that are smaller than the remaining rates in that category. In addition, all non-residential rates are greater than CESAN's average tariff. Differentiating between commercial, industrial, or public customers based on their water consumption level has negative effects on the resource allocation process. CESAN seems to be aware of this point, as minimum consumption levels for non-residential customers are explained by households classified as commercial or industrial customers because of the small family business they own and operate from their houses. However, a well designed tariff structure should automatically take care of this classification process. Households having a small family business within or attached to their homes should find themselves better off when classified as residential customers. Likewise, households having a larger than normal family business should find themselves better off when classified as non-domestic customers. In addition, CESAN's selected criteria to differentiate customers--such as activity and number of staff, are not related with the cost of providing service. Instead, this tariff differentiation may create incentives to change the classification and lower tariffs through irregular practices. Second, CESAN's application of higher tariffs in the non-residential sector are passed on to the residential customer, distorting the distribution objective. And third, the fact that

tariffs in the non-residential sector are higher than the cost of providing the service could result in negative consequences to the economy because it encourages exploration of alternatives, such as digging of wells or the operation of independent systems[3].

Sewerage Rates

15. Sewerage and water supply tariff structures are the same, with sewerage rates being equal to 35% of water rates when sewage is not treated, and 50% when sewage is treated (as of 1993, 9% of the water consumed is collected but only 6% of water consumed is collected and treated). Sewerage rates are not based on supply costs, but on financial factors. Systems without treatment have rates significantly higher than costs (except for residential customers), while systems with treatment have rates generally smaller than costs.

Economic Subsidies

16. As shown in Table 3, CESAN has several water supply and sewerage systems which have different supply costs, but which are aggregated and consolidated for financial and pricing purposes. CESAN's tariff structure is uniformly applied to all customers, independent of the individual system that serves them. Rate levels are also the same for all non-residential customers, independent of the individual system that serves them. Rate levels for residential customers served from systems outside Grande Vitoria and Guarapari are 83% smaller. This pricing feature results in large economic subsidies in favor of those customers being served from more expensive systems.

Table 3. WATER SUPPLY AND SEWERAGE SYSTEMS DISTRIBUTED BY SIZE
December, 1992

ANNUAL AVERAGE VOLUME PER SYSTEM (000 m³)	WATER SUPPLY				SEWERAGE			
	SYSTEMS		ANNUAL PRODUCTION		SYSTEMS		ANNUAL PRODUCTION	
	#	%	m³(000)	%	#	%	M³(000)	%
Up to 100	32	38	1,455	1	3	30	134	1
From 101 to 500	30	36	7,779	4	3	30	847	8
From 501 to 1,000	12	14	7,950	4	1	10	541	5
From 1,001 to 5,000	6	7	7,818	4	2	20	3,866	36
From 5,001 to 10,000	2	2	16,444	8	1	10	5,242	49
From 10,001 to 15,000	0	0	0	0	0	0	0	0
From 15,001 to 50,000	0	0	0	0	0	0	0	0
From 50,001 to 100,000	2	2	153,330	79	0	0	0	0
More than 100,000	0	0	0	0	0	0	0	0
All CESAN Water Supply Systems	84	100	194,776	100	10	100	10,630	100

17. Inside each system, as shown in Table 4, all non-residential customers are heavily overcharged, while most residential customers are heavily subsidized (the exception being those classified in the superior and special categories)[4]. On average, residential customers receive an average

[3] A recent survey found that about 10% of CESAN's major non-residential clients have wells to complement the water service they receive from CESAN (see CESAN (1993), Estudo de Demanda de Agua, October.

[4] Table 4 combines the results of the marginal cost pricing analysis presented on Annex 11 with CESAN's current tariff structure.

Table 4. CESAN'S MARGINAL COST AND TARIFF STRUCTURES AS OF SEPTEMBER 1993

REGION AND TARIFF CATEGORY	MARGINAL COST (US$/m3)						AVG. TARIFFS (US$/m3)		RATIO TARIFF / MARGINAL COST									
	WATER		SEWERAGE						WATER		SEWERAGE				WATER & SEWERAGE			
			W/O TREATMENT		WITH TREATMENT		WATER	SEWERAGE			W/O TREATMENT		WITH TREATMENT		W/O TREATMENT		WITH TREATMENT	
	TOURIST SEASON	OFF SEASON	TOURIST SEASON	OFF SEASON	TOURIST SEASON	OFF SEASON	BOTH SEASONS	BOTH SEASONS	TOURIST SEASON	OFF SEASON	TOURIST SEASON	OFF SEASON	TOURIST SEASON	OFF SEASON	TOURIST SEASON	OFF SEASON	TOURIST SEASON	OFF SEASON
GRANDE VITORIA							0.53	0.28										
NON-RESIDENTIAL CUSTOMERS							0.62	0.33										
– Industries Served with Raw Water	0.22	0.22	NA	NA	NA	NA	0.24	NA	1.08	1.09	NA	NA	NA	NA	1.08	1.09	1.08	1.09
– Industries Served from Treatment Plant	0.28	0.27	NA	NA	NA	NA	0.52	NA	1.89	1.90	NA	NA	NA	NA	1.89	1.90	1.89	1.90
– Industries Served from Prim. Distribution Pipes	0.48	0.48	0.36	0.36	0.57	0.57	1.41	0.70	2.96	2.96	1.94	1.94	1.22	1.22	2.52	2.52	2.01	2.01
– Industries Served from Sec. Distribution Pipes	0.58	0.58	0.36	0.36	0.57	0.57	1.41	0.70	2.44	2.45	1.94	1.94	1.22	1.22	2.25	2.25	1.83	1.83
– Small Commercial	0.58	0.58	0.36	0.36	0.57	0.57	1.09	0.38	1.89	1.89	1.05	1.05	0.66	0.66	1.57	1.57	1.28	1.28
– Other Commercial	0.58	0.58	0.36	0.36	0.57	0.57	1.38	0.50	2.39	2.40	1.39	1.39	0.87	0.87	2.00	2.01	1.63	1.63
– Public	0.58	0.58	0.36	0.36	0.57	0.57	1.16	0.45	2.01	2.01	1.25	1.25	0.78	0.78	1.71	1.72	1.40	1.40
RESIDENTIAL CUSTOMERS	0.58	0.58	0.36	0.36	0.57	0.57	0.48	0.23	0.83	0.83	0.64	0.64	0.40	0.40	0.76	0.76	0.62	0.62
– Basic	0.58	0.58	0.36	0.36	0.57	0.57	0.26	0.10	0.45	0.45	0.28	0.28	0.17	0.17	0.38	0.38	0.31	0.31
– Popular	0.58	0.58	0.36	0.36	0.57	0.57	0.39	0.18	0.67	0.68	0.50	0.50	0.31	0.31	0.61	0.61	0.49	0.50
– Standard	0.58	0.58	0.36	0.36	0.57	0.57	0.54	0.23	0.93	0.94	0.64	0.64	0.40	0.40	0.82	0.82	0.67	0.67
– Superior & Special	0.58	0.58	0.36	0.36	0.57	0.57	0.97	0.46	1.68	1.68	1.27	1.27	0.80	0.80	1.52	1.53	1.24	1.24
GUARAPARI							0.54	NA										
NON-RESIDENTIAL CUSTOMERS							0.45	NA										
– Industries Served from Prim. Distribution Pipes	1.60	1.39	0.58	0.58	0.82	0.82	1.38	NA	0.87	0.99	NA	NA	NA	NA	NA	NA	NA	NA
– Industries Served from Sec. Distribution Pipes	1.84	1.61	0.58	0.58	0.82	0.82	1.38	NA	0.75	0.86	NA	NA	NA	NA	NA	NA	NA	NA
– Small Commercial	1.84	1.61	0.58	0.58	0.82	0.82	0.98	NA	0.53	0.61	NA	NA	NA	NA	NA	NA	NA	NA
– Other Commercial	1.84	1.61	0.58	0.58	0.82	0.82	1.34	NA	0.73	0.83	NA	NA	NA	NA	NA	NA	NA	NA
– Public	1.84	1.61	0.58	0.58	0.82	0.82	1.07	NA	0.58	0.67	NA	NA	NA	NA	NA	NA	NA	NA
RESIDENTIAL CUSTOMERS	1.84	1.61	0.58	0.58	0.82	0.82	0.44	NA	0.24	0.27	NA	NA	NA	NA	NA	NA	NA	NA
– Basic	1.84	1.61	0.58	0.58	0.82	0.82	0.23	NA	0.13	0.14	NA	NA	NA	NA	NA	NA	NA	NA
– Popular	1.84	1.61	0.58	0.58	0.82	0.82	0.36	NA	0.20	0.22	NA	NA	NA	NA	NA	NA	NA	NA
– Standard	1.84	1.61	0.58	0.58	0.82	0.82	0.46	NA	0.25	0.29	NA	NA	NA	NA	NA	NA	NA	NA
– Superior & Special	1.84	1.61	0.58	0.58	0.82	0.82	0.84	NA	0.46	0.52	NA	NA	NA	NA	NA	NA	NA	NA

T&C: 12/14/95

economic subsidy equal to 21%. When economic subsidies are calculated for the combined services of water supply and sewerage without treatment, non-residential customers are overcharged less but households are subsidized even more (32%). When treatment is included in the sewerage service, non-residential customers are overcharged even less but households are subsidized almost twice as much as when they receive sewerage without treatment (61%).

Financial Subsidies

18. Overall, and taking Grande Vitoria as representative of all CESAN's systems, non-residential customers without special contracts are heavily overcharged from a financial viewpoint. The average water tariff for non-residential customers is 1.32 times CESAN's average tariff (from 106% for the small commercial category to 166% for the industrial category). On the other hand, the basic and popular categories of CESAN's residential customers are heavily subsidized (51% and 26%, respectively), while the other residential categories are overcharged (2% in the standard category, 75% in the superior category, and 100% in the special category). Because of the way sewerage tariffs are defined (para. 15), financial subsidies (overcharges) resulting from sewerage services are similar to those obtained for water in percentage terms.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
MARGINAL COST PRICING ANALYSIS: METHODOLOGY AND RESULTS

1. Marginal cost pricing has been applied to evaluate CESAN's tariff structure and the cost-effectiveness of its prospective investments in water supply and sewerage. Long-run average incremental costs (LRAIC) have been estimated for CESAN's water supply and sewage collection and treatment systems located in Grande Vitória and Guaraparí. The planning horizon covers 30 years (1994-2023) and the opportunity cost of capital (OCC) is assumed at 10%.

Projections of Water Consumption and Production

2. The urban population, projected by CESAN based on census data, is assumed to grow at a uniform rate from 1993 to the year in which the expanded water supply system reaches the saturation point. Saturation takes place at the year in which required water production (water demand plus unaccounted-for water) becomes equal to water production capacity. The urban population is assumed to be static after the saturation year, constrained by the project's water supply capacity. The urban population served is equal to total urban population times the estimated service coverage level. Using the long-run price elasticity of -0.30 estimated from the results of a Contingency Valuation (CV) study, total water consumption is projected as the product of the urban population served by an estimated daily water consumption per capita, which is calculated as the weighted average of seasonal consumption. Seasonal water consumption is calculated based on CESAN's last three years of records of a sample of users who, during this period, have had meters and have not been subject to rationing. The average unaccounted-for water (UFW) level is assumed to decrease during the project implementation period as a result of the actions to be taken under the institutional development program, and to remain steady at its 1998 level afterwards[1/]. The incremental volume of water available to CESAN's old and new customers as a result of the reduction in unaccounted-for water, BRL_t, is equivalent to an expansion in production capacity[2/]. Required seasonal and total water production is computed as the sum of water consumed and lost in the transmission and distribution networks[3/]. CESAN's special contracts with the Companhia Siderurgica do Tubarao (CST) and the Companhia Vale Do Rio Doce (CVRD) guarantee minimum volumes of 1 m^3/s of untreated water for CST and 0.254 m^3/s of treated water for CVRD. CVRD projected demand is calculated assuming a level of losses of only 2%, given that the industry is served directly from the treatment plant. CST projected demand is not included in CESAN's total projections since water projects are designed to satisfy treated water needs. Water production capacity is increased in accordance with the start up

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1/ The assumption of constant UFW levels after 1998, will require from CESAN to internalized into its day-to-day operations all the measures that will allow the expected change. Because of the strong implications of this requirement, the operation and maintenance (O&M) costs associated with the unaccounted-for water control program have been assumed at 10% of the investment cost of this program--that is, twice as much as the O&M costs associated with other investments.

2/ The following formula is used to approximately calculate the marginal benefit from reducing unaccounted-for water:

$$BRL_t = WP_t * \sum_{k=1}^{t} (L_{k-1} - L_k) = WP_t * (L_o - L_t)$$

where L_t is the loss level in year t and L_o is the average loss rate in the base year.

3/ This can be mathematically expressed as:

$$WP_t = \frac{WC_t}{1 - L_t}$$

where WC_t, L_t and WP_t are the consumption amount, the average loss level, and the total production in year t, respectively.

of new facilities. Actual total water production is equal to production capacity when the system is being rationed, and to the volume of water production required when there is enough capacity to satisfy it. The actual incremental water production at year t is calculated as the difference between the actual water production level at year t and the actual water production level at the base year (i.e., 1993). The seasonal index of excess capacity shows the percentage of the current production capacity which is not utilized. The net present values of the incremental volumes of water resulting from reducing the unaccounted-for water level and expanding supply capacity are calculated using the assumed OCC. As an example, population, consumption, and production projections for the water supply system of Grande Vitória are presented in Attachment 1.

Projections of Sewage Collection and Treatment

3. The urban population served with in-house sewerage connections is estimated as the product of total urban population and projected service coverage levels. The projected amount of sewage collected in each year is estimated based on the number of sewerage connections projected for each year and the amount of average sewage produced per connection in each year[4/]. The amount of sewage produced per connection is assumed to remain constant during the project implementation period. The incremental amount of sewage collected in year t is calculated as the difference between sewage collected in year t and in the base year. The total and incremental amounts of sewage both collected and treated are calculated analogously. The net present values of the incremental amounts of sewage only collected and sewage both collected and treated are then calculated using the assumed OCC.

Incremental Costs in Water Supply Systems

4. Incremental costs in water supply systems result from building new capacity, reducing UFW levels, and operating and maintaining new facilities. The capacity costs include investments for project management and supervision, operational development (to reduce UFW), water intake, water supply treatment, transmission, distribution, and connections[5/]. All investment costs are expressed in market prices as of June 1993, and include physical contingencies. Incremental fixed operating and maintenance (O&M) costs are associated with the formed capital stock. Therefore, incremental fixed O&M costs in year t are assumed to be 5% (except operational development that is estimated at 10%--see footnote 1) of the capacity investment costs accumulated from year 1 to year t. Total investment costs are equal to the sum of capacity investment costs and incremental fixed O&M costs. The net preset value of these stream of costs are calculated using the assumed OCC as the discount rate. Project investment and O&M costs for Grande Vitória are presented in Attachment 2.

Incremental Costs in Sewerage Systems

5. Incremental costs in sewerage systems result from building new capacity and operating and maintaining new facilities. The capacity cost includes investments for project management and supervision, sewerage connections, collectors, pumping stations, interceptors, and final disposal and treatment. As in water supply, all investment costs are expressed in market prices as of June 1993, and include physical contingencies. Also, as in water supply, all incremental fixed operating and maintenance (O&M) costs are associated with the formed capital stock and are accumulated over years. Incremental fixed O&M in year t are assumed to be 5% of the capacity investment costs

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[4/] The volume of sewage produced per connection has been estimated at 85% of the volume of water consumed.

[5/] Capacity investment costs also include the set of complementary investments to be built after the project implementation period is completed and up to the year in which the new system capacity reaches saturation. Complementary investments, mainly secondary distribution and house connections, are calculated based on the number of incremental connections to be served in each year, with given unitary costs.

accumulated from year 1 to year t. Again as in water, the net present value of all streams of costs are calculated using the assumed OCC as the discount rate.

Marginal Operating Costs

6. **Water Supply Systems.** The Marginal Operating Cost (MOC) is calculated for each season as the cost of the last water source used to satisfy the projected demand in that season, in that year. The last water source, the marginal water source, is found from optimizing the operation of the water system (namely, satisfying the projected demand at the minimum cost possible). To find out the marginal source is then necessary to know the unitary costs of all inputs (chemicals and electricity) necessary to produce an additional m^3 of water. In cases of shortage (that is, when available water sources and/or facilities are insufficient to satisfy the projected demand for water), the MOC has been assumed to equal the users' willingness to pay for having a non-interrupted service[6]. The MOC at each stage of the water supply chain is equal to the MOC at the water intake level multiplied by the corresponding Loss Adjustment Factor (LAF). Seasonal differences are irrelevant in Grande Vitoria, but highly significant in Guaraparí given its role as an important tourist center. The annual equivalent cost of the marginal costs corresponding to the years up to system saturation are then calculated using the assumed OCC. As an example, the results for Grande Vitória are presented in Attachment 3.

7. **Sewerage Systems.** MOC for the sewerage systems are equal to the sum of the cost necessary to collect and/or treat an additional m^3 of sewage (mainly, electricity). Seasonal differences are irrelevant.

Long-Run Average Incremental Costs

8. **Water Supply Systems.** Long-run average incremental costs (LRAIC) have been calculated at each stage of the water supply chain as the ratio of the sum of the present value of the respective capacity investment and incremental fixed O&M costs to the sum of the present values of the incremental volume of water resulting from reducing the unaccounted-for water level and expanding supply capacity. LRAIC have not been seasonally differentiated, that is, capacity investment and incremental fixed O&M costs have been evenly allocated to both seasons[7]. Since investments that reduce UFW levels produce results that are equivalent to increasing water production capacity, the present value of these investments is added to the present value of the capacity investment cost associated with building new water intake facilities. Since LRAIC are calculated based on incremental water production, an adjustment for water losses should be made at each stage of the water supply system to find the actual marginal cost. To this end and based on the current UFW distribution, loss adjustment factors (LAF)[8] have been calculated at the system's steady leakage level (see, as an example, the June 1993 water balance for Grande Vitoria in Figure 1). Marginal capacity costs (MCC)

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[6] The Contingency Valuation Study done for the preparation of this project found that currently rationed households are willing to pay--in addition to their monthly bills, monthly installments of about US$6.66 to get a reliable service, and US$3.64 to reduce the number of hours during which they are subject to rationing. The difference between these two values (US$3.02) corresponds to the households' willingness to pay for receiving a non-rationed water service. Given that the average monthly consumption subject to rationing is estimated at about 5 m^3 per household, the rationing cost has been estimated at about US$0.60 per actually consumed m^3. Assuming a 30% UFW level, the US$0.60 per actually consumed m^3 is equivalent to US$0.42 per produced m^3.

[7] For Guaraparí, however, seasonal differences are notable and a precise estimation of its LRAIC should take these differences into account.

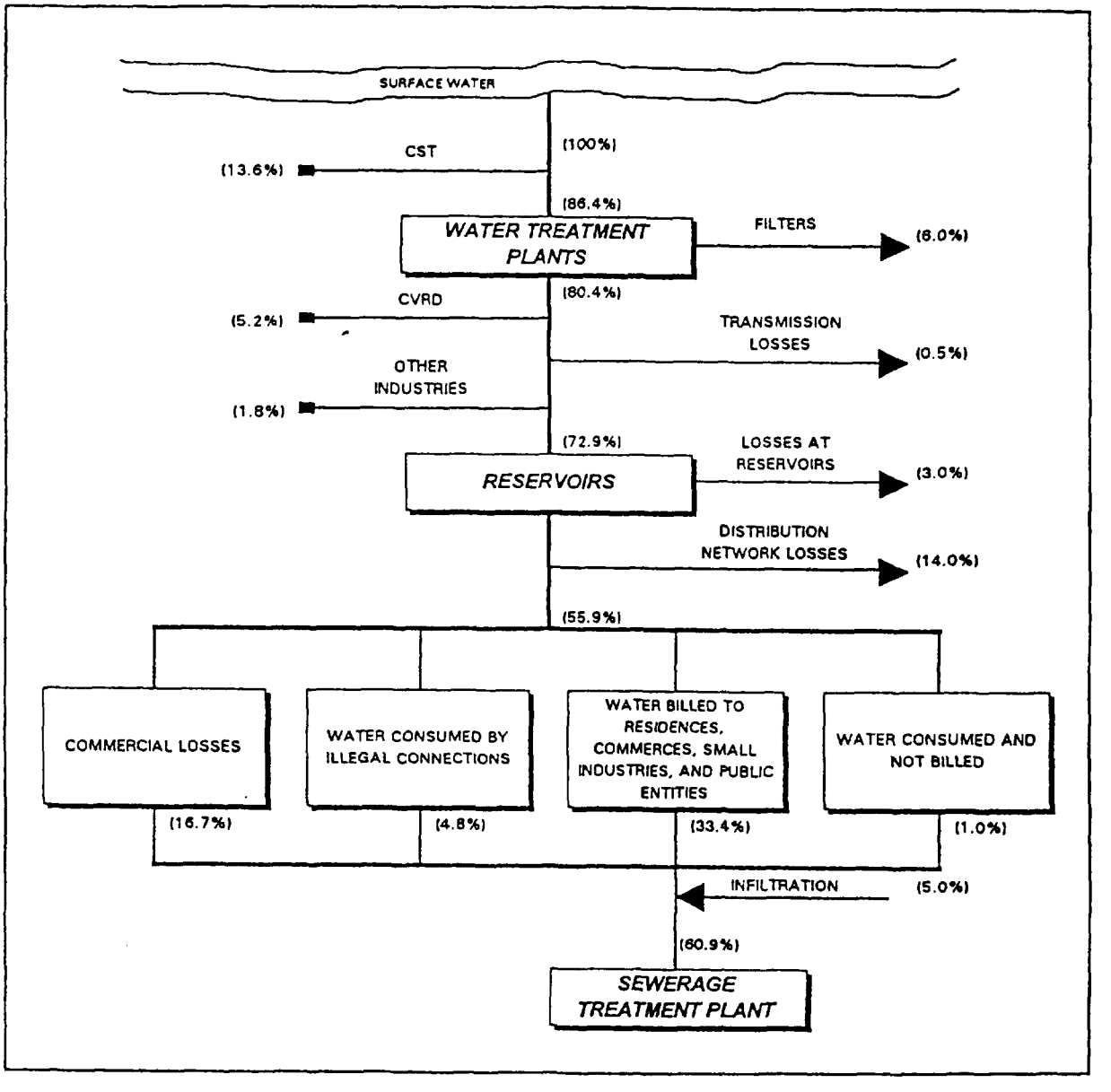
[8] The Loss Adjustment Factors (LAF) are calculated as follows:

$$LAF_i = \frac{1}{(1-L_i)}$$

where LAF_i and L_i are the LAF and the percentage of unaccounted-for water divided by 100 at level i of the water supply system, namely, water intake, treatment, transmission, primary distribution, secondary distribution, or connections.

at the water intake level are then equal to the product of LAF at that level for the corresponding LRAIC; the MCC at the water intake level plus the LRAIC at the treatment level; the MCC at the transmission level is equal to the LAF at that level multiplied by the sum of the MCC at the treatment level plus the LRAIC at the transmission level; and so on[9]. The estimated LRAIC, LAF, and MCC for Grande Vitória are presented in Attachment 4.

Figure 1. WATER BALANCE IN THE GRANDE VITORIA REGION AS OF JUNE 1993



[9] The Marginal Capacity Cost (MCC) is calculated as follows:

$$MCC_1 = LRAIC_1 * LAF_1$$

$$MCC_2 = (MCC_1 + LRAIC_2) * LAF_2$$

.....

$$MCC_i = (MCC_{(i-1)} + LRAIC_i) * LAF_i$$

9. **Sewerage Systems.** LRAIC for connections, collectors, and main collectors have been calculated, at each stage of the chain, as the ratio of the sum of the present value of the respective capacity investment and incremental fixed O&M costs to the sum of the present value of the incremental volume of sewage collected. LRAIC for interceptors and final disposal and treatment have been calculated, at each stage of the chain, as the ratio of the sum of the present value of the respective capacity investment and incremental fixed O&M costs to the sum of the present value of the incremental volume of sewage collected and treated. LRAIC associated with the sewerage systems do not exhibit any seasonality. Estimated LRAIC for Grande Vitória are presented in Attachment 4.

Marginal Costs and Average Customer Costs

10. Marginal Costs at each stage of either the water supply or the sewerage chain are equal to the sum of the corresponding MCC and MOC at that stage. Average Customer Costs comprise monthly billing costs (US$0.81/customer-month) and the investment costs associated with CESAN's strengthening program (US$0.34/customer-month). Estimated Marginal Costs and Average Customer Costs for Grande Vitória and Guarapari are presented in Attachment 4.

Final Comment

11. The results obtained for the Guarapari water supply system (see Attachment 4) illustrate the application of the marginal cost pricing methodology at evaluating the cost-effectiveness of prospective investments. Resulting marginal costs for Guarapari water supply system are not only significantly higher than for Grande Vitoria, but outside the acceptable range of eligibility[10/]. After learning about these results, CESAN revisited the engineering designs proposed for expanding Guarapari water supply system and found that, in effect, some of the assumptions and decisions that were originally made resulted in an overdimension of required facilities. CESAN is currently revising the project engineering designs.

10/ As indicated in Annex 18, water supply projects to be built in medium-sized cities--defined as those with more than 50,000 people but less than or equal to 500,000 people, will be accepted only if the average water tariff in that city exceeds 75% of the estimated marginal cost of providing the service to residential customers.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
POPULATION, CONSUMPTION AND PRODUCTION PROJECTIONS FOR THE WATER SUPPLY SYSTEM OF GRANDE VITORIA

Year	Urban Population			Water Consumption 1/			Unaccounted – for Water		Water Production Required			Water Production Capacity		Actual Water Production		Excess (Rationing) Capacity	
	Total (000)	Coverage Level %	Served (000)	Tourist Season (000)m3	Off Season (000)m3	Total (000)m3	Level 3/ %	Inc. Wtr. Available (000)m3	Tourist Season (000)m3	Off Season (000)m3	Total (000)m3	Tourist Season (000)m3	Off Season (000)m3	Total 4/ (000)m3	Incre– mental (000)m3	Tourist Season %	Off Season %
1993	1,125	88.4	995	22,218	61,940	84,158	40.0	NA	35,725	99,362	135,087	33,482	99,354	132,836	NA	(6.3)	0.0
1994	1,169	88.9	1,039	22,801	63,555	86,356	39.0	1,328	36,129	100,481	136,610	33,482	99,354	132,836	0	(7.3)	(1.1)
1995	1,214	89.4	1,085	23,401	65,217	88,618	37.0	4,084	36,000	100,123	136,123	47,790	141,811	136,123	3,287	32.8	41.6
1996	1,261	90.0	1,135	24,040	66,967	91,026	34.0	8,037	35,425	98,531	133,956	48,585	144,170	133,956	1,120	37.1	46.3
1997	1,310	90.6	1,187	25,050	69,786	94,836	31.0	12,061	35,439	98,569	134,008	48,585	144,170	134,008	1,172	45.7	46.3
1998	1,361	91.4	1,244	26,156	72,848	99,004	30.0	13,817	36,541	101,624	138,165	53,251	158,015	138,165	5,329	39.7	55.5
1999	1,414	92.0	1,300	27,259	75,904	103,163	30.0	14,411	38,117	105,989	144,106	53,251	158,015	144,106	11,270	34.7	49.1
2000	1,469	92.0	1,351	28,242	78,626	106,867	30.0	14,940	39,521	109,877	149,398	53,251	158,015	149,398	16,562	29.9	43.8
2001	1,526	92.0	1,404	29,264	81,457	110,720	30.0	15,490	40,961	113,921	154,902	53,251	158,015	154,902	22,066	25.3	38.7
2002	1,585	92.0	1,458	30,327	84,401	114,728	30.0	16,063	42,500	118,127	160,627	53,251	158,015	160,627	27,791	20.8	33.8
2003	1,647	92.0	1,515	31,432	87,464	118,896	30.0	16,658	44,079	122,503	166,582	53,251	158,015	166,582	33,746	16.5	29.0
2004	1,712	92.0	1,575	32,583	90,650	123,233	30.0	17,278	45,722	127,055	172,777	53,251	158,015	172,777	39,941	12.3	24.4
2005	1,779	92.0	1,636	33,779	93,964	127,743	30.0	17,922	47,432	131,789	179,221	53,251	158,015	179,221	46,385	8.2	19.9
2006	1,848	92.0	1,700	35,024	97,412	132,436	30.0	18,592	49,210	136,714	185,924	53,251	158,015	185,924	53,088	4.3	15.6
2007	1,920	92.0	1,767	36,311	100,977	137,288	30.0	19,286	51,049	141,808	192,857	53,251	158,015	192,857	60,021	0.5	11.4
2008	1,995	92.0	1,836	37,648	104,682	142,330	30.0	20,006	52,959	147,100	200,059	53,251	158,015	200,059	67,223	0.0	7.4
2009 2/	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2010	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2011	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2012	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2013	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2014	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2015	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2016	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2017	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2018	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2019	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2020	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2021	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2022	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
2023	2,007	92.0	1,846	37,853	105,248	143,101	30.0	20,116	53,251	147,909	201,160	53,251	158,015	201,160	68,324	0.0	6.8
NPV (10%)								127,347							258,081		

1/ Annual average consumption is estimated at 206 lcp, excluding CVRD. Because of the fluctuating population, annual average consumption increases by 7.2% during the Tourist Season. CVRD consumption is estimated at 0.254 l/s during both seasons. The tourist season has 92 days and off–season 273 days.

2/ The expanded water supply system of Grande Vitoria begins to operate at full capacity during the tourist season of this year.

3/ The unaccounted–for water level at CVRD is estimated at about 2%. CVRD is served directly from one of CESAN's water treatment plants.

4/ Actual water production capacity equals required water production when there is a surplus and water production capacity when there is a deficit.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
ESTIMATED INVESTMENT COSTS IN THE WATER SUPPLY SYSTEM OF GRANDE VITORIA
(US$ Thousands as of June 1993)

Year	Capacity Investment Cost /1								Incremental Fixed O&M Costs 2/							Total Costs
	Project Manag. & Spn. 3/	Operat. Develop. 4/	Water Intake	Treatment	Transmis.	Distribut. 5/	Connect. 6/	Total	Operat. Develop.	Water Intake	Treatment	Transmis.	Distribut.	Connect.	Total	
1993	0	0	17,609	9,498	0	0	0	27,107	0	880	475	0	0	0	1,355	28,462
1994	212	2,758	12,506	1,818	0	2,273	1,129	20,694	276	1,506	566	0	114	56	2,517	23,212
1995	222	1,674	990	0	0	2,364	1,200	6,449	443	1,555	566	0	232	116	2,912	9,362
1996	232	1,437	991	0	0	2,454	1,277	6,391	587	1,605	566	0	355	180	3,292	9,684
1997	1,421	772	804	895	11,892	8,040	1,360	25,183	664	1,645	610	595	757	248	4,519	29,702
1998	299	664	0	0	0	3,365	1,450	5,778	730	1,645	610	595	925	321	4,826	10,604
1999	268	118	0	0	0	2,750	1,548	4,683	742	1,645	610	595	1,062	398	5,053	9,736
2000	0	0	0	0	0	1,488	748	2,236	742	1,645	610	595	1,137	436	5,165	7,400
2001	0	0	0	0	0	2,432	1,222	3,654	742	1,645	610	595	1,258	497	5,347	9,001
2002	0	0	0	0	0	2,530	1,271	3,800	742	1,645	610	595	1,385	560	5,537	9,338
2003	0	0	0	0	0	2,631	1,322	3,953	742	1,645	610	595	1,516	626	5,735	9,688
2004	0	0	0	0	0	2,737	1,375	4,113	742	1,645	610	595	1,653	695	5,941	10,153
2005	0	0	0	0	0	2,847	1,430	4,277	742	1,645	610	595	1,796	767	6,154	10,432
2006	0	0	0	0	0	2,962	1,488	4,450	742	1,645	610	595	1,944	841	6,377	10,827
2007	0	0	0	0	0	3,063	1,539	4,602	742	1,645	610	595	2,097	918	6,607	11,209
2008	0	0	0	0	0	3,183	1,599	4,781	742	1,645	610	595	2,256	998	6,846	11,628
2009	0	0	0	0	0	487	244	731	742	1,645	610	595	2,280	1,010	6,883	7,614
2010	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2011	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2012	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2013	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2014	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2015	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2016	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2017	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2018	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2019	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2020	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2021	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2022	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
2023	0	0	0	0	0	0	0	0	742	1,645	610	595	2,280	1,010	6,883	6,883
NPV(10%)	1,858	5,976	31,069	11,761	8,123	23,381	9,892	92,060	6,149	16,157	6,119	4,127	11,553	4,862	48,965	141,045

1/ Includes the estimated cost of investments outside the Bank project.
2/ Incremental fixed O&M costs are assumed to be 5% of capacity investment costs, except the O&M costs associated with Operational Development that are estimated at 10%. There are no O&M costs associated with Management and Supervision.
3/ The investment costs associated with Project Management and Supervision are distributed among CESAN's water and sewerage systems, and inside each system among Grande Vitoria, Guarapari, and other systems in function of total estimated capacity costs in each system and geographical area.
4/ The investment costs associated with the Operational Development Program are distributed among CESAN's water systems in function of the current number of connections.
5/ Distribution costs are estimated at US$218 per connection from year 2000 onwards.
6/ Connection costs are estimated at US$115 per residential dwelling from year 2000 onwards.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
MARGINAL WATER SOURCE AND MARGINAL OPERATIONAL COST
(US$ as of June 1993)

Year	Tourist Season		Off–Season	
	Marginal Water Source	Marginal Cost US$/m3	Marginal Water Source	Marginal Cost US$/m3
1994	Rationing	0.4200	Rationing	0.4200
1995	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
1996	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
1997	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
1998	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
1999	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
2000	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
2001	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
2002	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
2003	Jucu River & Vale Esperanza	0.0165	Jucu River & Vale Esperanza	0.0152
2004	Jucu River & Cobi	0.0173	Jucu River & Vale Esperanza	0.0152
2005	Jucu River & Cobi	0.0173	Jucu River & Cobi	0.0153
2006	Jucu River & Cobi	0.0173	Jucu River & Cobi	0.0153
2007	Jucu River & Cobi	0.0173	Jucu River & Cobi	0.0153
2008	Jucu River & Cobi	0.0173	Jucu River & Cobi	0.0153
2009	Barra do Jucu River	0.0295	Jucu River & Cobi	0.0153
Annual Equivalent Cost at 10% (1994–2009) :		0.0639		0.0623

MWS&MOC : 12/18/93

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
MARGINAL COST STRUCTURE OF CESAN'S WATER AND SEWERAGE SYSTEMS AT GRANDE VITORIA AND GUARAPARI
(US$ as of June 1993)

Region, System and Stage	LRAIC Before Losses		Loss Adjustment Factor	Marginal Capacity Cost		Marginal Operating Cost		Marginal Cost		Average Customer Cost
	Tourist Season US$/m3	Off-Season US$/m3	1/	Tourist Season US$/m3	Off-Season US$/m3	Tourist Season US$/m3	Off-Season US$/m3	Tourist Season US$/m3	Off-Season US$/m3	US$/mo.
GRANDE VITORIA										
WATER SUPPLY SYSTEM										
Water Intake	0.16	0.16	1.00	0.16	0.16	0.06	0.06	0.22	0.22	variable
Treatment	0.05	0.05	1.02	0.21	0.21	0.07	0.06	0.27	0.27	variable
Transmission	0.03	0.03	1.01	0.24	0.24	0.07	0.06	0.31	0.31	variable
Distribution	0.09	0.09	1.19	0.40	0.40	0.08	0.08	0.48	0.47	variable
Connections	0.04	0.04	1.12	0.49	0.49	0.09	0.09	0.58	0.58	1.15
SEWERAGE SYSTEMS										
Connections	0.09	0.09	0.85	0.08	0.08	0.01	0.01	0.09	0.09	1.15
Collectors & Interceptors	0.22	0.22	1.00	0.30	0.30	0.01	0.01	0.31	0.31	NA
Disposal of Untreated Sewage	0.05	0.05	1.00	0.35	0.35	0.01	0.01	0.36	0.36	NA
Sewage Treatment	0.19	0.19	1.00	0.49	0.49	0.07	0.07	0.56	0.56	NA
Final Disposal of Treated Sewage	0.01	0.01	1.00	0.50	0.50	0.07	0.07	0.57	0.57	NA
GUARAPARI										
WATER SUPPLY SYSTEM										
Water Intake	0.40	0.40	1.00	0.40	0.40	0.18	0.01	0.58	0.42	variable
Treatment	0.16	0.16	1.02	0.58	0.58	0.18	0.01	0.76	0.59	variable
Transmission	0.25	0.25	1.01	0.83	0.83	0.19	0.01	1.02	0.84	variable
Distribution	0.32	0.32	1.19	1.37	1.37	0.22	0.02	1.59	1.39	variable
Connections	0.04	0.04	1.12	1.59	1.59	0.25	0.02	1.84	1.61	1.15
SEWERAGE SYSTEMS										
Connections	0.09	0.09	0.85	0.08	0.08	0.01	0.01	0.09	0.09	1.15
Collectors & Interceptors	0.39	0.39	1.00	0.47	0.47	0.01	0.01	0.48	0.48	NA
Disposal of Untreated Sewage	0.10	0.10	1.00	0.57	0.57	0.01	0.01	0.58	0.58	NA
Sewage Treatment	0.28	0.28	1.00	0.75	0.75	0.06	0.06	0.81	0.81	NA
Final Disposal of Treated Sewage	0.00	0.00	1.00	0.76	0.76	0.06	0.06	0.82	0.82	NA

MCS: 12/10/93

1/ The Loss Adjustment Factor of 0.85 is applied in the sewerage system, at the connection stage, to allow charging sewerage users based on its consumption of water as measured by the meter.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN: INCOME STATEMENT
Current US$ Thousands

Year	Historic 1990	1991	1992	Estimated 1993	Projected 1994	1995	1996	1997	1998	1999
Water Billed ('000 m3)	134,994	133,730	134,558	138,921	141,468	143,061	144,757	148,826	153,147	157,739
Sewage Billed ('000 m3)	9,724	11,130	12,059	12,045	13,179	14,546	22,389	36,229	44,705	55,618
Avg.Tariff-Water (US$/m3)	0.49	0.46	0.45	0.53	0.56	0.59	0.62	0.62	0.62	0.62
Avg.Tariff-Sewage (US$/m3)	0.23	0.28	0.23	0.29	0.32	0.54	0.57	0.57	0.57	0.57
Avg.Tariff (US$/m3)	0.47	0.45	0.43	0.51	0.54	0.58	0.61	0.61	0.61	0.61
Operating Revenues	70,318	67,524	65,163	84,969	86,084	94,874	105,293	115,991	123,708	133,026
Water	65,778	61,409	60,395	74,190	79,327	84,232	89,492	92,007	94,679	97,517
Sewerage	2,236	3,094	2,747	3,505	4,249	7,879	12,734	20,606	25,427	31,634
Other	2,304	3,021	2,021	7,274	2,507	2,763	3,067	3,378	3,603	3,875
Operating Expenses	44,861	38,089	49,341	47,097	49,164	50,094	51,533	53,575	55,337	57,507
Personnel	30,509	25,665	33,100	32,953	34,149	34,866	35,825	37,054	38,115	39,301
Materials	2,967	2,223	2,905	2,294	2,754	2,819	2,952	3,193	3,401	3,653
- Chemicals	1,138	546	884	601	933	917	888	877	892	922
- Other Materials	1,829	1,677	2,022	1,693	1,821	1,902	2,063	2,316	2,508	2,730
Third Parties	10,626	8,982	12,485	10,977	11,278	11,383	11,642	12,078	12,467	13,078
- Electricity	5,469	4,201	4,559	5,235	4,091	4,045	4,053	4,225	4,427	4,730
- Other Third Parties	5,157	4,780	7,926	5,742	7,186	7,338	7,589	7,853	8,040	8,348
General	673	721	779	796	897	937	1,017	1,141	1,236	1,346
Fiscal	86	498	72	76	86	90	97	109	118	129
Deprec. & Provisions	5,353	17,079	9,231	7,321	16,633	26,552	28,807	32,013	34,422	36,863
Deprec. + Prov.for Amort.	4,707	16,420	8,631	6,995	16,329	26,216	28,434	31,603	33,983	36,392
Prov. for Bad Debts	646	659	600	326	305	336	373	411	438	471
Operating Income	20,104	12,357	6,590	30,551	20,286	18,228	24,952	30,403	33,950	38,656
Net Non-Op. Expenses	(1,809)	(256)	(3,494)	0	0	0	0	0	0	0
Net Financial Expenses	4,934	(1,937)	2,549	947	1,430	1,896	1,880	2,118	1,917	6,997
Net Inflation Adjust.	(84,919)	21,142	46,258	0	0	0	0	0	0	0
Pre-Tax Income	(71,558)	35,180	46,804	29,604	18,856	16,331	23,072	28,285	32,033	31,659
Net Income Tax Charge	1,255	4,888	5,195	14,730	12,774	11,708	15,479	18,490	20,699	20,832
Net Income (Loss)	(72,813)	30,292	41,609	14,874	6,082	4,624	7,593	9,795	11,334	10,827

RATIOS:

Operating Ratio	0.71	0.82	0.90	0.64	0.76	0.81	0.76	0.74	0.73	0.71
Working Ratio	0.64	0.56	0.76	0.55	0.57	0.53	0.49	0.46	0.45	0.43
NTL compliance	1.20	1.06	0.98	1.34	1.17	1.12	1.23	1.27	1.30	1.18
RoR/ Avg Net Fixed Assets	-	16.1%	6.3%	26.3%	4.6%	4.0%	5.3%	5.8%	6.1%	6.5%

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN: FLOW OF FUNDS STATEMENT
Current US$ Thousands

	Historic			Estimated	Projected					
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
TOTAL SOURCES	26,514	(13,709)	(8,567)	52,554	81,166	109,095	97,572	89,054	86,070	91,755
Internal Sources	2,072	(38,267)	(21,458)	24,847	26,062	34,431	39,346	44,594	48,384	55,453
Net Inc. (Loss) aft.tax	(72,813)	30,292	41,609	14,874	6,082	4,624	7,593	9,795	11,334	10,827
Plus:										
Depreciation	4,707	16,420	8,631	6,995	16,329	26,216	28,434	31,603	33,983	36,392
Net Financial Expenses	6,164	4,568	3,884	2,978	3,652	3,591	3,319	3,196	3,067	8,234
Monetary Correction	64,014	(89,547)	(75,583)	0	0	0	0	0	0	0
External Sources	23,173	9,760	1,329	1,085	18,969	26,234	31,970	30,936	27,958	13,335
CEF	23,173	9,760	1,329	693	0	0	0	0	0	0
FAE	0	0	0	392	0	0	0	0	0	0
IBRD	0	0	0	0	18,969	26,234	31,970	30,936	27,958	13,335
Other	0	0	0	0	0	0	0	0	0	0
Equity	1,269	14,798	11,562	25,333	34,847	48,430	26,256	13,525	9,727	22,968
Federal Government	0	0	0	1,289	1,288	0	0	0	0	0
TOTAL APPLICATIONS	26,514	(13,709)	(8,567)	52,554	81,166	109,095	97,572	89,054	86,070	91,755
Capital Expenditures	12,550	15,248	24,692	17,990	54,810	84,516	69,268	69,296	65,298	57,439
Proposed Project	0	0	0	0	37,938	52,469	63,940	61,871	55,917	26,670
Other Investments	11,655	14,289	24,692	17,928	16,167	28,685	0	0	0	25,467
Interest During Construction	0	0	0	61	705	3,362	5,328	7,425	9,381	5,303
Capitalized Admin. Costs	895	959	0	0	0	0	0	0	0	0
Inc/(Dec) in Working Capital	(1,789)	(50,041)	(57,942)	25,583	18,637	16,798	22,693	14,147	15,161	16,266
Increase in Other Assets	7,400	12,500	16,970	0	0	0	0	0	0	0
Debt Service	8,352	8,585	7,713	8,982	7,719	7,781	5,611	5,611	5,611	18,050
Amortization	2,189	4,017	3,829	6,004	4,067	4,189	2,293	2,415	2,544	9,817
Interest	6,164	4,568	3,884	2,978	3,652	3,591	3,319	3,196	3,067	8,234
Cash Beginning Year	-	1,142	1,327	363	1,570	1,639	1,670	1,718	1,786	1,845
Cash in Year	-	185	(964)	1,207	69	31	48	68	59	72
Cash at Year End	1,142	1,327	363	1,570	1,639	1,670	1,718	1,786	1,845	1,917

RATIOS:

Debt Service Coverage	0.25	-4.46	-2.78	2.77	3.38	4.43	7.01	7.95	8.62	3.07
Internal Cash/Invest.	-46.2%	15.6%	116.5%	-54.2%	-1.8%	8.0%	8.9%	28.1%	32.6%	30.4%

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
CESAN: BALANCE SHEET
Current US$ Thousands

	Historic			Estimated	Projected					
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
ASSETS	76,128	145,759	166,427	181,996	531,936	591,281	633,370	672,382	704,662	726,875
Current Assets	11,438	16,678	9,066	13,640	13,085	14,130	15,385	16,704	17,669	18,836
Cash	1,142	1,327	363	1,570	1,639	1,670	1,718	1,786	1,845	1,917
Net Accounts Receivable	8,814	9,474	7,063	10,531	9,858	10,864	12,057	13,283	14,166	15,233
Inventory	387	253	350	248	298	305	320	346	368	396
Deferred Payments & Other	1,095	5,625	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
Short-Term Investment	0	0	0	0	0	0	0	0	0	0
Long -Term Assets	74	61	72	72	72	72	72	72	72	72
Total Fixed Assets	64,616	129,020	157,289	168,284	518,779	577,079	617,912	655,606	686,920	707,967
Net Fixed Assets	50,863	102,199	107,530	124,805	449,720	458,187	490,395	549,131	570,081	610,444
- Gross Fixed Assets	74,782	151,763	167,416	190,963	696,809	730,249	789,045	876,936	929,498	1,003,692
- Less: Acumulated Depreciation	23,920	49,564	59,886	66,158	247,089	272,062	298,650	327,805	359,417	393,248
Work in Progress	6,625	23,094	46,585	40,333	62,206	107,241	111,701	86,644	97,475	79,958
Long -Term Intangible Assets	7,128	3,727	3,175	3,145	6,853	11,650	15,816	19,830	19,364	17,565
LIABILITIES & EQUITY	76,128	145,759	166,427	181,996	531,936	591,281	633,370	672,382	704,662	726,875
Current Liabilities	12,100	34,297	30,412	22,591	25,126	24,948	19,365	19,426	26,078	33,460
Accounts Payable	3,398	24,278	13,295	15,021	12,915	10,862	9,405	9,526	9,533	9,349
Current Portofolio of Long-Term Debt	6,460	7,012	12,019	4,067	4,189	2,293	2,415	2,544	9,817	17,763
Third Party Services	2,242	3,007	5,099	3,503	8,022	11,793	7,545	7,356	6,728	6,348
Total Long-Term Debt	113,700	95,776	101,983	105,016	105,080	129,021	158,576	186,968	205,110	200,681
Less: Current Portio	6,460	7,012	12,019	4,067	4,189	2,293	2,415	2,544	9,817	17,763
Total Long-Term Debt	120,160	102,788	114,002	109,083	109,269	131,314	160,991	189,512	214,926	218,444
Equity	(49,672)	15,687	34,032	54,389	401,731	437,312	455,428	465,989	473,474	492,733

RATIOS:

Current Ratio	0.95	0.49	0.30	0.60	0.52	0.57	0.79	0.86	0.68	0.56
Long-Term Debt: Equity Ratio	-2.29	6.11	3.00	1.93	0.26	0.30	0.35	0.40	0.43	0.41
Accounts Receivable Comparator (days)	47	52	40	46	43	43	43	43	43	43

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
ASSUMPTIONS UNDERLYING CESAN'S FINANCIAL FORECASTS

A. Introduction

1. CESAN's financial projections are based on: (i) audited financial statements for FY90-92; (ii) the FY93 budget; and (iii) financial projections and explanatory notes for 1994-2000 as prepared by CESAN.

2. Because of the high inflation in Brazil during the past decade, historical financial statements have been translated into current US dollars (using the year-end exchange rates for balance sheets and average exchange rates for income statements). The projections are also prepared in current US dollars. International inflation was estimated at 2.8% for year 1994 and thereafter.

Year	End-year Exchange Rate Cr$/US$	Average Exchange Rate Cr$/US$	Domestic Inflation (%)	International Inflation Index 1993 = 100
1990[1/]	170.6	68.2	1,397	90.3
1991	1,068.8	404.9	528	93.9
1992	12,387.5	4,512.3	1,059	97.5
1993[2/]	273,931.4	87,675.1	2,111	100.0

B. Income Statement

Revenues

3. **Operating Revenue** consists of sales of water and sewerage services in Grande Victoria and other regions (Guarapari and other Interior systems). Major assumptions in the projections are that: (i) water coverage will increase from 91% in 1993 to 93% in 1999; (ii) there is a price elasticity of demand of -0.3, so the volume billed per household will decrease in relation to planned tariff increases; (iii) sewerage coverage will increase from 11% in 1993 to 43% in 1999; and (iv) other operating revenues such as connection and installation fees, and income from sale of equipment will amount to 3% of the water and sewerage services revenue.

4. **Retail Prices.** The average water tariff is projected to increase by 5% in 1994, 1995 and 1996, and remain constant in US$ terms thereafter. The sewerage tariff is estimated to be 50% of the water tariff in 1994, and 80% in 1995 and thereafter. These levels enable CESAN to comply with the NTL, and to generate sufficient internal cash for a contribution to investment.

1/ In 1990, the Cruzeiro (Cr$) replaced the Novo Cruzado (NCz$) at the rate of 1 = 1,000.

2/ In 1993, the Cruzeiro Real (Cr$) replaced the Cruzeiro (Cr$) at the rate of 1 = 1,000.

5. **Unaccounted-for Water (UFW)** is measured by the difference between water produced and water consumed, and include losses due to metering errors, theft, and other physical and commercial losses. The projection assumes that CESAN will reduce its UFW from an estimated 39% in 1994 to 30% in 1998 and maintain that level thereafter. (See Monitoring Indicators, Annex 21).

6. **Metering.** CESAN will increase the percentage of metered connections from 70% in 1993 to 90% by 1996.

Expenses

7. **Operating Expenses** include personnel, materials (chemicals and others), other third party services (electricity and contract labor), and general and fiscal (value added tax) costs. Variable costs (chemical and electricity) are based on CESAN's 1994 budgeted unit costs and production volume. Personnel costs, which account for 70% of operating cost, are projected to reflect an estimated average annual productivity gain of 7.5% (the number of connections per employee increases from 210 (4.8 employees/1000 connections) in 1993 to 347 (2.9 employees/1000 connections) in 1999. With the dramatic increase in the number of sewerage connections (more than 133,000 connections will be added by the project), CESAN will have to increase the number of employees operating the sewerage systems to ensure proper operation and maintenance.

8. **The number of employees** required per connection, however, is different for water and sewerage. In general, water connections require more employees than sewerage connections. Here, we assumed that for each 1,500 new sewerage connections, CESAN will have to add one employee to its sewerage operation. The projected productivity gain of 7.5% assumes that CESAN will be able to freeze the number of employees in the administration and water operation. The average salary is estimated to increase by 2% per annum, in real terms. "Third party labor" is estimated to increase in proportion to the number of employees. Third party labor is engaged mainly in meter reading, maintenance, and other regional operations.

9. **Depreciation** is calculated on a straight-line basis, assuming an expected useful life for different types of assets. The effect of the proposed asset revaluation study (to be commenced by CESAN early in 1994) was taken into account in the 1993 projections. **Provision for doubtful accounts** is 1.5% of accounts receivable, as determined by law.

10. **Net financial expenses** is the net of interest on long-term debt (excluding interest during construction on IBRD, CEF and FAE loans, which are capitalized). The projection assumes no interest income from investment.

11. **Net inflation adjustment** in the historic financial statements is net of monetary corrections on asset and equity accounts, and of foreign exchange gains and losses on long- and short-term debts.

12. **Tax Expense** is the sum of income taxes (35% of net income after interest expenses), the "social contribution tax" (10% of the income tax), the social security tax (2% of operating revenue), and the public service capital tax (0.65% of operating revenue + state and government transfer). Brazilian corporate law allows for an income tax loss carry-forward of up to four years. As CESAN has been reporting operating losses and losses were carried forward, it has not paid income taxes (the social contribution tax however was paid) in the past several years. The projection assumes that CESAN will start paying taxes in full, starting in 1994. Taxes for 1993 will be slightly lower, as CESAN had an accumulated loss of US$8.3 million at the end of 1992, which has been carried forward to 1993, reducing the tax requirements.

C. Balance Sheet

Assets

13. **Accounts receivable** are expected to decrease to 43 days of annual sales revenue by 1995, from 46 days in 1993, as the bill processing period is reduced to 22 days from its current 33 days. **Inventory** consists of chemicals and other materials and represents 39 days of total material cost. **Cash** is assumed to be 12 days of operating revenue.

14. **Fixed Assets** are revaluated with inflation every year and increase with investments. CESAN's current book value of net fixed assets is underestimated because of the inadequate revaluation of assets in the past. Until 1990, the revaluation index allowed by the government was much lower than the inflation rates. Although Decree 322 of 1991 enable the company to choose a more appropriate revaluation index for its assets[3/], and CESAN's assets were partially revalued in 1991, a more thorough study on the revaluation of assets is needed to determine the real value of its assets. Under the project, a study to determine the real value of CESAN's fixed assets will be initiated. In 1994, the real value of CESAN's fixed assets is adjusted upwards by multiplying the current book value figure by 3.5, to reflect the expected revaluation (a similar study in Sao Paulo resulted in a recommendation to multiply by 4.58 times the book values of reviewed fixed operating assets). Depreciation expenses are adjusted upwards accordingly.

Liabilities and Equity

15. **Long Term Debt** consists of local and external debt obligations with IBRD, CEF, FAE, and other creditors. The total long term debt as of May 1993, was US$94 million, of which US$86 million was internal (mainly to CEF) and US$8 million was external. Of the internal debt, US$62 million is due to CEF, and US$22 million to FAE. CEF debt was recently renegotiated to be paid back in 20 years with an interest rate of 5%. FAE debt, on the other hand, is expected to be capitalized, after formalizing the negotiations with the State of Espírito Santo. The projection assumes that the FAE renegotiation will be completed during the first quarter of 1994, and US$22 million will be converted into CESAN's equity. A copy of the agreement formalizing CESAN's capitalization of FAE debt will be a condition of Negotiations.

16. As for the external debt, the debt service was reduced substantially following an agreement reached with the State of Espírito Santo by which: (i) the State will assume the total principal payment (amortization) of CESAN's existing external debt, which will be converted into CESAN's equity; and (ii) CESAN will continue to pay interest to its external creditors.

17. **Share Capital** increases with the increased equity participation of the State over the period, as shown in the financing plan (Table 1).

D. Borrowing and Investments

Project Financing

18. **Proposed Bank Loan.** US$149.4 million equivalent borrowed over 15 years, including 5 years of grace, at the Bank's variable lending rate (7.43% at the time the projections were made). The first disbursement is expected during mid-1994, and the first repayment will start during mid-1999. The commitment fee is 0.75% of undisbursed balance.

[3/] Either the National Treasury Bonds (BNT) index or the consumer price index.

19. **Internal Cash Generation.** CESAN is expected to finance about 21% of the projected Bank investment program (US$61.4 million) with internally generated resources. Including interest during construction, CESAN's financing percentage will increase to 28% (to US$92.9 million).

20. **Other Resources.** The State of Espírito Santo will finance about 29% of the projected investment (US$88.0 million).

Non-Project Investment Borrowing

21. In the period 1994-1999, CESAN is expected to borrow US$ 36.7 million from CEF (already contracted), at an annual interest rate of 6%, maturity of 25 years, and a commitment fee of the 1.0% of the undisbursed balance. The already contracted State transfer for non-Bank project investments, should amount to US$28.5 million during the project period. There is no transfer from the federal government, except for the US$1.3 million transfer already contracted for 1994.

Table 1. FINANCING PLAN FOR CESAN's TOTAL INVESTMENT PROGRAM
(US$million)

SOURCES	1994	1995	1996	1997	1998	1999	Annual Average	Total	
								US$ million	%
Financing Plan For IBRD Project[1/]:									
• IBRD Loan	19.0	26.2	32.0	30.9	28.0	13.3	24.9	149.4	50.0
• State Transfers	19.0	19.7	26.2	13.5	9.7	0.0	14.7	88.0	29.5
• CESAN's Internal Resources	0.0	6.5	5.7	17.5	18.3	13.3	10.2	61.4	20.5
Total	37.9	52.5	63.9	61.9	55.9	26.7	49.8	298.8	100.0
Financing Plan For IBRD Project and CESAN's Other Investments:									
• IBRD Loan	19.0	26.2	32.0	30.9	28.0	13.3	24.9	149.4	40.5
• State Transfers	21.1	25.1	26.2	13.5	9.7	22.8	19.7	118.4	32.1
• CESAN's Internal Resources	0.0	6.5	5.7	17.5	18.3	15.3	10.2	63.3	17.1
• CEF	13.4	23.3	0.0	0.0	0.0	0.0	6.1	36.7	10.0
• Federal Transfers	1.3	0.0	0.0	0.0	0.0	0.0	0.2	1.3	0.3
• Total	54.1	81.2	63.9	61.9	55.9	52.1	64.5	369.1	100.0

1/ Does not include capitalized interests (US$ 31.5 million on Bank project), which will be fully financed by CESAN's internal resources.

Total Investment Costs

22. The total investment cost of CESAN is estimated to be US$ 369.1 million (US$ 400.7 million including capitalized interest), of which US$298.8 million represents the Bank project (US$330.3 including capitalized interest). CESAN is expected to finance 17% of the total investment cost with its internal cash. Including IDC, CESAN's financing will rise to 24%.

E. Sensitivity Analysis

23. Two sets of sensitivity analysis were conducted to measure the project risk. One pertains to CESAN's operational performance and tariffs, and the other pertains to the State Government's ability to provide counterpart funds to the project. The second sensitivity analysis was done specifically to address the issue of the poor track record of Brazilian state governments in providing counterpart funds in a timely manner.

CESAN's Operational Performance

24. Two factors were identified as crucial to the success of this project: (i) the average tariff level; and (ii) operational efficiency as represented by labor (employee) productivity. Under the Base Scenario described above, the average tariff level is expected to increase by 5% in years 1994, 1995, and 1996, and the productivity index to increase by 7.5% per year (in terms of connections per employee). With such productivity gains and tariff levels, CESAN's internal cash generation would cover 17% of the total investment cost, after operating cost and debt service.

25. The various scenarios analyzed and a summary table for the results under the six possible combinations are presented below. The combination "A2" corresponds to the Base Scenario.

Contribution to Investment	Scenario A1	Scenario A2	Scenario A3
CESAN's Contribution to Investment: • US$ million • % of total Investment Cost[a]	 US$68.1 19%	 US$62.3 17%	 US$40.6 11%
Espírito Santo's Counterpart: • US$ million • % of total Investment Cost	 US$113.6 31%	 US$118.4 32%	 US$141.1 38%

Contribution to Investment	Scenario B1	Scenario B2	Scenario B3
CESAN's Contribution to Investment: • US$ million • % of total Investment Cost[a]	 US$51.5 14%	 US$46.6 13%	 US$23.9 7%
Espírito Santo's Counterpart: • US$ million • % of total Investment Cost	 US$130.2 35%	 US$135.1 37%	 US$157.8 43%

[a] Not including interest during construction (capitalized interest) of US$31.5 million, paid from CESAN's internal cash.

26. **Tariff Increases.** Scenarios "A1", "A2", and "A3" assume tariff increases of 5% in 1994, 1995, and 1996. The average water and sewerage tariff remains at US$0.61 after 1997. This assumption, together with the projected increase in water consumption, translates into an annual average revenue increase of 7.6% between 1993 and 2000.

27. Scenarios "B1", "B2", and "B3" assume no tariff increase. The average water and sewerage tariff level stays as in 1993 at US$0.51/m^3. This assumption, together with the projected increase in water consumption, translates into an annual average revenue increase of 6% between 1993 and 2000.

28. **Productivity Gains.** Scenarios "A1" and "B1" assume productivity gains of 8.5% per year. Under these scenarios, the number of connections (water and sewerage) will increase from 210 (4.8 employees per 1,000 connections) in 1993 to 347 (2.9 employees per 1,000 connections) in 1999. The productivity gain of 8.5% could be achieved if CESAN keeps the number of employees at the 1993 level, despite the considerable increase in the number of sewerage and water connections it needs to service.

29. Scenarios "A2" and "B2" assume productivity gains of 7.5% per year. Under these scenarios, the number of connections per employee will increase from 210 in 1993 to 324 (3.1 employees per 1000 connections) in 1999. See para. 8 of this Annex for an explanation of how the 7.5% (the base scenario regarding employee productivity) was attained.

30. Scenarios "A3" and "B3" assume no productivity gains. Under these scenarios, the number of connections per employee remains at 210.

31. **Results.** The sensitivity analysis confirms that the average tariff level and the employee productivity will have a large impact on CESAN's cash generation. Under the base scenario "A2", (tariff increases of 5% in years 1994, 1995, and 1996, a moderate productivity gain of 7.5% per year, and a price elasticity of demand of -0.3), CESAN will be able to cover more than 17% of the investment cost from its internally generated funds (24% including IDC). Under this base scenario, the working ratio[4/] will decrease from 0.55 in 1993 to 0.43 in year 2000. On the other hand, if CESAN's productivity stays at the current level, its contribution will drop to a mere 11% even with the projected tariff increase.

32. Under Scenarios "B1", "B2", and "B3" (that is, under the assumption of no tariff increases), even with the productivity gain of 8.5%, CESAN's contribution to investment will be 14% of the project cost. With the most pessimistic scenario of no productivity gain and no tariff increase, CESAN's contribution will drop to 7%, requiring almost US$158 million (43% of the project cost) from the State.

Counterpart Funds

33. The scenarios analyzed above, however, implicitly assume that the State government would have the ability to provide counterpart fund requirements. It also assumes that the State government will not change its recent policy to increase its investment in the sanitation sector. In order to determine the effect of the State not being able to provide counterpart funds, we analyzed a scenario where the State is not able to provide more than US$15 million per year in transfer to CESAN, including the counterpart fund for the project. In addition, we worsened this new scenario even more by combining it with the "B3" scenario presented above, that is, by assuming no productivity gain and no tariff increases. The limited amount of State counterpart funds and CESAN's internal cash generation implies scaling down the investment program executed each year.

34. Under such a scenario, implementation of the investment program originally scheduled for 1994-1999 would take three more years (from 1994 to 2002). However, CESAN's contribution to its total investment program increases to about 13%, almost twice the contribution resulting from the "B3" Scenario, as CESAN will be able to contribute three extra years of internal cash generation to the investment program. A summary table of the results for this low counterpart fund scenario, vis-a-vis the "B3" Scenario, is shown below.

4/ Operating Cost (not including depreciation) over Operating Revenue.

Scenario	Years to Project Completion	CESAN's Contribution to Investment	State's Contribution to Investment
"B3" Scenario and the State contribution limited to US$15 million per year.	9 years	US$ 62.4 million • Avg. US$ 7.2 million per year • 13% of total investment	US$ 134.9 million • Avg. US$ 15 million per year • 37% of total investment
"B3" Scenario and No ceiling on the State contribution.	6 years	US$ 23.9 million • Avg. US$ 4.0 million per year • 7% of total investment	US$157.8 million • Avg. US$26.3 million per year • 43% of total investment

35. Its is important to note that the internal financial rate of return (IFRR) under the most pessimistic low counterpart fund scenario would decline slightly, as the net incremental revenue from the project is deferred. For example, for the Grande Vitória region, the IFRR would decline to 15% (from 18% under base scenario) for the water supply system and to 4% (from 12% under the base scenario) for the sewerage system. With expected tariff increases, however, the decline in the IFRR is minimal: to 17% for the water supply system and to 11% for the sewerage system. The impact of a tariff freeze is much higher for the sewerage system, since a steeper increase in sewerage tariffs is expected and CESAN's investment program concentrates on the expansion of its sewerage systems.

F. Ratio Analysis

36. The definition and the explanation of the financial ratios presented with the financial statements (Annex 12) are as follows:

37. **The Operating Ratio** is defined as the ratio of operating expenses plus depreciation to operating revenue. The ratio dropped in 1993 with the sharp increase in tariff levels and low level of investment. The ratio then increases in 1994, as the depreciation expense is adjusted upwards with the revaluation of fixed assets expected that year. The ratio then gradually decreases as CESAN's operational efficiency improves.

38. **The Working Ratio** is defined as the ratio of operating expenses to operating revenues. Personnel and labor cost accounts for more than 80% of operating expenses. The ratio drops steadily as CESAN achieves its expected productivity gains.

39. **NTL Compliance** is achieved when the ratio of operating revenue to operating cost plus depreciation plus debt service is equal to or larger than 1. With the projected tariff increase, CESAN will be able to comply with NTL throughout the project execution period.

40. **The Rate of Return on Average Net Fixed Assets** is defined as the percentage of net operating income after depreciation in relation to average net fixed assets. The rates of returns are erratic in the last several years, as a result of the fluctuation of the real tariff and thereby tariff revenue. The percentage is naturally lower after the expected revaluation of fixed assets, as the depreciation expenses increases and fixed assets triples in size. The 1994 percentage reflects the full revaluation.

41. **The Current Ratio** is defined as the ratio of current assets over current liabilities.

42. **The Debt to Equity Ratio** is defined as the ratio of long-term debt over equity. CESAN's total long-term debt does not include the current portion of CESAN's long-term debt.

43. **The Accounts Receivable Comparator** is calculated by multiplying the accounts receivable plus the provision for bad debt by 360 days, and then dividing this product by CESAN's operating revenue.

44. **The Debt Service Coverage Ratio** is defined as the ratio of net income after tax plus interest on long-term debt plus depreciation to amortization plus interest.

45. **The Percentage of CESAN's Investments Financed by Internal Cash** is calculated as follows: (i) the sum of interest during construction, increases in working capital, and debt service is subtracted from the sum of income after tax, depreciation, and financial expenses; and (ii) that difference is divided by CESAN's total investments (project and non-project), not including interest during construction.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
TRANSFERS OF THE STATE OF ESPIRITO SANTO TO CESAN
Current US$ millions

Year	Total Revenue of the State 1/ US$ million	Transfers to Sanitation 2/		Transfers to CESAN 3/	
		Total US$ million	% of Revenue	Total US$ million	% of Revenue
1988	399.0	1.5	0.4	0.6	0.2%
1989	716.3	4.3	0.6	1.7	0.2%
1990	799.0	4.0	0.5	1.2	0.2%
1991	686.9	9.5	2.1	14.7	2.1%
1992	659.0	13.4	2.0	11.3	1.8%
1993 4/	656.0	26.8	4.1	14.7	2.2%
1994 5/	724.1	26.8	3.7%	21.1	2.9%
1995 5/	758.3	26.8	3.5%	25.1	3.3%
1996 5/	768.7	26.8	3.5%	26.2	3.4%
1997 5/	767.1	26.8	3.5%	13.5	1.8%
1998 5/	776.9	NA	NA	9.7	1.2%
1999 5/	772.6	NA	NA	22.8	3.0%

1/ Source: State Government of Espirito Santo. Revenues include ICMS, other tax income, transfer from the federal government, and credit operations.
2/ Source: State Government of Espirito Santo.
3/ Source: State Government of Espirito Santo for the historical transfers and CESAN's Financial Projections for the projected transfers.
4/ Estimated.
5/ Projected.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
ENVIRONMENTAL ASSESSMENT

A. Introduction

1. The Espírito Santo Water and Coastal Pollution Management Project consists of works of potable water, sewerage, interceptors, and sewage treatment plants for the Grande Vitória and Guarapari areas, as well as sewerage and sewage treatment plants for municipalities in the Santa Maria and Jucu river basins. The project also includes institutional strengthening components for the State Water Company of Espírito Santo (CESAN) and the State Secretariat of the Environment (SEAMA).

2. Major environmental issues in the project are related to the sewage treatment components. An environmental assessment report (EA) was prepared by CESAN in mid-1993. This report brings together, summarizes, and updates the findings of all environmentally related work done both by CESAN and SEAMA during project preparation. The draft EA was subject to public hearings as required by Brazilian law. Additional community participation workshops were held to address specific issues (see para. 22 and Box 2). A copy of the EA was also submitted to SEAMA for detailed review and comments. Formal Bank review of the final EA was carried prior to appraisal and it was found to be fully consistent with Bank policy guidelines concerning environment.

B. Project Description

3. The sewerage and wastewater treatment component will include the construction of sewerage and wastewater treatment and disposal systems for 12 urban areas: Praia do Canto, Praia da Costa, Bairro de Fátima, Centro de Guarapari, Guarapari/Praia do Morro, Santa Maria de Jetibá, Santa Leopoldina, Domingo Martins, Marechal Floriano, Centro de Vitória/Cariacica I, Paul, and Cariacica II. With the exception of the last three areas, all other systems already have selected waste treatment technologies and completed engineering designs. Annex 8, Attachment 1, summarizes the wastewater components of the project.

C. Legal and Administrative Framework

4. The project requires two sets of licenses. The first set, which includes municipal licenses for the siting and construction of civil works, rights of way, and infrastructure crossings (roads, railways, etc.), has been already approved by the concerned municipalities. The second set includes State licenses for the siting construction, and operation of water and sanitation facilities. SEAMA, the State agency responsible for this environmental licensing process, has already approved the EA--the necessary condition for granting these licenses, and granted all siting licenses. The project has been prepared within the context of Espírito Santo's Water Resources Management Plan. The project will strengthen this plan by providing technical assistance to SEAMA to design and implement water quality regulations and monitoring programs.

5. CESAN will be responsible for the construction and operation of all sewerage and wastewater treatment plants. Monitoring of treatment efficiencies and quality of effluents will also be under CESAN's responsibility. Monitoring of water quality in aquatic ecosystems and the management of a water quality network for inland and ocean waters will be carried out by SEAMA.

D. Environmental Baseline

Water Quality

6. The principal water resources in the area of influence of the project are the Santa Maria de Vitória and Jucu rivers, which are the main sources of water supply for Grande Vitória (the state capital) and the cities of Santa Maria de Jetibá, Marechal Floriano, Santa Leopoldina, and Domingo Martins. In the Guarapari area the main watersheds are the Una, Peroção, and Jabutí rivers, the latter constituting the main water supply source for Guarapari. The estuarine and bay areas of Grande Vitória and Guarapari constitute important ecosystems with spawning and maturing sites for numerous aquatic species for continental and ocean fisheries. The ecosystems include several beaches with tourism potential, and the fisheries represent the main livelihood for approximately 14,000 low-income fishermen in the areas of Vitória, Barra do Jucu, Vila Velha, Peroção, and Guarapari.

7. Existing water quality conditions are relatively good in all upstream reaches of water basins with still good waste assimilation capacities. However, once rivers enter the metropolitan areas they receive untreated domestic sewage and industrial waste waters. Dissolved oxygen and coliform levels reach critical levels in the lower portions of all rivers. Water quality monitoring of coastal and bay waters indicate that there are several areas with inappropriate conditions for contact sports, swimming, and other recreational uses. Tourist beaches close to the estuarine areas have critically high coliform levels.

8. Water pollution sources in the area of the project include untreated domestic sewage, industrial effluents, and inappropriate disposal of solid wastes in water courses. Deforestation, inappropriate agricultural and land use practices, and road construction in the upper watershed contribute to relatively high erosion rates, pesticide run-off, and sedimentation loads in the lower reaches of the rivers and the estuarine and bay ecosystems. Water use conflicts are evident as the dilution of untreated waste water discharges hinders tourism, fisheries, water supply, and irrigation.

Aquatic and Terrestrial Ecosystems

9. Terrestrial ecosystems in the area of influence of the project, especially in the proposed wastewater treatment plant sites, are deteriorated. Only two sites (Guarapari and Praia do Morro) present relatively good vegetation cover with forests in an advanced stage of regeneration. Besides the riverine and estuarine ecosystems described above, the area has important patches of mangroves in Vitória (18 km^2) and Guarapari (6 km^2). In addition to heavily polluted waters flowing into these mangrove areas, uncontrolled urban expansion and solid waste disposal systems are exerting additional pressures on these ecosystems. Other important aquatic ecosystems in the area of influence of the project are coastal lagoons and salt water marshes which are found in small areas around some of the wastewater treatment plants.

10. There are 21 Conservation Units or legally protected areas totalling 11,300 hectares in the area of influence of the project; 8 of these units are managed by the State and the remaining 13 by the municipalities (9 in Grande Vitória alone). These areas present variable conditions of preservation and are subject to different threats such as illegal fishing and hunting, water pollution loads, fires, uncontrolled urban expansion, cutting for firewood, and leachates from sanitary landfills. The Biological Reserve of Lamerão, a mangrove ecosystem in Grande Vitória exacerbated by practically non-existent protection, is representative of the above conditions. There are approximately 46 aquatic and terrestrial animal species represented in these protected areas which some degree of ecological importance, that are either locally threatened or in danger of extinction.

Economic Conditions

11. The principal economic activities in the region are port activities related to mining (Tubarão), cellulose (Aracruz Cellulose), and the commercial harbors of Vitória, Capuaba, and Ubu. Brazil's third major steel company (CST) is located in the area, as well as the industries belonging to the Companhia Vale do Rio Doce (CVRD). Tourism also plays an important role in the local economic activity of Grande Vitória and Guarapari, attracting large numbers of out of state visitors during the summer season.

12. Local artisan communities make pots from clay deposits which are found near mangrove ecosystems in the area. These pots represent a cultural symbol for the State and most tourism campaigns are based upon the use of these pots for typical fish dishes (*moqueca de peixe*).

13. Potable water supply coverage varies from 85% to 90% in all municipalities. Sewerage and sewage treatment coverage is low (11%). Solid waste collection and disposal is also deficient, with coverage from 50% to 80%. With the exception of Grande Vitória, most solid wastes are disposed of in open dumps near water courses. Given these sanitary conditions, water related diseases are the main causes of mortality and morbidity among children and lower income segments of the population.

E. Environmental Impacts

Water Quality

14. Water quality modelling efforts for the river-bay systems forecast major improvements and recovery of dissolved oxygen and coliform levels in key points in the area of influence of the project. These positive impacts will enhance water uses including potable water supply, recreation, and tourism, reduce health-related risks, and benefit aquatic fauna by reducing water toxicity.

15. Residual negative impacts are associated with the disposal of treated effluents in water bodies with low dilution and waste assimilation capacity. In these cases, there will be some probability of eutrophication of these water bodies, persistent low dissolved oxygen levels and high coliform concentrations. However, mathematical models demonstrate that the area of influence of these deteriorated conditions will be much less extensive than existing conditions. Water quality conditions can also be impaired during malfunctions of wastewater treatment plants and pumping stations, and by the inappropriate disposal of solid wastes generated in the wastewater treatment systems.

Aquatic and Terrestrial Ecosystems

16. Positive impacts related to water quality are also important for aquatic and terrestrial ecosystems. Improved water quality will benefit aquatic fauna and associated terrestrial animals. Spawning and maturing sites will present better conditions for fish and shrimp species, thus increasing their population.

17. Negative impacts on aquatic and terrestrial ecosystems are related to wastewater treatment plant siting. Hydraulic and economic considerations in engineering designs require these sites to be in the lower parts of the basins served by sewerage systems. Treated effluent pipes or canals must also go through lowlands. These areas are generally associated with mangrove and coastal lagoon ecosystems in the area of influence of the project. Vegetation loss, soil instability, erosion, and coastal lagoon disturbances will be caused in three of the proposed wastewater treatment plant sites. However, the magnitude and importance of these impacts are quite low, and have been further reduced with appropriate changes in design, project siting, and additional engineering works.

Economic Conditions

18. Improved environmental conditions will benefit tourism, fisheries, and health. The construction of sewerage systems and interceptors will also improve the sanitary conditions of urban channels, thus enhancing the overall quality of life in the urban areas.

19. Again, negative impacts may be associated with project siting. One major social and cultural impact of great importance and magnitude is related to the location of the wastewater treatment plant for the Praia do Canto system. This site contains the principal clay deposit for the preparation of clay pots (*panelas)* by local artisan communities. Because of the social, economic, and cultural importance of this impact, additional technical and social studies were carried out in order to identify alternatives for mitigation and compensation measures (see Box 2).

20. Other social and economic impacts are of lesser importance and magnitude and are related to construction practices typical of this type of projects: disruption of traffic patterns, interference with other urban infrastructure, noise, and dust. However, these impacts will occur during the construction period only. Project siting will require the relocation of some existing infrastructure at those sites.

Cumulative Impacts

21. Cumulative impacts were also analyzed in the area of influence of the project. Perhaps the most critical situation arose in the Joanna D'Arc neighborhood where the treatment plant located in that area will add additional environmental pressure to a region already overloaded by an existing quarry, a solid waste composting plant, an asphalt plant, and increased traffic from a major city road.

F. Mitigation Measures

22. Perhaps the most efficient techniques for mitigating negative impacts caused by the project have been careful project siting and the selection of appropriate alternatives for wastewater treatment technologies. Project siting has kept the disturbance of aquatic and terrestrial ecosystems to a minimum and has avoided the location of any plant within protected areas. All wastewater treatment technologies were selected independently for each system according to water quality restrictions, receiving water body assimilation capacity, eutrophication potential, and available land. Several water quality models were used intensively in this process (see Box 1).

23. Additional measures for minimizing impacts on water quality and aquatic and terrestrial ecosystems include: lengthening effluent pipes or canals to water bodies with higher waste assimilation capacity; changing effluent pipe layout in order to avoid coastal lagoon ecosystems; design of solid waste treatment facilities in all wastewater treatment plants; contingency plans for eventual raw sewage discharges caused by system malfunctions; design of containment walls in unstable sites in order to avoid soil disposal and erosion on mangroves; design of appropriate construction practices; and the design of revegetation plans/vegetation barriers around all wastewater treatment plants.

24. Additional engineering and socio-economic studies carried out by CESAN and SEAMA, with the participation of the Municipality of Vitória and the Association of *Paneleiras*, identified several mitigation and compensatory programs for the social and cultural impacts resulting from the Praia do Canto site. A well developed community consultation and participation program around this potentially sensitive issue has turned this project into a major opportunity for the *paneleiras* to maintain their activity (See Box 2).

25. Cumulative impacts in the Joanna D'Arc neighborhood were the subject of an intensive community consultation program. Inter-institutional agreements were reached in order to strengthen environmental control in existing pollution sources (quarry, asphalt plant, and composting plant),

BOX 1: WATER QUALITY MODELLING: METHODOLOGIES AND FINDINGS

Water quality modelling was a major tool used to quantify the achievement of water quality objectives during project preparation. Using the data from the matrices of pollution sources (Annex 2) and existing water quality (Annex 4) it is possible to arrive at the most efficient wastewater treatment scheme in order to obtain a specific set of water quality objectives for wastewater receiving water bodies, as follows: (i) define the specific water quality objectives for a given water body (river, bay, estuaries, etc.) according to the State's present and proposed future water quality legislation; (ii) calibrate a water quality model (for rivers: QUAL-2e; for ocean: Marine Pollution Model, MPM) to simulate current water quality conditions, and then to simulate water quality conditions for a time-horizon of twenty years, without project implementation, to obtain future water quality levels; and (iii) analyze different wastewater collection, treatment and disposal alternatives which will achieve, through water quality modelling, the desired objective in the time horizon. This methodology permitted the identification of needed treatment efficiencies, the most appropriate disposal points and the need for additional and complementary actions in industrial pollution control in some specific locations in the area of influence of the project. Perhaps the most important conclusion of the modelling efforts is that project implementation is required to bring water quality up to the standards needed for swimming and other water contact sports in the beaches of Camburi, Iate, Jurema, and Aterro. Water quality modelling will be a major component in the institutional development programs of both CESAN and SEAMA.

establish additional green areas in the neighborhood, plan for the long term removal of the solid waste plant from the neighborhood, and construct more tree barriers and additional mitigation measures in the wastewater treatment plant, including some areas which will be set aside in the site for community recreation (soccer, basketball).

26. Other mitigative measures for minor socio-economic impacts include: design of project construction schedules taking into consideration local traffic conditions, and tourism activities and timing; reconstruction or reposition of affected infrastructure; and project presentation and sanitary education programs for communities in the vicinity of pumping stations and wastewater treatment plants.

G. Summary of Negative Impacts and Mitigative Measures

27. Attachment 1 summarizes major negative environmental impacts and the proposed mitigation measures, indicating the sewerage and/or wastewater treatment plant system affected by these impacts and measures.

H. Institutional Requirements

28. Achieving the project's environmental goals and enhancing the positive environmental impacts identified will require complementary and coordinated actions by other governmental agencies and non-governmental organizations. Additional actions in solid waste recollection and disposal, industrial pollution control, water quality monitoring, conservation of ecosystems and water resource management were identified as necessary conditions to guarantee the achievement of water quality objectives and overall environmental recovery of the area of influence of the project. These actions will be carried out under SEAMA's institutional development component and will be coordinated within

BOX 2: CULTURAL IMPACTS IN PROJECT SITING: THE *PANELEIRAS* CASE

The cultural complex of clay pots or *paneleiras* is believed to have been in Brazil before the arrival of the Portuguese (Tupiguarani and Una traditions). The exploitation of the Mulemba Valley clay deposits goes back several generations. The work is performed mainly by women and the younger members of the families who transport the clay from the deposits to work areas located 8 km away. The community, and similar ones from other areas of the State, is organized around an Association of *Paneleiras*. The *panelas* and the fish dishes that are associated with them have become a symbol of the State and the *capixaba* culture. This situation was one the most critical problems at the initial stages of the project given the lack of suitable areas for the location of wastewater treatment plants in this heavily urbanized area. The Bank requested additional technical and socio-economic studies. These studies demonstrated that remaining clay deposits in the Valley would last 6 more years at the current rate of exploitation. Geological studies identified alternative clay deposits in other areas; however, clay characteristics will require different technologies for the preparation of pots. Social studies determined that more than 60% of the approximately 100 families (500 people) of *paneleiras* depend exclusively on this activity. A community consultation program defined a compensatory and social development program for the *paneleiras* to be implemented through CESAN and the Municipality of Vitoria, and supervised by SEAMA, which includes: guaranteed legal access to new deposits; technical assistance, equipment, and training for new clay technologies; excavation, transportation, and storage of clays from the Mulemba Valley; technical assistance in commercialization techniques and one sales outlet in Vitoria; upgrading of existing sanitation and infrastructure in working areas; and support to other cultural activities of the *paneleiras*.

existing or proposed federal or State programs. CESAN has established an Environmental Unit in order to carry out all future environmental work and develop a sanitary education program. The project will also finance training programs, laboratory equipment, environmental information systems, and specific environmental studies for both SEAMA and CESAN. Environmental and sanitary education programs will be carried out through local NGOs and community associations.

TABLE 1: NEGATIVE ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impacts	Sewerage and Wastewater System												Mitigative Measures
	Sta. Maria de Jetiba	Santa Leopoldina	Marechal Floriano	Domingo Martins	Cariacica Area I	Paul/Vilha Velha	Praia da Costa	Cariacica Area II	Praia do Couto	Bairro de Fatima	Centro de Guarapari	Praia do Morro	
Water Quality													
-Residual water quality degradation from disposal of treated wastewater in water bodies with low waste assimilation capacity & dilution potential D.O. level reduction, high coliform levels & local low to medium eutrophication potential	X	X	X	X	X	X	X	X	X	X	X	X	-Design & construction of additional links of final effluent discharge pipes/channel to points/water bodies with higher waste assimilation potential
-Water quality deterioration form disposal of solid waste from wastewater treatment plants	X	X	X	X	X	X	X	X	X	X	X	X	-Design & construction of solid waste disposal systems for all wastewater treatment plants
-Water quality deterioration from raw sewerage discharge due to malfunctions in wastewater treatment plants, pumping stations & main collectors	X	X	X	X	X	X	X	X	X	X	X	X	-Adoption and implementation of efficient O&M plans; designed & implementation of contingency plans for raw sewage discharge events in key sensitive areas
Aquatic & Terrestrial Ecosystems													
-Alteration of coastal lagoons ecosystems & other wetlands						X	X						-Select alternative waste treatment plant site
-Loss of secondary forests ("capoieiras") in advanced state of recovery											X	X	-Implementation of revegetation program barriers around sites
-Alteration of mangrove wetlands by earthworks, construction waste disposal, soil instability											X		-Appropriate disposal of construction waste/earth cuts; construction of containment walls
Social and Economic Components													
-Closure of clay deposits for local artisan communities ("paneleiras")									X				Access to new deposits to allow for permanence of activity; compensation measures for community organization
-Transformation of land use patterns in area of influence of wastewater treatment plants	X	X	X	X	X	X	X	X	X	X	X	X	-Scenic recuperation/revegetation/ enclosures of wastewater treatment plants; municipal land use zoning enforcement
-Displacement/closure of infrastructure: groundwater wells for domestic & agro-industry, soccer fields, port infrastructures	X		X	X		X		X					-Construction/reposition of affected infrastructure; relocate Paul/Vilha Velha wastewater treatment plant

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
COST-BENEFIT ANALYSIS: METHODOLOGY AND RESULTS

A. Introduction

1. The Espírito Santo Water and Coastal Pollution Management Project is expected to benefit the entire population served by CESAN, about 74% of Espírito Santo's urban population (2.05 million as of December 1993). At the end of project implementation (December 1999), CESAN's investments in water supply will have directly benefited about 640,000 people--about 1.41 million people once the project facilities saturates, and its investments in sewerage about 770,000 people--about 1.22 million people once the project facilities are operating at full capacity. Seven categories of benefits arising from project implementation are identified for the cost-benefit analysis. These categories include: (i) direct utility increases from being connected to a water supply network and/or from an improved water service, that is, a water service with fewer hours of rationing--water supply benefits; (ii) direct utility increases from being connected to a sewage collection network--sewage collection benefits; (iii) specific utility increases from the availability of clean water in the recreational beaches of Vitória and Guarapari bays--water recreation benefits; (iv) general increases in utility, from an ecological perspective, arising from cleaner waters in rivers, estuaries, and bays, excluding those from water recreation in beaches--environmental recovery benefits; (v) expected revenue arising from increases in tourism activities--tourism benefits; (vi) expected reductions in public health care expenditures as a result of the project--health benefits; and (vii) expected increases in fishing production--fishing benefits.

2. An economic analysis was conducted to measure the willingness to pay for the water supply component and to quantify the direct benefits of the project arising from this component--benefit (i) above.[1/] A separate economic analysis was conducted to measure the willingness to pay for the sewage collection and treatment component and to quantify the direct benefits arising from this component--benefits (ii) through (v) above.[2/] Health benefits--benefit (vi) above, were determined using a proportion of the hospital expenditures faced by Brazil's National Health System (INAMPS) that originates from the State of Espírito Santo[3/]. Due to data limitations, fishing benefits--benefit (vii) above, were not measured, even though there is a clear indication that they are important for the sustainability of the fishing sector in the state.

3. This annex presents: (i) a summary of the assumptions, methodologies, and field studies conducted to quantify project benefits; (ii) a description of the project beneficiaries; (iii) the calculated unit and total benefits for each of the seven categories described above; (iv) a summary of the project investment costs; and (v) the economic rates of return for the components of the project.

1/ Faria, Diomira (1993), Estudo de Avaliçõo Econômica Para o Gerenciamento da Demanda de Agua, Relatôrio Preliminar, Programa de Despoluição dos Ecossitemas Litorâneos do Espírito Santo, Novembro.

2/ Ampla Visão (1993), Quantificacão dos Beneficios: Relatório Preliminar, Programa de Despoluicão dos Ecossistemas Litorâneos do Estado do Espírito Santo, Julho.

3/ Seroa da Motta, R.S. (1993), Health Costs Associated with Household Waste Pollution in Brazil, International Conference on Environmental Economics, Santiago de Chile, June 22-24.

B. Methodologies for Benefit Quantification

4. The benefits of the project are quantified using contingency valuation (CV) and opportunity cost (OC) methodologies. A travel cost (TC) methodology is also applied to measure the water recreation benefits in order to check the robustness of the results from the contingency valuation methodology.

Contingency Valuation Methodology

5. A Contingency Valuation (CV) study was used to estimate the five first project benefits identified above: water supply, sewage collection, water recreation, environmental recovery, and tourism benefits. CV is a method to elicit an individual's economic valuation of different types of goods including: (i) private goods which have no revealed market value due to the potential customer's lack of experience with such a good (new customers connecting to a water supply network after having used other sources for a long time); (ii) private goods with no revealed market value due to the customer's lack of experience with a particular attribute of the good (such as fewer hours of rationing from a water supply network with a history of interrupted service); (iii) public goods valued at their user benefits (sewage collection and treatment and water recreation benefits); and (iv) natural resources which may not have an explicit market value (environmental benefits).

6. This method provides a direct estimate of the monetary value of benefits of such goods by establishing hypothetical markets. The markets are defined using the particular service attributes (e.g., four more hours of water supply) that are being evaluated to assess preferences. The potential beneficiaries are asked how much they would be willing to pay for a new service or an improvement in the levels and type of service provided by the project. The respondent is asked to choose between: (a) paying a hypothetical price in exchange for an expected benefit, if the project is implemented; and (b) not implementing the project hence having no expenses. The prices quoted cover the full range of possibilities for the willingness to pay (WTP). As such, the methodology elicits the preferences for water supply and sewerage related benefits as well as the perceived utility from receiving these benefits. The preferences are measured in terms of the proportion of project beneficiaries willing to pay a given price for a defined service, obtained from the proportion of "yes" responses to the WTP a given price for a project. The quoted WTP by each questionnaire respondent is a valuation of the perceived utility derived from the project, as well as a measure of the degree of acceptance of the project. The WTP prices estimated by CV methodology represent the average unit benefit accruing to each project beneficiary. The total project benefits are obtained by multiplying the average (or median) WTP by the number of project beneficiaries.

7. **Dealing with the Limitations of the CV Methodology.** The CV methodology has a number of limitations which have been extensively identified in the literature, that may lead to biases in the estimation of WTP values and the consequent valuation of benefits. One of the conditions for the CV methodology to work well is that subjects being interviewed must understand or be familiar with the service being valued, and that subjects must have had (or be allowed to obtain) prior valuation and choice experience with respect to the consumption levels of the service. These conditions are met by almost all of the potential project benefits because: (i) everyone uses water even if not connected to a water supply network and hence is familiar with the potential benefits and differences between a "good" and "bad" service; (ii) the benefits of sanitation are easily explained and perceived by individuals as they are aware of the consequences of not having the service, even if they cannot easily perceive the relative differences in quality of service; (iii) most people (especially in the project area) have used the beaches and know the value of a clean beach in terms of their recreation needs; and (iv) the project beneficiaries are well informed about the value of clean rivers, estuaries, and bays. For the case of benefits type (iii) and (iv), which are environmental goods, it is more difficult to rely upon the estimates from the CV methodology, especially for those residents who do not live close to the areas that will be affected by the project. This is mainly because even an experienced and knowledgeable consumer may find it difficult to value a resource that is ordinarily not priced. As a result, a Travel Cost methodology was used to test the robustness of the CV estimates.

Travel Cost Methodology

8. The Travel Cost (TC) methodology was used to measure the willingness of beneficiaries such as tourists to pay a premium, over and above the normal price, to visit a recreational site. Demand for the good is measured by the frequency of visits per year, and is related to variables affecting consumption such as travel cost and distance. The TC method was used to check the results of the CV analysis regarding water recreation benefits. A comparison of the results from both methodologies yielded very similar estimates. This satisfied the robustness test of the CV results and provided more confidence in the CV estimates.

Opportunity Cost Methodology

9. The Opportunity Cost (OC) methodology was used to estimate two of the seven project benefits identify above: indirect benefits deriving from increased revenues from tourism and from reductions in public health expenditures. The OC methodology estimates the foregone revenues in tourism and the foregone savings in health expenditures, without the project. For the case of tourism benefits, estimates are made of the flows of tourism in the region affected by the project. Assumptions were also made as to the impact of the project on these flows. Similarly for the case of health benefits, the contribution of the project towards reducing health-related expenditures is made based on assumptions on the extent to which investments in sanitation and water supply are correlated with reductions in water-borne diseases.

C. Calculation of Project Benefits

Water Supply Benefits

10. **Definition of Project Beneficiaries.** There are six groups of potential project beneficiaries for the water supply component. These potential beneficiaries are categorized as follows:

- Group 1. This group includes the population that is currently receiving rationed service but that will begin to receive a 24-hour supply with the project. This group will receive incremental benefits over and above the benefits they currently have from being connected.

- Group 2. This group includes the population that is currently receiving rationed service but that will receive more hours of service with the project. This group will also receive incremental benefits but lower than in Group 1 due to the continued rationing of service with the project.

- Group 3. This group includes the population that is currently not connected to service but that will be connected to a 24-hour supply after the project. This group will receive total benefits because this population is not yet connected to CESAN's network. Alternative sources of water such as wells, public standposts, and even clandestine consumption are currently being used by households in this group.

- Group 4. This group includes the population that is currently not connected to service but that will be connected to a rationed service after the project. This group will also receive substantial benefits but slightly lower than in Group 3 because of the rationing.

- Group 5. This group includes the new customers that will result from future population growth--the largest proportion of total new connections. The benefits of this category will be spread over time, following the general trend in population growth and the changes in Espírito Santo's economic activity.

- Group 6. This group includes the regular visitors who own houses in the Guarapari area and hence behave like residents, and seasonal tourists who live in temporary rentals for weekends,

a few days, or other such arrangements. This fluctuating population accounts for about 4.5% of Guarapari's urban residents and has an average cumulative occupancy of about 4 months out of the year. This group, currently receiving a rationed service, will begin to receive a 24-hour supply with the project.

11. **Characteristics of Project Beneficiaries.** The number of people benefiting from the project is summarized below by group. By the end of 1999, the number of beneficiaries in group 5 will account for 58% of the total number of beneficiaries. Once the project facilities are operating at full capacity, the share of group 5 will have increased to 81%.

Benefit Group	Beneficiaries at end-1999 Number of People (000)	Beneficiaries at Project Saturation Number of People (000)
Group 1	182.6	182.6
Group 2	55.4	55.4
Group 3	19.7	19.7
Group 4	1.5	1.5
Group 5	373.7	1,147.7
Group 6	6.0	6.0
Total	638.9	1,414.9

12. By end-1999, 76% of new connections to service (Groups 3, 4, and 5) will be located in Grande Vitória, 2% in Guarapari, and the remaining 22% will be in Santa Maria de Jetiba, Santa Leopoldina, Domingo Martins, Marechal Floriano, and other small cities and towns. Also by the same date (end-1999), 94% of those households benefitting from less hours of rationing (Groups 1, 2 and 6) will be located in Grande Vitoria, and the remaining 6% in Guarapari.

13. As shown below, the water supply component of the project is clearly targeted toward the poor--households earning less than 2 Minimum Salaries (MS) per month. Available data did not allow further subdivision of the 2-5 MS range, but it was found from recent survey results that at least 50% of the potential beneficiaries in this range earn between 2 and 3 MS.

Income Category	Number of People (000)	%
00-02 MS	198.3	55.6
02-05 MS	156.2	43.8
05-10 MS	1.4	0.4
>10 MS	0.7	0.2
Total	356.7	100.0

14. **Benefit Quantification.** The benefits accruing to the various groups are calculated by identifying the appropriate population category among the beneficiaries and multiplying the number of households in each category by the unit benefit. The unit benefits for groups 1, 2, 3, 4, and 6 are obtained from the results of a CV analysis, where the median WTP values represent the average benefit per household.

15. The CV questionnaire covered beneficiaries of all groups, except Group 5. The CV analysis results for Group 3 could not be used for the case of Group 5 because the Group 3 residents represented in the CV survey are from very low income groups whose WTP levels may be biased

downward. It is expected that households to be connected in the future (Group 5), will have an income distribution closer to Espírito Santo's general income distribution than that exhibited by Group 3 beneficiaries. The median WTP for project benefits resulting from the CV study is summarized below:

Benefit Group	Benefit (US$/month/household)
Group 1	6.66
Group 2	3.64
Group 3	8.94
Group 4	5.91
Group 5	39.61
Group 6	8.82

16. An elasticity approach was used to project the demand from beneficiaries classified in Group 5. The CV analysis allowed a calculation of the elasticity of demand (in m^3 per household) with respect to price, income, and other household-specific variables. The result from the CV methodology is a function relating the WTP (measured in percentage terms) to explanatory variables such as price, income, education, and age. This percentage could be interpreted as the probability that a particular individual would be willing to pay the price appearing on the right hand side of the estimation, for the service evaluated. As such, it can be used to calculate the expected demand (in terms of quantity) given a price. At any population level, this percentage represents the fraction of the population willing to pay a given price for a service, for an average consumption of the good. An elasticity value is obtained from estimating a "joint" WTP function across all possible service combinations, with the assumption that these combinations (24-hour service, rationed service, and no service) will be present in the future. Using the estimated results, a long-run (without lags) price elasticity of -0.30 was estimated and used to calculate the benefits for Group 5.

Sewage Collection and Treatment Benefits

17. **Definition of Project Beneficiaries.** The sewage collection and treatment component, which includes investments in Grande Vitória and Guarapari, has five types of benefits: (i) direct benefits from having household sewage collected; (ii) water recreation benefits derived from the availability of clean water in recreational beaches (due to the collection and treatment of sewage); and (iii) environmental recovery benefits derived from the availability of clean rivers, estuaries, and bays (due to the collection and treatment of sewage); (iv) tourism benefits derived from an expected increase in tourism activities; and (v) health benefits derived from an expected reduction in public health care expenditures.

18. **Characteristics of Project Beneficiaries.** The households to be connected to CESAN's sewerage system will be the beneficiaries of the sewage collection subcomponent. Water recreation, tourism, and health benefits will accrue to the households of Grande Vitória and Guarapari, as well as to the tourists (home-owners and seasonal tourists) visiting these localities. Environmental recovery benefits will accrue to households living in Grande Vitória, Guarapari, and other municipalities within the project area, as well as to the tourists visiting the project area. The number of people benefiting from sewage collection, water recreation, and environmental recreation is shown in the Table below. The expected increase in tourism activities will indirectly benefit all inhabitants of Grande Vitória and Guarapari. The expected reduction in health expenditures will benefit the federal and State governments, as well as all inhabitants and visitors of Grande Vitória and Guarapari.

Benefit Type	Number of People (000) At end-1999	Number of People (000) At Project Saturation
Sewage Collection	774.4	1,221.8
Water Recreation	1,490.5	2,153.0
Environmental Recovery	1,505.3	2,174.2

19. Although people benefiting from sewage collection are also benefiting from water recreation and environmental protection, double counting of benefits does not occur because of the nature of the benefits. The direct benefits from collecting are easily perceived from any individual household. Benefit perception is straightforward because households are well aware of the serious consequences that the lack of this service has on their health and ambient living conditions. As shown in the Table below, the allocation of project benefits by category of income is balanced across income categories and not targeted towards the poor as the water supply component. In the case of water recreation, the additional value derived from water recreation is clearly different from the direct benefits of having raw sewage removed from one's residence. In the case of environmental recovery, the impact of collected and treated wastewater on water supply sources and other ecological systems is quite separate from the direct benefits of having raw sewage removed from one's residence, as well as the additional benefits derived from water recreation. Finally, the expected benefits from an increase in tourism activities as well as from a reduction in health expenditures will be clearly additional to the three types of benefits discussed above. Therefore, due to the location and level at which they are perceived, these benefits are mutually exclusive, and the project total benefits from the sewage collection and treatment component can be derived from a straightforward summation.

Income Category	Number of People (000) At end-1999	Households (%)
00-01 MS	3.1	0.4
01-02 MS	134.7	17.4
02-03 MS	119.3	15.4
03-05 MS	146.4	18.9
05-10 MS	201.3	26.0
10-15 MS	87.5	11.3
>15 MS	82.1	10.6
Total	774.4	100.0

20. **Benefit Quantification.** The project benefits for sewage collection, water recreation, and environmental recuperation are calculated as unit benefits per household. These unit benefits are the median WTP values obtained from the results of a CV analysis. The different type of project benefits are calculated by identifying the appropriate number of households that will benefit from each particular category--as was presented earlier, by the unit benefit. Unit values for these three type of benefits are estimated as shown below.

Benefit Type	Benefit (US$/month/household)
Sewage Collection	8.20
Water Recreation	7.82
Environmental Recuperation	5.82

21. **Tourism Benefit Quantification.** An opportunity cost (OC) approach is used to calculate the benefits deriving from tourism. The main tourism service in the State of Espírito Santo, which is firmly engaged in the development of its tourism sector, is based on "sun and beaches". An improvement in the quality of its beaches has therefore the potential to increase the demand for tourism in the State[4/]. The projected flow of tourists between origin and destination states, as well as the benefits derived from tourism, are presented in one of the CV studies[5/]. Two scenarios were used for projecting the flow of tourists to Espírito Santo in that study: (i) a conservative scenario which assumes an annual 1.8% growth rate in GNP over 20 years of analysis; and (ii) an optimistic scenario using an annual 6.5% growth rate. Tourism benefits were quantified assuming that: (i) the current number of tourists visiting Espírito Santo is about 1 million per year; (ii) each tourist spends about US$120 per year; (iii) the flow of tourists visiting Espírito Santo will grow in accordance with the pessimistic scenario; (iv) 40% of tourist expenditures represent local value added; (v) the project will be responsible for attracting 25% of the expected number of incremental tourists; and (vi) about 50% of the tourists entering the State will frequent the areas affected by the project.

22. **Health Benefit Quantification.** The current levels of water and environmental pollution exact high health expenditures from Espírito Santo's State government and its population. The incidence of oral-fecal diseases is high (up to 12,000 cases in the State for 1990) and the consequent health care costs resulting from hospitalization following water and sanitation related diseases are substantial (around US$1 million in 1990). The considerable efforts made by the State in the past to increase water coverage (currently at about 88%), have significantly reduced water-related diseases. However, the current level is still relatively high because of the lack of sewerage facilities. Health benefits were quantified assuming that: (i) about 71% of all health expenditures originate in waterborne diseases; (ii) urban households spend on average about US$0.67 per year on health; and (iii) after the project the incidence of waterborne diseases will decrease by about 92%[6/]. The total health benefits are obtained by multiplying the unit benefits derived from reduced health expenditures by the projected urban population. The pattern of benefits from the reductions in health-related expenditures would, therefore, follow the general pattern of growth of the urban population in Espírito Santo.

23. **Fishing Benefits.** The estuaries, bays, and coastal waters in the State of Espírito Santo provide an important source for the fishing industry. The coast of Espírito Santo is approximately 521 km long, stretches across 14 coastal municipalities, and serves up to 60 communities of fishermen. The volume of fish produced by the State in 1989 was about 13,899 tons, making up close to 2% of the national fishing production. The fish derived from the waters of Espírito Santo represent some 18 species, including tuna, shrimp and lobster. The environmental impact of coastal and river pollution on the diversity and quantity of fish from these waters is believed to be serious. Data limitations precluded an estimation of the benefits deriving from the fishing industry following the project.

Other Non-Quantifiable Benefits

24. In addition to fishing benefits, the project also has other non-quantifiable benefits such as: (i) improvements in the future planning and management of the water and environmental systems in the State of Espírito Santo; and (ii) a temporary but significant generation of employment for non-qualified

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4/ Tourism specialists have estimated between 25% and 50% the incremental expansion of tourism that will result from the implementation of this project.

5/ Ampla Visão (1993), **Quantificação dos Benefícios: Relatório Preliminar**, Programa de Despoluição dos Ecossistemas Litorâneos do Estado do Espírito Santo, Julho.

6/ Seroa da Motta estimated the correlation between the incidence of waterborne diseases and sanitation levels at about 92%. See Seroa da Motta (1993), R.S. (1993), **Health Costs Associated with Household Waste Pollution in Brazil**, International Conference on Environmental Economics, Santiago de Chile, June 22-24.

labor. These benefits are over and above all the quantifiable benefits discussed in the last two sections.

D. Internal Economic Rates of Return

25. The evaluation of economic viability considered the Bank project as a part of CESAN's overall investment program, and hence evaluated the economic viability of the Bank project including all CESAN investment costs during the 1994-2023 period of analysis[2/]. Other data used in the analysis include the incremental operation and maintenance costs projected for that period, and the economic benefits resulting from the project, as discussed in the preceding Sections.

26. **Water Supply Component.** A weighted tax rate of 9% is used to obtain the project costs (investment plus operation and maintenance costs) without taxes. This tax rate corresponds to the rate for goods and services broken down as follows: (i) a 12% equipment and materials tax (Imposto sobre Circulação de Mercadorias e Serviços-ICMS) applied to 58% of project costs; and (ii) a 5% civil works and consultant tax (IPI) applied to 42% of project costs. An interest rate of 10% is used to calculate the net present value (NPV) of the project costs resulting from the water supply component.

27. Six investment categories were developed for the analysis: (i) permanent residents of Grande Vitória only; (ii) permanent residents of Guarapari only; (iii) permanent residents of Guarapari and tourists visiting the area; (iv) permanent residents of both Grande Vitória and Guarapari; (v) permanent residents of both Grande Vitória and Guarapari, plus tourists visiting Guarapari; and (vi) permanent residents of both Grande Vitória and Guarapari under the assumption that all of them could be classified as poor, that is, earning less than 2 MS per month. The investment category (vi) is a theoretical scenario built to represent the case where the above targeting of the low income category, in terms of new connections to the system resulting from population growth, is continued throughout the project analysis period. The differential economic rate of return between this scenario and scenario (v) is an estimate of the opportunity cost of poverty targeting.

28. The Internal Economic Rates of Return (IERR) for the six investment categories mentioned above are summarized below. IERR are high because of the high WTP values estimated by the CV analysis. As can be seen from the IERR, all the investment scenarios are economically viable, excluding scenario VI which assumes a continued targeting of the poor throughout the analysis period. However, even this IERR (8.78%) is very close to the assumed opportunity cost of capital for Brazil (10%).

Investment Scenario	IERR (%)
I. Grande Vitória	34.97
II. Guarapari (Residents)	10.48
III. Guarapari (Residents and Tourists)	10.55
IV. Scenario I + II	33.36
V. Scenario I + III	33.30
VI. Scenario V plus Poverty Targeting	8.78

29. However, as pointed out in Annex 11, the marginal cost pricing analysis found that the proposed subproject for reinforcing and expanding Guarapari water supply system was not acceptable. The subproject marginal cost falls outside the acceptable range of eligibility for this type of projects in a city of Guarapari's size. Therefore, given that CESAN is currently revising the engineering designs of Guarapari water supply project and the new marginal costs are expected to resemble those of

[2/] In the case of the water supply component, a group of specific investments executed during 1992 and 1993 was also included because they form part of the overall investment package from which the benefits of the World Bank project are derived.

Grande Vitória, the IERR for Grande Vitória alone (Scenario I) is the most representative IERR for the entire water supply component of the project.

30. **Confirmation of the High IERR for Water.** One of the questions in the CV survey was open ended, asking people to list their six major priorities. The results of the survey show that the most important priority of the people surveyed is water supply, followed by health and solid waste collection; all sectors related to water supply and sanitation. The importance of water as a priority generally declines with increasing income, as expected since the higher income households generally have better service and even when the reliability of service is low, they are capable of adopting alternatives to cope with unreliable supply (such as building storage tanks and filtering water in their homes). The size of the water bill (included in the "other" category) is generally not a problem, as it did not feature very prominently in the list of priorities of the people surveyed. This result indicates that people are generally willing and able to pay for the water services they demand. The survey results, in combination with the high values of WTP estimated for this component of the project, provide confidence in the high IERR calculated above. A summary of the priorities by income group is shown in the Table below.

31. **Sewage Collection and Treatment Component.** A weighted tax rate of 7% is used to obtain the project costs (investment plus operation and maintenance costs) without taxes. This rate corresponds to the rate for goods and services broken down as follows: (i) a 12% equipment and materials tax (ICMS) applied to 25% of project costs; and (ii) a 5% civil works and consultant tax (IPI) applied to 75% of project costs. An interest rate of 10% is used to calculate the net present values (NPV) of the project costs resulting from the sewage collection and treatment component.

Income Category	Stated Priorities (%)				
	Water	Health	Waste	Transport	Other[9/]
00-01 MS	56	17	7	12	9
01-02 MS	56	16	11	8	8
02-03 MS	45	17	17	11	10
03-04 MS	48	16	10	15	10
04-05 MS	47	15	12	13	12
05-10 MS	42	8	21	19	11
>10 MS	28	17	18	28	8
Total	47	15	14	14	9

32. The costs and benefits resulting from the sewage collection and treatment component of the project are grouped into three categories in order to analyze the project's economic viability: (i) sewage collection only; (ii) sewage collection, water recreation, and environmental protection; and (iii) sewage collection, water recreation, environmental protection, tourism, and health. The IERR for these three categories are summarized below.

[9/] This priority includes the importance attached by the population to both education and the water bill.

Category	IERR (%)
Sewage Collection Only	12.79
Sewage Collection, Water Recreation & Environmental Protection	31.11
Sewage Collection, Water Recreation, Environmental Protection, Tourism & Health	32.17

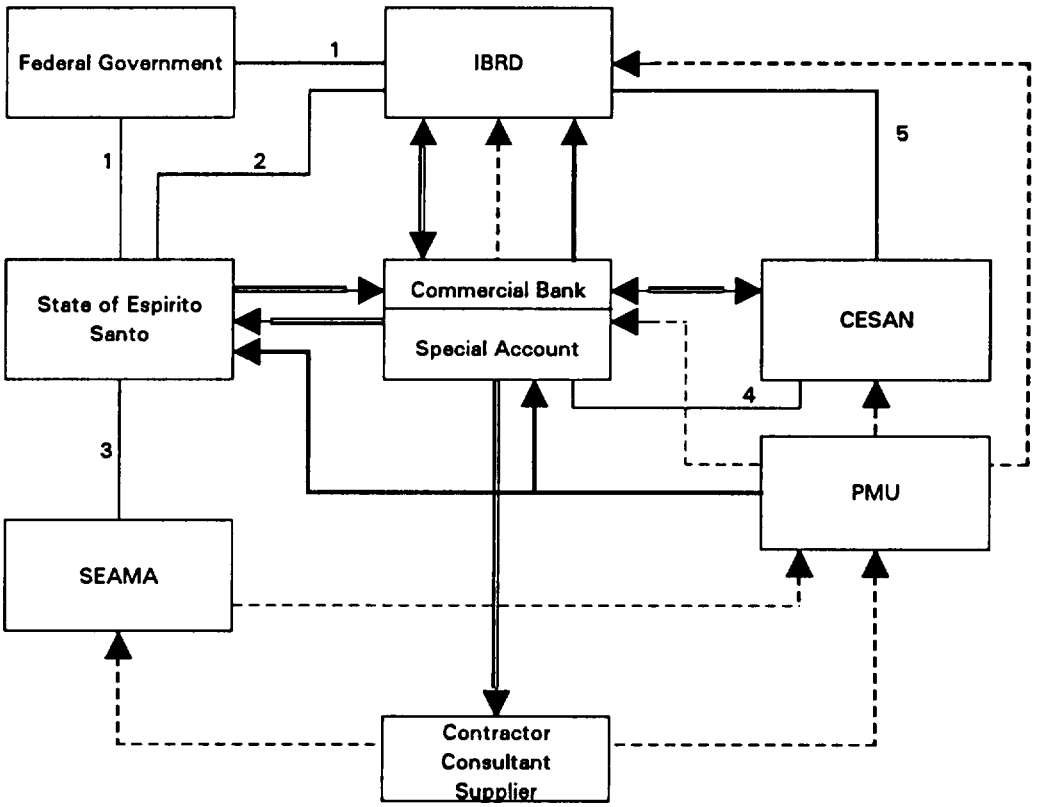
33. The IERRs for this component of the project are slightly lower than those for the water supply component for at least two reasons: (i) as commonly stated, people perceive water supply as more important than sewage collection and treatment; the estimated WTP for the water supply component is higher than the estimates for all other categories of benefits, such as those derived from sewage collection, water recreation, and environmental recovery; and (ii) the water supply component also includes an improvement in service quality (a considerable reduction in the number of hours in which the service is rationed), and it has been repeatedly shown that rehabilitation and improvement projects generally have higher rates of return than new projects.

34. As shown in the IERR above, the sewage collection and treatment component of the project is economically viable for all categories. The ERR of the category that only includes sewage collection is significantly lower than the other two. This result illustrates the notable importance attached to a clean environment by the population of Espírito Santo.

35. **CESAN's Total Investment Program.** The IERR of CESAN's total investment program, calculated as the weighted average of the IERR of the proposed investments in water supply, operational development, and sewage collection and treatment, is 33.36%. Therefore, CESAN's investment program as a whole is economically viable.

ANNEX 17

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
Project Flows / Legal - Financial - Technical



FINANCIAL RESOURCES

LEGAL DOCUMENTS

1. Guarantee Agreement
2. Loan Agreement
3. Agreement State/Commercial Bank
4. Onlending Agreement
5. Project Agreement

TECHNICAL AND FINANCIAL DOCUMENTS

ACCOUNTABILITY OF EXPENSES

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
GUIDELINES FOR EVALUATION OF SUBPROJECTS

1. These guidelines have been prepared to provide a common framework for the evaluation of subprojects by all entities involved in this operation: The State of Espírito Santo, CESAN, SEAMA, and the Bank. The evaluations will be prepared by either CESAN or SEAMA, reviewed and submitted to the Bank by the Project Management Unit (PMU), and approved by the Bank.

2. The objective of these evaluations is to determine the technical, environmental, financial, and economic feasibility of each proposed subproject. Each subproject should correspond to the least-cost solution. The technical evaluation will analyze this issue, as well as the priority of the proposed components, its consistency with sector policies, and its contribution to improve the delivery of services in a given locality. The evaluation also aims to ascertain that neither the subproject nor its components would adversely affect the environment and that their benefits equal or exceed their costs. The justification of each individual subproject will be based on the long-term average incremental costs (LRAIC) vis-a-vis CESAN's average tariffs. LRAIC will be calculated on the basis of the incremental demand it will satisfy, the estimated investment cost--including complementary works, and the estimated operational and maintenance cost (see Annex 11).

3. The evaluation of sanitation subprojects will also verify that each proposed subproject adequately contribute to meet the water quality objectives agreed during project preparation (see Annex 4), as well as those other objectives defined by applicable federal, state, or local regulations. The achievement of water quality objectives will be assessed using the water quality models for rivers and ocean, and other bay and estuarine models developed during the preparation of the project (see Annex 15). The waste assimilation capacity of receiving water bodies will be considered as the principal criterium for the selection of final disposal points.

4. A subproject is the sum of one or more components from three main categories: (i) institutional development programs; (ii) rehabilitation of existing infrastructure; and (iii) construction of new facilities. These categories are listed in descending order or priority. The composition of a subproject, however, should be tailored to the specific needs of a given locality.

5. Several steps will be followed to perform this analysis in a systematic and effective way. First, the current water supply and/or sewerage systems will be described and evaluated in detail. Second, the existing and future demands for these services will be carefully determined. Third, all feasible alternatives to provide the services demanded, including the removal of institutional and physical constraints, will be explored and compared. Fourth, based on the former analysis, a group of clearly defined alternatives will be selected. Fifth, the alternative corresponding to the least-cost solution will be identified. Sixth, an environmental assessment will be performed to ensure that the proposed subproject meets acceptable environmental protection standards, social concerns, and community participation. Seventh, a marginal cost pricing analysis will be performed to evaluate the tariff structure, the economic benefits, and the cost-effectiveness of the project.

Institutional Strengthening Programs

6. Both CESAN and SEAMA institutional strengthening programs were assessed during appraisal. Both programs, designed to improve these agencies' efficiency, are justified on the basis of a general assessment of their overall design and main organizational units, of the effectiveness of the proposed financial, commercial, and operational activities, and of the training needs of their staff. To assure an accurate post-evaluation of these programs, both CESAN and SEAMA will develop appropriate accounting systems to carefully record all costs and benefits associated with them. The level of

aggregation will depend on the nature of the activities--for example, costs and benefits associated with CESAN's financial improvements may be aggregated in a single account, but not costs and benefits associated with operational improvements.

Investment Projects

7. The evaluation of a water supply and sewerage system begins with an engineering assessment of the main existing components of the system (main physical dimensions, materials, condition, reliability, and capacity). This engineering evaluation provides the basis for assessing the feasibility of rehabilitating the system's components to bring them up to their optimal capacity at a cost usually lower than that required to construct a new facility.

8. **Demand Analysis.** The evaluation of a water supply or sewerage system continues with an analysis of existing coverage levels and type of service provided as well as per capita and aggregate consumption and production volume. The demand analysis will address, at a minimum, the following issues:

- existing coverage levels and types of service provided (including total population, population served, number of house connections, standpipes, and septic tanks);
- metered water consumption (based on house connections), preferably disaggregated by main users (residential, commercial, industrial, and public), and estimated unmetered consumption (including a detailed explanation and justification of the criteria used for estimation);
- price and income elasticities of demand;
- metered water production and estimated unmetered production (with the same breakdown and explanations as indicated above); and
- unaccounted-for water (UFW), defined by the difference between production and metered consumption.

9. The analysis of historical production, UFW, and demand will cover the previous two to five years. Projections of water consumption, UFW, and water production will be based on the projected growth of house connections or service accounts, and will also consider the effects of increasing water metering, implementing specific plans to reduce UFW and improve marketing practices, and increasing water prices (if applicable) and regional income. Projections of sewage collection will also be made on the basis of the number of connections to the sewer system and reasonable assumptions on consumption and infiltration flows. Sewage collection projections will be broken down by type of final treatment and disposal systems used. Water and sewage projections will be made on a yearly basis up to the time in which the system begins to operate at its full capacity.

10. **Least-Cost Solution.** In determining the optimum investment expansion plan (i.e., the least-cost solution), the following aspects will be taken into account:

- all investment works will be built or expanded as far into the future as possible, as determined by the demand projection and the existing capacity of the component under analysis; and
- facilities will be sized so as to minimize idle capacity. Several models are available to determine the optimum size and sequencing of investments.

11. To determine the optimal expansion program of a water supply or sewerage system, an analysis of all technically feasible alternatives will be made and the most promising ones compared on the basis of discounted total costs (capital and operational). A special effort will always be made to include in

the analysis an alternative related to rehabilitation and/or optimization of existing facilities. A discount rate representative of Brazil's opportunity cost of capital will be used to perform the analysis. The one with the lowest cost will be selected. A sensitivity analysis will be conducted when two or more alternatives present similar costs.

12. It will be remembered that only economic costs enter into the calculations. Costs will be expressed in constant prices; that is, inflation will not be taken into account. Financial and transfer costs such as interest, depreciation, and taxes will not enter into the calculations. Moreover, economic costs to be included are the incremental investment and operating costs associated with the component. These costs are determined on the basis of an analysis of the situation "with" and "without" the project, which is not necessarily the same as "before" and "after" the project. Annex 11 contains a detailed description of the methodology to be used for calculating water and sewerage incremental costs.

13. **Construction Indicators.** Unit costs and tangible monitoring indicators that can be easily followed during project execution will be explored and developed for each subproject. These indicators will be routinely used during project execution as control devices to ensure that all investments will produce the intended results and remain cost-effective. Unit cost indicators are also intended to create a cost data bank to be used to improve cost estimates for future subprojects and to help identify cost-effective and replicable programs.

14. Benefit and cost parameters will be followed closely during the construction of each subproject. An adverse change in any of these parameters will trigger a review of the project and, if necessary, the subproject will be modified to ensure that maximum net benefits continue to accrue.

15. **Environmental Analysis.** All subprojects will be screened to determine the degree, if any, to which potential environmental impacts may occur. All projects will comply with the Bank's environmental policies. Site selection will avoid direct and indirect damage to existing municipal and state protected areas and unprotected sensitive coastal ecosystems. Special attention should be given to social and cultural issues associated with the site and the surrounding communities. Special consideration will be given to proposed actions that will prevent or mitigate any adverse effects and ensure that the subproject is environmentally sound and sustainable. Many subprojects are likely to require only a limited environmental analysis. Each assessment will include:

- a detailed description of the project and of relevant environmental conditions;
- an analysis of positive and negative impacts likely to result from the project's components, including social and cultural impacts;
- an analysis of alternatives to mitigate any adverse effects, as well as costs and benefits of proposed remedial actions;
- a proposed plan to reduce potentially significant adverse environmental, social, and cultural impacts to acceptable levels; its capital and recurrent costs; as well as its institutional and training requirements (if any);
- a monitoring plan regarding environmental impacts and performance; and
- the final report should include the conclusions and recommendations of all community and public consultation meetings held during the study.

16. Regardless of the environmental analysis required for a given project, all existing local, state and federal environmental regulations should be complied with. All proposed projects should have approved Location and Installation Environmental Licenses by SEAMA.

17. **Subproject Eligibility.** In large cities, defined as those with more than 500,000 inhabitants, water projects will be approved only if CESAN's current average water tariff in that city (AWTi) exceeds 75% of the marginal cost of providing the water supply service to residential customers with the given project (MCWi) in 1994, 80% in 1995, and 85% in 1996 and thereafter. In medium-sized cities, defined as those with more than 50,000 but less than or equal to 500,000 inhabitants, water projects will be approved only if the AWTi exceeds 75% of the MCWi in 1994, and 80% in 1995 and thereafter. In small-sized cities and towns, defined as those localities with more than 5,000 but less than or equal to 50,000 inhabitants, water projects will be approved only if the AWTi exceeds 60% of the MCWi in 1994, 65% in 1995, and 70% in 1996 and thereafter. In rural communities, defined as those localities with 5,000 people or less, water projects will be approved only if the AWTi exceeds 60% of the MCWi. Sewerage projects in large cities will be approved only if CESAN's current average sewerage tariff in the project's site (ASTi) exceeds 60% of the marginal cost of providing the sewerage service to residential customers with the given project (MCSi) in 1994, 65% in 1995 and 75% in 1996 and thereafter. Sewerage projects in medium-sized cities will be approved only if the ASTi exceeds 60% of the MCSi in 1994, 65% in 1995, and 70% in 1996 and thereafter. Sewerage projects in small-sized cities and towns will be approved only if the ASTi exceeds 60% of the MCSi in 1994 and 1995, and 65% in 1996 and thereafter. Sewerage projects in rural communities will be approved only if the ASTi exceeds 60% of the MCSi. In any case and year, and independently of the size of the locality, the ASTi should cover 100% of the marginal cost of collecting the sewage from residential customers with the given project.

18. **Social Considerations.** Subprojects satisfying the technical, environmental, and social conditions indicated in the guidelines presented in Annex 18, but not complying with the financial and economic conditions (i.e., presenting an average water/sewerage tariff lower that the specific percentage of the marginal cost of providing the service), may be accepted by the Bank on a case-by-case basis. The analysis should, however, explicitly address the following issues: (i) the lack of alternative and feasible solutions; (ii) the impossibility of recovering costs through tariffs; and (iii) the impact on poverty alleviation and health conditions. These subprojects are likely to be in towns where urban poverty prevails and large investments are needed to compensate for investments not made earlier.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
SUPERVISION PLAN

1. Bank Supervision Input into Key Activities. A preliminary schedule of supervision missions including key activities and specialization needed in indicated in the table below. The key activities shown in the table are in addition to desk supervision needs, which include the review of: (a) progress reports; (b) studies and recommendations; (c) audits; (d) procurement documents, awards and resulting issues; (e) updating of plans and operational guidelines; and (f) correspondence. These desk supervision needs are estimated to require six staff weeks per year during the entire implementation period.

2. The main emphasis during the initial project phase would be on; (a) assisting the Project Management Unit (PMU) to launch the program in coordination with the executing agencies, the Bank operational guidelines, and the agreed monitoring system; (b) making certain that all parties are knowledgeable of the project objectives and scope, and of required project documentation; and (c) confirming that all parties are familiar with Bank procedures with emphasis on procurement, auditing (especially Statements of Expenditure), disbursements, and progress reports.

3. When the system is in place, Bank assistance will focus on: (a) institutional strengthening of both executing agencies--CESAN and SEAMA; (b) preparation and implementation of CESAN's unaccounted-for water program; (c) eligibility of subprojects; (d) preparation of agreed studies and implementation of recommended actions--in particular those actions conducive to a reorganization of the water and sanitation sector in the State of Espírito Santo; (e) water quality monitoring; (f) monitoring of environmental impacts of subprojects; (g) monitoring of the implementation of the environmental action plan, especially in the control of water pollution of medium- and small-size industries, and solid waste collection, treatment, and disposal systems; and (h) community involvement and training.

4. Borrower's Contribution to Supervision. The responsibilities of the Borrower (the State of Espírito Santo), the executing agencies (CESAN and SEAMA, and the Project Management Unit (PMU) are described in the main text. The PMU will be in charge of overseeing all project activities, including project monitoring and coordination; execution of project studies; arrangements for Bank supervision missions; and submission of project documents for Bank review and approval, including progress reports.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BANK SUPERVISION INPUT INTO KEY ACTIVITIES

Approximate Dates (month/year)	Activity	Expected Skill Requirements	Staff Input (staff-weeks)
7-8/94	Supervision Mission: Project Launch Workshop	Procurement Disbursement Engineering Economics/Financial Analysis Environment	6
10-11/94	Supervision Mission: Emphasis on overall tuning and understanding of Bank procedures	Economics/Financial Analysis Procurement Engineering	4
1-2/95	Supervision Mission: Review overall progress	Economics/Financial Analysis Environment	4
4-5/95	Second Workshop on project implementation	Procurement Disbursement Engineering Economics/Financial Analysis Environment	6
7-11/95	Two Supervision Missions: Review overall progress	Economics/Financial Analysis Engineer/Procurement	8
2-4/96	Supervision Mission: Review overall progress	Economics/Financial Analysis Engineer/Procurement	4
6-8/96	Mid-term Review: Assess completion of studies and implementation of recommendations, progress made in improving commercial performance, effectiveness of institutional strengthening, and compliance with covenants	Economics/Financial Analysis Engineering Environment Procurement Disbursement	8
10-11/96	Supervision Mission: Review overall progress	Economics/Financial Analysis Engineer/Procurement	4
1997	Three Supervision Missions: Review overall progress	Economics/Financial Analysis Engineer/Procurement Environment	12
1998	Three Supervision Missions: Review overall progress Thorough review of project status and final plans for completion	Economics/Financial Analysis Engineer/Procurement Environment	12
1999	Three Supervision Missions: Including one to prepare PCR	Economics/Financial Analyst Engineering/Procurement Environment	12

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
MONITORING INDICATORS

1. The specific objectives of this project are: (i) to improve the efficiency of CESAN's water supply and sewerage systems by supporting the company's efforts to operate on a commercial basis with financial self-sufficiency; (ii) to increase the coverage level of CESAN's water supply and basic sanitation services (i.e., sewage collection, treatment, and disposal) in the urban areas of Grande Vitória, Guarapari, Castelo, Iúna, São Gabriel da Palha, Nova Venecia, and Conceição da Barra, and other towns located in the Santa Maria and Jucu river basins; and (iii) to provide appropriate water and sanitation infrastructure in low-income urban areas of Grande Vitória and Guarapari. By achieving these specific objectives, the project will allow to expect: (i) an improvement in the quality of life of about 1.2 million urban inhabitants of the State of Espírito Santo; (ii) a reduction in the incidence of oral-fecal diseases; and (iii) an improvement in the quality of water for human consumption and recreational uses through the restoration and protection of the environmentally deteriorated river basins of Santa Maria, Jucu, Jabutí, Peroção, and Una, as well as the estuarine and coastal ecosystems within and adjacent to the municipalities of Grande Vitória and Guarapari.

2. The set of physical, operational, environmental, and financial targets presented in Attachment 1 will be used as monitoring indicators for the project's specific objectives. The definition of each of these indicators is presented in Section A of this Annex. The project's expected long-term benefits will be monitored using the complementary set of indicators presented in Section B of this Annex. Both the project targets and its expected long-term benefits will be monitored jointly by CESAN and SEAMA. The long-term monitoring plan will be financed by the Bank.

A. Definition of Monitoring Indicators of Project Targets

Physical Indicators

- **Water Treatment Capacity as a Percentage of Total Capacity** is equal, in year t, to the sum of the water treatment capacity actually installed from year 0 (1994) to year t, divided by the total water treatment capacity to be installed during the project implementation period.

- **Water Connections as a Percentage of Total Connections** is equal, in year t, to the sum of all water connections actually installed from year 0 (1994) to year t, divided by the total number of water connections to be installed during the project implementation period.

- **Sewerage Connections as a Percentage of Total Connections** is equal, in year t, to the sum of all sewerage connections actually installed from year 0 (1994) to year t, divided by the total number of sewerage connections to be installed during the project implementation period.

- **Sewage Treatment Capacity as a Percentage of Total Capacity** is equal, in year t, to the sum of the sewage treatment capacity actually installed from year 0 (1994) to year t, divided by the total sewage treatment capacity to be installed during the project implementation period.

Operational Indicators

- **The Water Coverage Level** in year t is defined as the estimated number of urban residents that are currently served by CESAN's water systems at December 31 of year t divided by the estimated number of people living in CESAN's area of influence at December 31 of year t.

- **The Water Connections with Meters Indicator** is calculated in percentage terms as the total number of CESAN's water connections with a meter attached to them divided by the total number of CESAN's water connections.

- **The Unaccounted-for Water Indicator for Year t** is calculated in percentage terms as the volume of water produced in year t minus the volume of water sold in year t over the volume of water produced in year t.

- **The Residual Chlorine in Water Pipes** is to be calculated using an analysis program based on samples of CESAN's water distribution systems. The analysis program should include at least 300 points in Vitória and 60 points in Guarapari, and should have a sampling frequency of once a day for Vitória and twice a week for Guarapari. In any given year, each point must present concentrations equal to or higher than 0.2mg/l, more than 96% of the times it is measured. Concentration of less than 0.2mg/l must never be present in two consecutive sampling dates.

- **The Number of Water and Sewerage Connections per Permanent Employee in Year t** is calculated by dividing CESAN's total number of permanent employees (i.e., its regular staff) at December 31 of year t by the total number of water and sewerage connections under operation at December 31 of year t.

- **The Number of Water and Sewerage Connections per Permanent and Temporary Employee in Year t** is calculated by dividing CESAN's total number of temporary and permanent employees (i.e., its regular staff plus the equivalent number of third party employees) at December 31 of year t by the total number of water and sewerage connections under operation at December 31 of year t. The equivalent number of third party employees is approximated by dividing the total cost of third party contract labor by the average annual salary of CESAN's employees, including social benefits.

- **The Personnel Cost over Operating Cost** is calculated as the percentage of personnel cost to operating cost <u>not</u> including depreciation.

- **The Sewerage Coverage Level** in year t is defined as the estimated number of urban residents that are currently served by CESAN's sewerage systems at December 31 of year t divided by the estimated number of people living in CESAN's area of influence at December 31 of year t.

- **The Sewage Collected over Water Consumed Indicator in Year t** is calculated as the percentage of the volume of sewage actually collected by CESAN in year t divided by the volume of water actually consumed by CESAN's customers in year t.

- **The Sewage Collected and Treated over Water Consumed in Year t** is calculated as the percentage of the volume of sewage actually collected and treated by CESAN in year t divided by the volume of water actually consumed by CESAN's customers in year t.

Environmental Indicators

- **The Efficiency of Sewage Treatment Plants** measures the reduction of organic load (BOD_5) observed in wastewater. The sewage treatment efficiency of each plant will be calculated using the following formulae: $(BOD_{in} - BOD_{out}) / (BOD_{in}) * 100$. The percentage corresponding to plant y will be given by the monthly average results obtained from applying the water quality sampling program to plant y.

- **The Number of Water Quality Monitoring Stations in Year t** will be calculated as the number of operational water quality monitoring stations for inland and sea waters in good working condition in year t.

- **The Pollution Load Control for Existing Industries in Year t** will be measured as the percentage of additional organic load (BOD_5) under control at the end of year t, out of the total pollution load of all uncontrolled industries at end-1994. An industry survey will be carried out during 1994 to provide an updated reference baseline.

Financial Indicators

- **The Average Water Tariff in Year t** is equal to CESAN's water revenue in year t divided by the volume of water billed in year t. The average water tariff is given in (US$/m^3).

- **The Average Sewerage Tariff in Year t** is equal to CESAN's revenue for sewerage services in year t divided by the volume of sewage billed in year t. The average sewerage tariff is given in (US$/m^3).

- **The Working Ratio** is defined as the percentage of operating expenses in relation to operating revenues.

- **The Accounts Receivable Comparator** is calculated by multiplying the accounts receivable plus the provision for bad debts by 360 days, and then dividing this product by CESAN's operating revenue. This indicator is expressed in number of days.

- **The Rate of Return** is defined here as the percentage of net operating income after depreciation in relation to average net fixed assets.

- **Debt Service Coverage** is defined as the ratio of net income after tax plus interest on long-term debt plus depreciation over amortization plus interest.

- **The Net Internal Cash over Investment Indicator** is defined here as cashflow from operation (the sum of net income after tax, depreciation, financial expenses, and monetary correction--if any) minus the sum of interest during construction, increase in working capital, and debt service, over CESAN's total investments (the Bank's project and other investments), not including IDC.

B. Monitoring Indicators of Long-Term Benefits

Water Quality

3. The water quality sampling and analysis program will include 130 stations distributed throughout the Santa Maria, Jucu, and Guarapari river basins; the estuarine areas within Grande Vitória and Guarapari; and the coastal waters adjacent to these municipalities. To track improvements in water quality, the following indicators will be analyzed on a three-month basis:

- Biochemical Oxygen Demand (BOD)
- Dissolved Oxygen (DO)
- Total Number of Coliforms (MPN/100 ml)
- Phosphates
- Nitrates

Health Conditions

4. Improvements in health conditions will be evaluated based on data from the area's major hospitals. Trends in the following diseases will be monitored and analyzed quarterly.

- Diarrhea
- Intestinal Worm Infections
- Skin Lacerations--due to contact with polluted waters

Quality of Life and Water Use

5. In addition to the physical indicators for infrastructure construction and service coverage, two additional indicators will be monitored to perceive how the project is improving the quality of life and enhancing water use in the area of influence of the project.

- Rationing of Water Supply. As measured by the number of hours-person per year.
- Inappropriate Water Conditions for Recreation. As measured by the number of days per year that health authorities find the conditions of public beaches, both in Grande Vitória and Guarapari, inappropriate for water recreation.

Coastal Ecosystems

6. The effective area of mangrove forest in the Lamirão Reserve will be quantified every two years to appraise how the project is protecting coastal ecosystems.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
MONITORING INDICATORS OF PROJECT TARGETS

INDICATOR	Actual	Estimated	Projected					
	1992	1993	1994	1995	1996	1997	1998	1999
PHYSICAL								
Water Treatment Capacity as a % of Total	NA	NA	12	69	69	69	86	100
Water Connections as a % of Total	NA	NA	14	29	46	63	81	100
Sewerage Connections as a % of Total	NA	NA	4	6	31	58	66	100
Sewerage Treatment Capacity as a % of Total	NA	NA	0	16	63	80	80	100
OPERATIONAL								
Water Coverage Level (%)	88.4	91.2	91.4	91.6	91.9	92.3	92.7	93.2
Water Connections with Meters (%)	65.5	70.3	79.1	86.9	90.1	90.1	90.1	90.1
Unaccounted-for Water (%)	37.0	36.3	39.0	37.0	34.0	31.0	30.0	30.0
Residual Chlorine in Water Pipes (mg/l)	>0.2	>0.2	>0.2	>0.2	>0.2	>0.2	>0.2	>0.2
W&S Connections per Permanent Employee	194	210	220	229	254	280	294	324
W&S Connections per Perm. & Temp. Employee	152	168	177	185	198	219	236	253
Personnel Cost/Operating Cost (%)	67.1	70.0	69.4	69.4	69.2	68.9	68.6	68.0
Sewerage Coverage Level (%)	10.9	11.0	12.7	13.1	22.7	31.8	33.2	43.3
Sewage Collected/Water Consumed (%)	8.7	8.7	9.8	9.8	14.8	23.1	27.6	33.4
Sew. Coll.& Treated/Water Consumed (%)	5.9	5.4	5.8	6.6	11.6	20.0	24.6	32.0
ENVIRONMENTAL								
Efficiency of Sewage Treatment Plants (%)	>80	>80	>80	>80	>80	>80	>80	>80
Water Quality at Monitoring Stations (#)	0	0	0	130	130	130	130	130
Pollution Load Control for Existing Industries (%)	NA	NA	10	35	45	55	65	75
FINANCIAL								
Average Water Tariff (US$/m3)	0.45	0.53	0.56	0.59	0.62	0.62	0.62	0.62
Average Sewerage Tariff (US$/m3)	0.23	0.29	0.32	0.54	0.57	0.57	0.57	0.57
Working Ratio (%)	76	55	57	53	49	46	45	43
Accounts Receivable Comparator (days)	40	46	43	43	43	43	43	43
Rate of Return (%)	6.3	26.3	4.6	4.0	5.3	5.8	6.1	6.5
Debt Service Coverage (times)	-2.8	2.8	3.4	4.4	7.0	8.0	8.6	3.1
Net Internal Cash/Investment (%)	116.5	-54.2	-1.8	8.0	8.9	28.1	32.6	30.4

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BID PACKAGES FOR CIVIL WORKS: WATER SUPPLY

System	Purpose	Type	Estimated Cost US$ million	Bidding/Execution 1993 3Q	1993 4Q	1994 1Q	1994 2Q	1994 3Q	1994 4Q	1995 1Q	1995 2Q	1995 3Q	1995 4Q	1996 1Q	1996 2Q	1996 3Q	1996 4Q	1997 1Q	1997 2Q	1997 3Q	1997 4Q	1998 1Q	1998 2Q	1998 3Q	1998 4Q	1999 1Q	1999 2Q	1999 3Q	1999 4Q
G. Vitoria – Sta. Maria	Pumping, Treatment & Reservoirs	LCB	1.70																										
Grande Vitoria	Reservoirs & Transmission	LCB	3.07																										
G. Vitoria – Civit, Jacaraipe, N.Almeida & Other Sectors	Pumping, Trasmission, Reservoirs & Distribution	LCB	3.45																										
G. Vitoria – Sta. Clara, Caraicica, Itaquari & Others	Pumping, Trasmission, Reservoirs & Distribution	LCB	0.99																										
Guarapari Lot I	Treatment	LCB	3.00																										
Guarapari Lot II	Water Intake, Pumping & Transmission	LCB	2.50																										
Guarapari	Reservoirs	LCB	2.11																										
Guarapari	Pumping, Transmission & Distribution	LCB	2.94																										
Other Systems – Iuna	Treatment	LCB	0.15																										
Other Systems – N.Venecia & San Gabriel da Plaha	W.Intake, Treatment, Pumping Transmission & Reservoirs	LCB	1.46																										
Other Systems – Castelo	Water Intake, Transmission, Treatment & Reservoirs	LCB	0.55																										
Other Systems – Conceicao da Barra	Treatment & Reservoirs	LCB	0.47																										
Grande Vitoria Lot I	Distribution & Connections	LCB	2.51																										
Grande Vitoria Lot II	Distribution & Connections	LCB	2.89																										
Grande Vitoria Lot III	Distribution & Connections	LCB	3.34																										
Guarapari & Other Systems Lot I	Distribution & Connections	LCB	0.51																										
Guarapari & Other Systems Lot II	Distribution & Connections	LCB	0.56																										
Guarapari & Other Systems Lot III	Distribution & Connections	LCB	0.63																										

BIDPKJWW:12/09/93

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BID PACKAGES FOR GOODS: WATER SUPPLY

System	Purpose	Type	Estimated Cost US$ million	Bidding/Execution 1993 3Q	1993 4Q	1994 1Q	1994 2Q	1994 3Q	1994 4Q	1995 1Q	1995 2Q	1995 3Q	1995 4Q	1996 1Q	1996 2Q	1996 3Q	1996 4Q	1997 1Q	1997 2Q	1997 3Q	1997 4Q	1998 1Q	1998 2Q	1998 3Q	1998 4Q	1999 1Q	1999 2Q	1999 3Q	1999 4Q
G. Vitoria – Sta. Maria	Iron Cast Pipes	ICB	10.29																										
Guarapari	Iron Cast Pipes	ICB	7.89																										
Other Systems – N.Venecia, Iuna, Cast., Conc. & SGdaP.	Iron Cast Pipes	ICB	0.98																										
Guarapari & Other Systems	PVC Pipes	ICB	1.95																										
Guarapari & Other Systems	Steel Pipes	LCB	0.05																										
G. Vitoria, Guarapari & Other Systems	Pumps & Electrical Equipment	ICB	4.82																										
G. Vitoria, Guarapari & Other Systems	Filters' Bed	ICB	0.40																										
Guarapari & Other Systems	Fiber Glass	LCB	0.07																										
Other Systems – N.Venecia, Iuna, Cast., Conc. & SGdaP.	Concrete	LCB	0.07																										
Other Systems – N.Venecia & San Gabriel da Plaha	Insurance Equipment	LCB	0.005																										
Guarapari & Other Systems	Laboratory	LCB	0.09																										
Other Systems – N.Venecia, Iuna, Cast., Conc. & SGdaP.	Aluminium	LCB	0.004																										
Grande Vitoria, Guarapari & Other Systems – Interior	PVC Pipes	ICB	4.66																										
Grande Vitoria, Guarapari & Other Systems – Interior	PVC Pipes	ICB	5.38																										
Grande Vitoria, Guarapari & Other Systems – Interior	PVC Pipes	ICB	6.20																										
Grande Vitoria, Guarapari & Other Systems – Interior	Water Meters	ICB	1.07																										
Grande Vitoria, Guarapari & Other Systems – Interior	Water Meters	ICB	1.26																										
Grande Vitoria, Guarapari & Other Systems – Interior	Water Meters	ICB	1.51																										

BIDPKGOGW:12/08/95

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BID PACKAGES FOR CIVIL WORKS: SEWERAGE

System	Purpose	Type	Estimated Cost US$ million	Bidding/Execution 1993 3Q	1993 4Q	1994 1Q	1994 2Q	1994 3Q	1994 4Q	1995 1Q	1995 2Q	1995 3Q	1995 4Q	1996 1Q	1996 2Q	1996 3Q	1996 4Q	1997 1Q	1997 2Q	1997 3Q	1997 4Q	1998 1Q	1998 2Q	1998 3Q	1998 4Q	1999 1Q	1999 2Q	1999 3Q	1999 4Q
Vitoria – Center Lot I	Treatment & Outfall Pipes	LCB	2.69																										
Vitoria – Center Lot II	Pumping Station & Raw–Sewage Pressure Pipes	LCB	0.53																										
Vitoria – Center Lot III	Connections & Collectors	ICB	8.30																										
Praia do Canto – B4 Lot I	Treatment & Outfall Pipes	ICB	9.05																										
Praia do Canto – B4 Lot II	Pumping Stations & Raw–Sewage Pressure Pipes	LCB	2.01																										
Praia do Canto – B4 Lot III	Connections & Collectors	ICB	10.54																										
Praia do Canto – B5 Lot I	Pumping Station	LCB	0.37																										
Praia do Canto – B5 Lot II	Connections & Collectors	ICB	9.16																										
Bairro de Fatima	Pumping, Pressure Pipes, Collectors & Connections	LCB	2.90																										
Vila Velha – Praia da Costa Lot I	Treatment & Outfall Pipes	ICB	19.48																										
Vila Velha – Praia da Costa Lot II	Pumping Station & Raw–Sewage Pressure Pipes	LCB	2.35																										
Vila Velha – Praia da Costa Lot III	Connections & Collectors	ICB	14.21																										
Vila Velha – Paul Lot I	Pumping Station & Raw–Sewage Pressure Pipes	LCB	0.37																										
Vila Velha – Paul Lot II	Connections & Collectors	ICB	7.43																										
Cariacica – Campo Grande Lot I	Treatment & Outfall Pipes	ICB	4.90																										
Cariacica – Campo Grande Lot II	Pumping Station & Raw–Sewage Pressure Pipes	LCB	0.48																										
Cariacica – Campo Grande Lot III	Connections & Collectors	ICB	14.48																										

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BID PACKAGES FOR CIVIL WORKS: SEWERAGE (cont.)

System	Purpose	Type	Estimated Cost US$ million	Bidding/Execution 1993 3Q	1993 4Q	1994 1Q	1994 2Q	1994 3Q	1994 4Q	1995 1Q	1995 2Q	1995 3Q	1995 4Q	1996 1Q	1996 2Q	1996 3Q	1996 4Q	1997 1Q	1997 2Q	1997 3Q	1997 4Q	1998 1Q	1998 2Q	1998 3Q	1998 4Q	1999 1Q	1999 2Q	1999 3Q	1999 4Q
Guarapari – P. do Morro Lot I	Treatment & Outfall Pipes	LCB	3.61																										
Guarapari – P. do Morro Lot II	Pumping Station & Raw–Sewage Pressure Pipes	LCB	1.49																										
Guarapari – P. do Morro Lot III	Connections & Collectors	ICB	6.03																										
Guarapari – Centro Lot I	Treatment & Outfall Pipes	ICB	5.42																										
Guarapari – Centro Lot II	Pumping, Pressure Pipes, Collectors & Connections	ICB	6.71																										
Domingos Martins	Treatment, Pumping, Pressure Pipes, Collectors & Connects.	LCB	1.18																										
Marechal Floriano	Treatment, Pumping, Pressure Pipes, Collectors & Connects.	LCB	2.91																										
Santa Leopoldina	Treatment, Pumping, Pressure Pipes, Collectors & Connects.	LCB	1.06																										
Santa Maria de Jetiba	Treatment, Pumping, Pressure Pipes, Collectors & Connects.	LCB	2.65																										
Grande Vitoria Lot I	Connections	LCB	0.40																										
Grande Vitoria Lot II	Connections	LCB	0.93																										
Grande Vitoria Lot III	Connections	LCB	1.57																										
Guarapari Lot I	Connections	LCB	0.04																										
Guarapari Lot II	Connections	LCB	0.08																										
Other Systems (Interior) Lot I	Connections	LCB	0.03																										
Other Systems (Interior) Lot II	Connections	LCB	0.04																										
Other Systems (Interior) Lot III	Connections	LCB	0.06																										

BID:PKGSW:12/09/93

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
BID PACKAGES FOR GOODS: SEWERAGE

System	Purpose	Type	Estimated Cost US$ million	Bidding/Execution 1993 3Q	1993 4Q	1994 1Q	1994 2Q	1994 3Q	1994 4Q	1995 1Q	1995 2Q	1995 3Q	1995 4Q	1996 1Q	1996 2Q	1996 3Q	1996 4Q	1997 1Q	1997 2Q	1997 3Q	1997 4Q	1998 1Q	1998 2Q	1998 3Q	1998 4Q	1999 1Q	1999 2Q	1999 3Q	1999 4Q
Vitoria–B4, V.Velha–PdaC Guarapari–P. do Morro	PVC Collectors	ICB	12.22																										
Vitoria–B5, Guarapari–C D. Martins & M. Floriano	PVC Collectors	ICB	4.16																										
Cariacica, Sta. Leopoldina & Sta. Maria de Jetiba	PVC Collectors	ICB	3.10																										
Vitoria–Centro, Serra V.Velha–Paul	PVC Collectors	ICB	2.64																										
Vitoria–B4, V.Velha–PdaC Guarapari–P. do Morro	Iron Cast Collectors	ICB	4.28																										
Vitoria–B5, Guarapari–C D. Martins & M. Floriano	Iron Cast Collectors	ICB	3.27																										
Cariacica, Sta. Leopoldina & Sta. Maria de Jetiba	Iron Cast Collectors	ICB	2.33																										
Vitoria–Centro, Serra V.Velha–Paul	Iron Cast Collectors	ICB	2.59																										
Vitoria–B4, V.Velha–PdaC Guarapari–P. do Morro	Concrete Collectors	ICB	1.91																										
Vitoria–B5, Guarapari–C D. Martins & M. Floriano	Concrete Collectors	ICB	0.95																										
Cariacica, Sta. Leopoldina & Sta. Maria de Jetiba	Concrete Collectors	LCB	0.19																										
Vitoria–Centro, Serra V.Velha–Paul	Concrete Collectors	ICB	0.37																										
Vitoria–B4, V.Velha–PdaC Guarapari–P. do Morro	Steel Collectors	ICB	2.50																										
Vitoria–B5, Guarapari–C D. Martins & M. Floriano	Steel Collectors	LCB	0.06																										
Cariacica, Sta. Leopoldina & Sta. Maria de Jetiba	Steel Collectors	LCB	0.04																										
Vitoria–B4, V.Velha–PdaC Guarapari–P. do Morro	Miscellaneous Equipment	ICB	2.81																										
Vitoria–B5, Guarapari–C D. Martins & M. Floriano	Miscellaneous Equipment	ICB	1.16																										
Cariacica, Sta. Leopoldina & Sta. Maria de Jetiba	Miscellaneous Equipment	ICB	0.97																										
Vitoria–Centro, Serra V.Velha–Paul	Miscellaneous Equipment	ICB	0.64																										
Vitoria–B4, V.Velha–PdaC Guarapari–P. do Morro	Polyethylene	ICB	1.47																										
Grande Vitoria Other Systems–Interior	PVC Collectors	LCB	0.18																										
Grande Vitoria, Guarapari Other Systems–Interior	PVC Collectors	ICB	0.42																										
Grande Vitoria, Guarapari Other Systems–Interior	PVC Collectors	ICB	0.71																										

BIDPKOSO:12/09/93

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECTS
CONSULTANT SERVICES AND OTHER PROCUREMENT

System	Purpose	Type	Estimated Cost US$ million	Preparation (Bidding) / Execution																									
				1993		1994				1995				1996				1997				1998				1999			
				3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
CESAN	Studies	CC	0.79																										
CESAN	Sanitary Education Program	CC	0.83																										
CESAN	Training	CC	0.65																										
Water Systems	Engineering	CC	3.20																										
Sewerage Systems	Engineering	CC	1.51																										
Water & Sewerage Systems	Project Management & Supervision	CC	5.32																										
CESAN	Operational Development	CC	7.72																										
CESAN	Miscellaneous Equipment	ICB	1.95																										
CESAN	Headquarters	ICB	4.89																										
SEAMA	Studies	CC	1.43																										
SEAMA	Technical Assistance	CC	0.82																										
SEAMA	Training	CC	1.06																										
SEAMA	Other Services	CC	0.65																										
SEAMA	Miscellaneous Equipment	ICB	2.56																										
SEAMA	Headquarters	ICB	2.24																										

BIDPKGEM:12/09/93

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
LOAN DISBURSEMENT SCHEDULE

Bank Fiscal Year and Quarter Ending	Quarterly Disbursements US$ million	Cumulative Disbursements	
		US$ million	% of Total
FY 1994			
March 31, 1994	0.0	0.0	0.0
June 30, 1994	0.0	0.0	0.0
FY 1995			
September 30, 1994	17.8[1/]	17.8	11.6
December 31, 1994	9.8	27.6	17.9
March 31, 1995	6.9	34.5	22.4
June 30, 1995	6.9	41.4	26.9
FY 1996			
September 30, 1995	6.9	48.3	31.4
December 31, 1995	6.9	55.2	35.8
March 31, 1996	8.4	63.6	41.3
June 30, 1996	8.4	72.0	46.8
FY 1997			
September 30, 1996	8.4	80.4	52.2
December 31, 1996	8.4	88.8	57.7
March 31, 1997	7.9	96.7	62.8
June 30, 1997	7.9	104.6	67.9
FY 1998			
September 30, 1997	7.9	112.5	73.1
December 31, 1997	7.9	120.4	78.2
March 31, 1998	7.1	127.5	82.8
June 30, 1998	7.1	134.6	87.4
FY 1999			
September 30, 1998	5.9	140.5	91.2
December 31, 1998	4.7	145.2	94.3
March 31, 1999	2.2	147.4	95.7
June 30, 1999	2.2	149.6	97.1
FY 2000			
September 30, 1999	2.2	151.8	98.6
December 31, 1999	2.2	154.0	100.0

1/ Includes US$8 million deposit into the project's Special Account.

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT
SELECTED DOCUMENTS AVAILABLE IN PROJECT FILE

A. General reports and studies of the water and wastes sector and environment:

A1. CESAN (1992), **Uma Síntese do Perfil Ambiental do Estado e das Estratégias para Recuperação**, Doc.02/92, November.

A2. Commissão Coordenadora do Relatório Estadual sobre Meio Ambiente e Desenvolvimento (1992), **Meio Ambiente e Desenvolvimento no Espírito Santo, Relatório Final**, May.

A3. Moraes Netto, Sergio (1993), **Legislação Ambiental do Estado do Espírito Santo - Proposta de Regulamentação-**. Doc. EA 002/93, July.

A4. Moraes Netto, Sergio (1993), **Anexo I, Legislação Ambiental do Espírito Santo, Programa Despoluição dos Ecossistemas Litorâneos do Estado do Espírito Santo**, July.

B. General reports and studies relating to the project:

B1. AMPLA VISÃO ASSESSORIA E SERVIÇOS (1993), **Quantifição dos Benefícios do Componente de Esgotamento Sanitário - Relatorio Preliminar**, Doc. EF 015/93, July.

B2. Análise, Instituto de Pesquisa (1993), **Projeção de População nas Áreas de Influência do Programa: 1991/2030**, Doc. EE 005/93, June.

B3. CESAN (1993), **Avaliação da Experiencia Operational com Tipo de Rede Projetada, Avaliação de Coliformes, e Avaliação de Algas**, Doc. EE 001/93, April.

B4. CESAN (1993), **Programa de Controle de Águas não Faturadas para Grande Vitória e Guarapari - Perfil do Projeto**, Doc. EE 006A/93, July.

B5. CESAN (1993), **Estudos para Priorização de Implantação dos Empreendimentos**, Doc. EE 007/93, July.

B6. CESAN (1993), **Cronograma Físico-Financeiro Resumido**, Doc. EE-007A/93, July.

B7. CESAN (1993), **Considerações sobre as Projeções dos Demonstrativos Financeiros da CESAN**, Doc. EF 007/93, April.

B8. CESAN (1993), **Termos de Referência para Reavaliação do Ativo Fixo da CESAN**, Doc. EF 008/93, July.

B9. CESAN (1993), **Programação de Investimentos Simulação Econômico-Financeira da Cesan, Fichas Técnicas dos Empreendimentos**. Doc. EF 009/93, July.

B10. CESAN (1993), **Estudo Preliminar de Avaliação do Custo de Fornecimento de Água à CVRD e CST**. Doc. EF 010/93, June.

B11. CESAN (1993), **Estimativa de Custos de Operação e Manutenção - Água e Esgoto**. Doc. EF 011/93, June.

B12. CESAN (1993), **Identificação dos Coeficientes de Sazonalidade por Região.** Doc. EF 012/93, June.

B13. CESAN (1993), **Projeções Demograficas para Cidades e Vilas do E.S. de Populações Residentes e Flutuantes no Horizonte 2005 e Calculo da Taxa de Atendimento da CESAN no Periodo 1990/1993**, Doc. EF 013/93, July.

B14. CESAN (1993), **Anteprojeto de Educação Sanitaria.** Doc. EG 002/93, July.

B15. CESAN (1993), **Estudos Ambientais.** 5 Volumes: Summary, Main Report, plus 3 Annexes, September, 1993.

B16. CESAN and SEAMA (1993), **Estudo do Complexo Paneleiras e Jazida do Vale do Mulemba**, Relatorio Sintesis plus 3 Annexes, Doc EA 012/93, November, 1993.

B17. CESAN (1993), **Proposta do Plano de Licitação.** Doc. EG 003/93, August.

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B21. CESAN (1993), **Cronograma Físico-Financiero - Resumido/Detalhado**, Doc. EE 007B/93, July.

B22. CESAN (1993), **Proposta de Estudo de Reformulação do Projeto do Sistema Integrado de Abastecimiento de Água de Guarapari**, Doc. EE 010/93, December.

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B24. CESAN (1993), **Estudo de Demanda de Agua**, Doc. EF 018/93, October.

B25. CESAN (1993), **Síntese da Situação de Drenagem Pluvial na Grande Vitoria e em Cariacica**, April.

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B34. SEAMA (1993), **Matriz de Fontes de Poluição e Planilhas Eletrônicas**, Doc. EA 011/93, September 1993.

B35. SEAMA (1994), **Termos de Referencia para Inventario Industrial, Sistema de Informações Ambientais, e Viabilidade Residuos Solidos Grande Vitória**, Doc. EA 013/94, January.

B36. SEAMA (1993), **Diagnóstico de Recursos Hídricos**, Doc. EA 008/93, June.

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B39. UFES (1993), **Estudos Complementares, Controle de Algas - Anàlise de Eutrofização, Relatório Final**, Doc. EE 002B/93, July.

B40. UFES, SEAMA (1993), **Estudos Complementares para Remoção de Coliformes**, Doc. EE 003/93, June.

B41. UFES (1993), **Estudos Complementares, Determinação do Tombo da Maré, Relatório Final**, Doc. EE 004A/93, July.

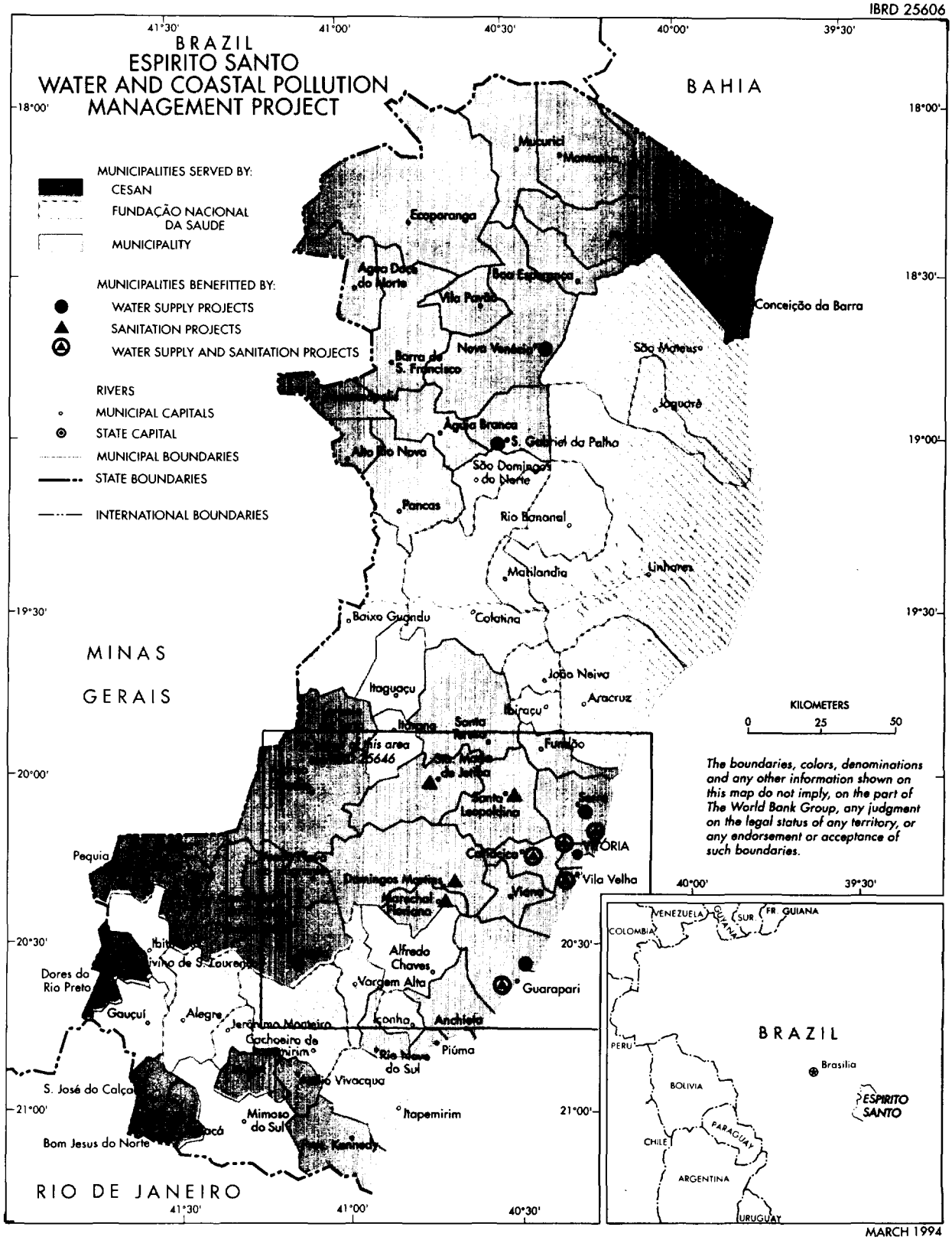
IBRD 25606

BRAZIL
ESPIRITO SANTO
WATER AND COASTAL POLLUTION MANAGEMENT PROJECT

MUNICIPALITIES SERVED BY:
- CESAN
- FUNDAÇÃO NACIONAL DA SAUDE
- MUNICIPALITY

MUNICIPALITIES BENEFITTED BY:
- WATER SUPPLY PROJECTS
- SANITATION PROJECTS
- WATER SUPPLY AND SANITATION PROJECTS

RIVERS
- MUNICIPAL CAPITALS
- STATE CAPITAL
- MUNICIPAL BOUNDARIES
- STATE BOUNDARIES
- INTERNATIONAL BOUNDARIES



MARCH 1994

IBRD 25646

BRAZIL
ESPIRITO SANTO WATER AND COASTAL POLLUTION MANAGEMENT PROJECT

MAIN AREAS TO BENEFIT FROM THE CONSTRUCTION OF NEW INFRASTRUCTURE FACILITIES FOR:

- WATER SUPPLY
- SEWAGE COLLECTION & TREATMENT
- WATER SUPPLY AND SEWAGE COLLECTION & TREATMENT
- SEWERAGE AND WASTEWATER TREATMENT SYSTEMS
- SELECTED RIVERS
- RIVER BASIN BOUNDARIES
- MUNICIPAL CAPITALS
- STATE CAPITAL
- MUNICIPAL BOUNDARIES
- STATE BOUNDARY
- INTERNATIONAL BOUNDARIES

0 5 10 15 20 KILOMETERS

MINAS GERAIS

20°00'

41°00'

40°30'

20°30'

Santa Teresa

Fundão

Afonso Claudio

Santa Maria de Jetibá

STA. MARIA DA VITÓRIA RIVER BASIN

R. Sta. Maria da Vitória

Santa Leopoldina

R. Mangaraí

R. Melgaço

R. Santa Maria

R. Jucu Braço Norte

R. Jucu Braço Norte

R. Galo

R. Vicente

JUCU RIVER BASIN

Domingos Martins

Vendo Nova do Imigrante

Conceição do Castelo

R. Jucu Braço Sul

Marechal Floriano

R. Fundo

Viana

R. Jucu

R. Formate

Vila do Carito

Praia da Costa

Vitória

Atlantic Ocean

R. Jabuti

R. Conceição

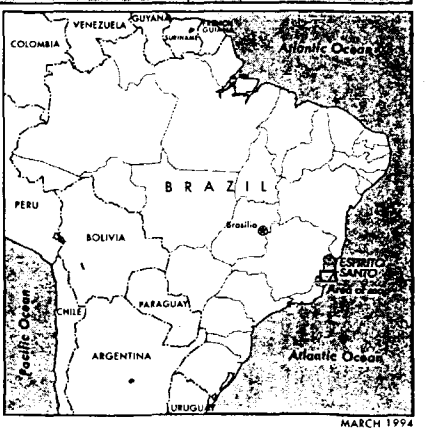
JUCARAPARI DRAINAGE AREA

Alfredo Chaves

Vargem Alta

Iconha

The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.



MARCH 1994