

E917
February 2004

Executive Summary

**Espírito Santo Water And Coastal Management
Project
Águas Limpas Phase**

**Governo do Estado do Espírito Santo
Fevereiro de 2004**

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1 EXECUTIVE SUMMARY

1.1 Introduction

The State of Espírito Santo, a border state between the impoverished northeast region and the richer southeast Brazilian region, exemplifies the constraints affecting Brazil's water and sanitation sector. At the middle of the 90s, Espírito Santo's urban water supply coverage level had reached about 87%. However, the increasing discharge of raw domestic wastes into the rivers has degraded the fluvial water quality, which serves as water supply sources. Also, a widespread coastal pollution has been observed since. The increasing level of water pollution is still a permanent cause of water-borne diseases and infant mortality.

On June 28, 1994, the World Bank approved a US\$154 million loan to the State of Espírito Santo for the *Espírito Santo Water and Coastal Pollution Management Project* (Loan 3767-BR). Loan 3767-BR closed on 30 June, 2003 having disbursed just under US\$112.5 million and only partially achieved the water and sewerage coverage and institutional development targets established at appraisal. Locally, the project changed names under successive State Governments (it was referred to locally as "PRODESPOL" between 1994 and 1999 and "PRODESAN" between 2000 and 2003). The State Government in office since January, 2003 has now requested an additional World Bank loan in the amount of US\$36 million to complement the activities carried out over the past 9 years in order to reach the project's original development objectives. This new phase of the project is referred to locally as the "AGUAS LIMPAS project", though it, like its predecessors (PRODESPOL and PRODESAN) carries out activities identified and appraised under the integrated *Espírito Santo Water and Coastal Pollution Management Project*. Additional financing for this existing project seeks to guarantee that the resources already allocated are optimized and that the expected economic, financial, social and environmental results are consolidated. The remainder of this document uses the local nomenclature (PRODESPOL "project", PRODESAN "project" and Aguas Limpas "project").

This report is structured as follows:

- Section 2 gives an overview of the public administration in Espírito Santo State concerned by the World Bank Contract BR-3767;
- Section 3 describes the sanitation systems implanted by PRODESAN and its impacts in the sanitation system in Greater Vitoria;
- Section 4 gives a description of the proposed *Águas Limpas* Project as a complement to PRODESAN Project;
- Section 5 gives a environmental characterization of the project areas;
- Section 6 makes an environmental evaluation of the PRODESAN and *Águas Limpas* Projects;
- Section 7 gives a description of the institutional strengthening activities proposed to IEMA (Environmental Control Institute) and CESAN (State Water Company);
- Section 8 proposes an Environmental Management Plan as a complement to the activities mentioned above; and finally,
- Section 9 describes the two public consultation recently promoted by the state government to present and discuss the *Águas Limpas* Project.

1.2 Public Administration in Espírito Santo

The principal actors in the political -administrative structure of Espírito Santo, with respect to the World Bank Contract BR-3767 are: i) SEPLOG: the Department of Planning, Budget and Administration; ii) SEAMA: the Department of Environment and Water Resources; iii) CESAN- the Espírito Santo Sanitation Company; and iv) IEMA – the State Environmental Institute.

CESAN was created in 1967 and is a mixed state-private corporation in which the state government has a majority in voting stock options. CESAN operates in 52 of the state's 78 municipalities. Prior to the PRODESAN project, the company provided

treated water to 1,765,653 inhabitants and sewage connections to 378,403 inhabitants.

IEMA, created in 1988, is an autarky with administrative and financial autonomy whose mission is to protect the environment and the management of water resources in the state, from a perspective of sustainable development with social justice.

During 2003, Espírito Santo promoted significant institutional advances on environmental issues, reactivating the State and Regional Environmental Councils (CONSEMA and CONREMA) and the State Water Resources Council (CERHG). The inauguration of the PRODESAN public works in 2003 initiated the environmental recuperation of the Vitoria Bay, of the coastal region of greater Vitoria and of the principal water sources that supply the capital and nearby municipalities (the Santa Maria da Vitoria and Jucu Rivers).

1.3 The Sanitation Systems Implanted by PRODESAN

Public works implanting sanitation systems, inaugurated in the final days of 2003, will result not only in an improvement in the population's quality of life, but also in a substantial reduction in pollution, leading to an indisputable gain for the environment.

Prior to PRODESAN, the PRODESPOL project (1994-2000, financed also by the World Bank) initiated the implantation of sanitation systems in the municipalities of Greater Vitoria. At that time, part of these systems was executed, with emphasis on wastewater collection.

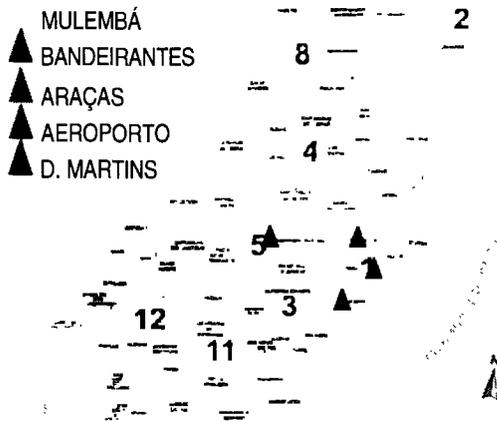
In 2001, PROEDSAN elaborated a single Turn-Key contract to put into operation part of the works that had been implanted by PRODESPOL, and to build four sewage treatment plans in the metropolitan region. The contract's strategy, using the Turn-Key mechanism, was a very successful experience, fully reaching its objectives and correcting the main errors identified during the PRODESPOL project. The system was completely implanted and currently is in operation.

The PRODESAN project also constructed the Domingos Martins Sewage Treatment Plant, using previously existing sewage collection, freeing this mountain municipality from a large level of pollutants that were degrading the region's rivers.

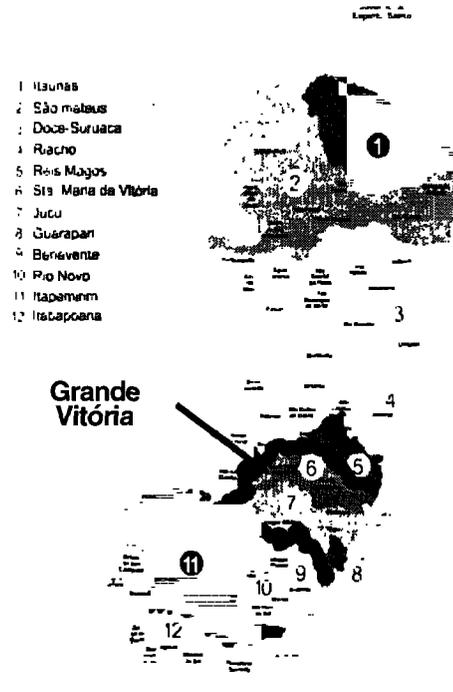
REGION	MUNICIPALITY	SYSTEMS	DESCRIPTION
METROPOLITAN	Vitoria	MULEMBÁ	Includes some of the most populous and wealthy neighborhoods of Vitoria municipality, such as: Praia do Canto, Barro Vermelho, Santa Lúcia, Bento Ferreira e Suá.
	Cariacica	BANDEIRANTES	Includes various populous neighborhoods of the Cariacica municipality, such as: C. Grande, D. Bosco, Vila Capixaba, Cruzeiro Sul, S. Geraldo, Bandeirantes, Vale Esperança, Bela Aurora e Sotelândia.
	Vila Velha	ARAÇÁS	Includes some of the most important neighborhoods of Vila Velha municipality, including almost all of the beach areas: Praia da Costa, Itaparica, Itapuã, Glória, Boa Vista, Cristóvão Colombo entre outros.
	Guarapari	AEROPORTO	Includes the coastal urban area that runs from the extreme northeast of the Morro Beach to the Guarapari Bay
MOUNTAINS	Domingos Martins	DOMINGOS MARTINS	Includes most of the neighborhoods of the tourist city of Domingos Martins, 42 Km from Vitoria.

LEGENDA

1	METROPOLITANA
2	POLO LAGUNAS
3	MET. EXP. REC.
4	CENTRAL BERRAMA
5	SUDOESTE BERRAMA
6	LITORAL NORTE
7	EXTREMO NORTE
8	POLO COLATINA
9	NOROESTE 1
10	NOROESTE 2
11	POLO CACHOEIRO
12	CAPRAO



Localização dos sistemas de esgotamento sanitário



Localização das bacias hidrográficas

The dates for the works horizons, through operational units of the system, are indicated in the below table for the four systems implanted in the metropolitan region of Vitoria.

	GRAVITY SEWERS	TRANSMISSION MAINS	SEWAGE TREATMENT PLANT	OUTFALLS
Mulembá	2023	2023	2009/2023	2023
Bandeirantes	2023	2023	2009/2023	2023
Araçás	2023	2023	2009/2023	2023
Aeroporto	2023	2023	2009/2023	2023

DATES FOR THE WORKS HORIZONS OF GREAT VITORIA SANITATION SYSTEM

Another way of presenting the works horizons dates of the four systems is to subdivide between components and between public works projects and equipment, as in the below table.

SYSTEM UNITS	WORKS HORIZONS		
	MACRO STUDY	CIVIL WORKS	EQUIPMENTS
Gravity sewers, transmission mains and pumping stations	2023	2023	2009
Sewage Treatment plant and outfalls*	2023	2023	2009

* Mulembá, Bandeirantes, Araçás e Aeroporto have outfalls through diffusers until 2009.

DATES FOR THE WORKS HORIZONS OF GREAT VITORIA SANITATION SYSTEM

1.3.1 The influence of PRODESAN in the Sanitation System of CESAN

The below table shows the impacts of the projects implemented through the World Bank Loan (3767-BR) in the sanitation system in the metropolitan region of Vitoria. The number of people benefited with sewage treatment grew from zero to 2,405 in the city of Domingos Martins. In Vitoria, there was an increase of 124% in the number of people benefited with treated sewage. In Cariacaica, Vilha Velha and Guarapari the increase was even greater, 392%, 626% and 333% respectively.

SYSTEMS	PARAMETERS	BEFORE BR -3767	BR -3767	AFTER BR -3767
VITORIA	Sewage networks (m)	102.418	44.657	147.075
	House connections	10.887	2.094	12.981
	Pumping stations	08	07	15
	Sewage treatment plant	03	01	04
	Population served	113.003	27.502	140.505
CARIACICA	Sewage networks (m)	63.674	188.090	251.764
	House connections	7.353	15.226	22.579
	Pumping stations	06	01	07
	Sewage treatment plant	03	01	04
	Population served	26.271	76.739	103.010
VILA VELHA	Sewage networks (m)	22.648	91.338	113.986
	House connections	2.498	7.505	10.003
	Pumping stations	07	09	16
	Sewage treatment plant	03	01	04
	Population served	12.695	66.805	79.500
GUARAPARI	Sewage networks (m)	25.705	56.493	82.198
	House connections	1.709	4.528	6.237
	Pumping stations	06	07	13
	Sewage treatment plant	01	01	02
	Population served	26.319	61.292	87.611
DOMINGOS MARTINS	Sewage networks (m)	9.978	0	9.978
	House connections	633	0	633
	Pumping stations	01	01	02
	Sewage treatment plant	0	01	01
	Population served	0	2.405	2.405

1.3.2 The Sewage Treatment System in 2004

In the four systems implanted (Mulembá, Bandeirantes, Araçás and Aeroporto), there is currently excess treatment capacity that could be utilized to increase the number of the population served by wastewater treatment facilities.

The gravity sewers and transmission mains of the implanted systems are not completely operating. That is, in the urban areas of these systems there are areas:

- with full implantation (operating networks)
- with inoperative networks, requiring complementation
- that are unattended.

The implantation of networks in the entire urban area will increase significantly the sanitation services in these regions, leaving however some treatment plants working over capacity and others with excess capacity.

The program of joining the system finds itself at the beginning of 2004 in development, and must be increased in the immediate future. However, to evaluate the over capacity and idle capacities of the existing treatment plants, we presumed the program to promote increased domestic sewage collection to be concluded.

Sewage Treatment Plants (STP)	Col. 1 SYSTEM CAPACITY	Col. 2 SYSTEMS ALREADY IMPLEMENTED	Col. 3 ÁGUAS LIMPAS PROJECT	Col. 4 COLUMNS 2+3	Col. 5 EXCESS OR OVER CAPACITY	Col. 6 OBSERVATIONS
MULEMBÁ	74.791	29.747	125.985	155.732	- 80.941	STP with over capacity
ARAÇÁS	191.653	59.130	98.987	158.117	+ 33.536	STP with excess capacity
BANDEIRANTES	150.025	85.350	59.232	144.582	+ 5.443	STP with excess capacity
AEROPORTO	90.555	76.334	103.523	179.857	- 89.302	STP with over capacity
TOTAL	507.024	250.561	387.727	638.288		

POPULATION SERVED BY THE SANITATION SYSTEMS (NUMBER OF INHABITANTS)

Mulembá / Vitoria Sewage Treatment Plant

This treatment plant, implemented by PRODESAN, does not have the capacity to attend the existing population in the Jacutuquara basin and vicinity (B5 basin), calling for a study for a specific treatment system that could be obtained with the expansion of the Mulembá plant or with the implantation of another plant in the same locale.

Bandeirantes and Araçás / Cariacica and Vila Velha Treatment Plants

These two plants, built by PRODESAN, have the capacity to fully attend the population foreseen in the *Águas Limpas* Project, without requiring any expansion. The Araçás system will have substantial excess capacity (33,536 inhabitants) while the Bandeirantes system will have a residual capacity of 5,443 inhabitants.

Aeroporto / Guarapari Sewage Treatment Plant

The Aeroporto Treatment Plant, also built by PRODESAN does not have the capacity to attend the population foreseen in the *Águas Limpas* Project. Therefore, a study should be conducted for a specific treatment system, which could be obtained through the expansion of the Aeroporto plant or with the construction of another plant elsewhere.

1.4 Complementary System of PRODESAN: The *Águas Limpas* Project

The *Águas Limpas* Project is not only a proposal to expand sewage collection and treatment services. It also intends to expand state action on environmental and water resources issues more generally, leading to governmental actions of environmental quality recuperation, according to the below table.

Utilization of installed capacity of sewage treatment plants
Since the existing construction and equipments in pumping stations and sewage treatment plants have excess capacity, it is possible to increase the sewage network. In doing so, the existing system will be optimized, improving as well the quality of life of the population and promoting substantial pollution reduction, with important gains for the environment.
Expanding coverage of sewage services
Some regions of Greater Vitória that are not benefiting from the PRODESAN projects would obtain their own sewage treatment installations. This is the case of the following locations: Manguinhos, Nova Almeida, Praia Grande, Guarapari-Centro, Jucutuquara and Viana-Sede.
Improvements in Water Supply Security
The security of the water supply system in Greater Vitória depends on the implantation of reservoirs in the following places: (1) Santa Clara/Vitória; (2) Pedreiras/Vitória; (3) Garoto/Vila Velha; (4) Araçás/Vila Velha; and (5) Morro do Pico/Cariacica/Viana. In addition, some improvements in the potable water production systems are needed in Carapina/Serra, Caçaroca/Vila Velha and Guarapari, as well as the implantation of aqueducts in the Iges-Boa Vista/Vila Velha section and the Planalto-Civit-Serra/Serra sections.
Institutional Strengthening of CESAN and IEMA
The operational and financial strengthening of CESAN will promote the reestablishment of its self financing capacity, expanding investments, with a multiplier effect on employment and income generation in the state economy. The strengthening of IEMA will provide this management agency with more appropriate conditions for exercising its functions, to promote sustainable development.
Implantation of the Environmental Management System
Accompanying the above mentioned institutional strengthening, the implantation of an environmental management system is planned, allowing for the preservation and recuperation of river and sea water quality.

These actions in the Greater Vitória water and sewer systems will lead to important improvements in the quality of life of the population and a substantial reduction of

pollution in water bodies. The population that will be benefited with the improvement efforts in water supply is expected to be about 1,330,000, while the population attended by sewage treatment will grow by more than 350,000.

In addition to the PRODESAN sanitation works utilizing installed capacity, there are some works to expand coverage. In this category, there are four interventions that are already being discussed with environmental agencies, which will bring notable improvements in the water quality of local beaches.

The Manguinhos and Nova Almeida systems were well defined in the Master Plan for Sanitation for the municipality of Serra. The location of the sanitation plant is close to the urban area, in a pasture area without human occupation or apparent environmental restrictions with respect to public works.

The Viana and Guarapari Systems resulted from preliminary studies and should require additional efforts.

The Jucutuquara system is a result of a study during the PRODESPOL period. It includes coverage expansion works for Vitória, with the implantation of a collection networks and pumping stations, taking sewage to the Mulembá treatment plant.

PHYSICAL-FINANCIAL ANNUAL CRONOGRAM (values in US\$)

COMPONENTS OF THE PROJECT	2004		2005			2006			2007			2008			Total		
	INT	TOTAL	EXT	INT	TOTAL	EXT	INT	TOTAL	EXT	INT	TOTAL	EXT	INT	TOTAL	EXT	INT	TOTAL
	COUNT PART		BIRD	COUNT PART		BIRD	COUNT PART		BIRD	COUNT PART		BIRD	COUNT PART		BIRD	COUNT PART	
a) Water supply:	916	916	1.248	250	1.498	2.437	812	3.249	2.108	703	2.810	0.931	0.310	1.241	6.723	2.991	9.714
Water production system																	
Greater Vitoria																	
Sta. Maria Syst. - Carapina STP*			450	150	600	300	100	400							750	250	1.000
Carapina/Sede Serra's pipeline and WTP**	750	750													0	750	750
Caçaroça/B. Jucu's WTP** rehabilitation			300	100	400	300	100	400							600	200	800
Ibes-Boa Vista pipeline						206	69	275	206	69	275				413	138	550
Guarapari																	
Water supply system (WTP** and pumping st)	166	166	498		498										498	166	664
Water storage infrastructure																	
Greater Vitoria																	
Santa Clara Reservoir - 1.390m³									105	35	140	158	53	210	263	88	350
Pedreras/Sto Antônio Reservoir - 5.000m³									431	144	574	320	107	426	750	250	1.000
Garoto Reservoir - 5.000m³						506	169	674	316	105	421	304	101	405	1.125	375	1.500
Araçás Reservoir - 6.500m³						525	175	700	525	175	700				1.050	350	1.400
Morro do Pico Reservoir - 10.000m³						600	200	800	525	175	700	150	50	200	1.275	425	1.700
b) Sanitation			5.205	2.535	7.740	8.723	8.623	17.345	6.608	5.658	12.265	0	2.035	2.035	20.535	18.850	39.385
Greater Vitoria																	
Sewers network's optimization																	
Praia do Canto and vicinities - B4			236	79	315										236	79	315
Praia da Costa and vicinities - B13			369	123	492										369	123	492
Cariacica - Bandeirantes			101	34	134										101	34	134
Guarapari																	
Praia do Morro			67	22	89										67	22	89
Systems' complementation																	
Greater Vitoria																	
Praia do Canto and vicinities - B4			300	100	400	1.275	425	1.700							1.575	525	2.100
Praia da Costa and vicinities - B13			975	325	1.300	2.100	700	2.800	1.399	466	1.865				4.474	1.491	5.965
Cariacica - Baixo Marinho -Bandeirantes			600	200	800	1.500	500	2.000	1.076	359	1.435				3.176	1.059	4.235
Guarapari																	
Praia do Morro			938	313	1.250	750	250	1.000							1.688	563	2.250
New Systems																	
Greater Vitoria																	
Implem. of Syst. Jucutuquara and vicinities - B5			1.170	390	1.560	2.798	933	3.730	4.133	1.378	5.510				8.100	2.700	10.800
Implem. of Syst. Nova Almeida/Praia Grande												1.295	1.295			4.100	4.100
Implem. of System Manguinhos				800	800											2.105	2.105
Viana - Sede										400	400		200	200		600	600
Guarapari																	
Centro						2.905	2.905			1.755	1.755		540	540		5.200	5.200
c) Inst Strengthening & Env Management Plan	786	786	2.048	1.031	3.078	3.347	1.357	4.704	2.652	1.045	3.697	696	256	952	8.742	4.475	13.217
TOTAL	1.002	1.702	8.501	3.816	12.316	14.507	10.791	25.298	11.367	7.405	18.772	1.626	2.602	4.228	36.000	26.316	62.316

* STP = Sewage Treatment Plant ** WTP = Water Treatment Plant

1.5 Environmental characterization of the Project Areas

The three principal river basins that will be recuperated in the metropolitan area of Vitória are those of the Jucu, Santa Maria da Vitória and Guarapari rivers.

Despite high levels of urban occupation, these basins still have 10% of their areas covered by natural forest reserves and approximately 15% of their areas used by agriculture. The environmental system includes 25 Protection Areas in these basins.

The Jucu and Santa Maria da Vitoria rivers provide the entirety of water supply for Greater Vitoria, a region that includes about 50% of the state population, as well as the most important industrial and commercial complex.

1.5.1 Attending Environmental Policies

With respect to environmental policies, the new projects and the improvement of existing projects can be thus characterized:

1.5.1.1. Environmental Assessment (OP 4.01)

The new sanitation and water supply systems will follow the same procedures adopted by other undertakings financed by the World Bank already in operation. For this end, the projects are concerned with fostering the involvement through prior consultations of the environmental management agency (SEAMA/IEMA), starting with the design phase and selection of location alternatives and continuing through installation and operation phases.

1.5.1.2 Natural Habitats (OP 4.04)

The *Águas Limpas* Program is located in the Vitória Metropolitan Region. There are no habitations in the new sanitation systems areas, normally pasture areas. Improvements in sewer systems (network expansion) will involve public works in the urban area.

Similarly, the new water supply projects are located in the basins where already implanted projected operate, in non occupied areas, with no social or environmental impacts detected.

1.5.1.3 Resettlement (OP 4.12)

For all sewage projects, the following considerations apply:

i) Sewage networks/outfalls/transmission mains

The entire sewer networks will be located on public lands, with no interferences in private properties, eliminating concerns about dislocation or resettlement of residents or of removal of land improvements.

ii). Pumping Stations

The selected areas for locating the pumping stations are situated on public lands (parks, public gardens, municipal lands) or private lands that are currently unoccupied and uninhabited.

iii) Sewage Treatment Systems

All the location alternatives considered for treatment units are in non occupied areas so that there will be no need to resettle residents or remove land improvements.

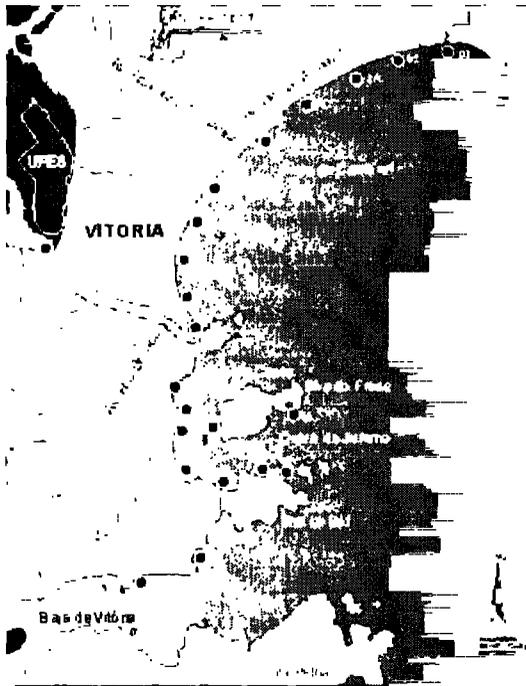
The water supply projects include expected improvements plants that have existed for more than 20 years, in areas owned by CESAN, so that there will be no need to resettle residents or remove land benefits. With respect to pipelines and reservoirs placed in public areas, these will also involve no interferences in private properties, eliminating concerns about dislocation or resettlement of residents or removing land improvements.

1.5.1.4 Cultural Property (OPN 11.03)

With respect to the existing sewer and water systems that will be improved, these were subjected to environmental studies, are licensed and in operation. With respect to the areas where new sewer and water supply systems will be implanted, there is no indication that these are located on archeological sites or areas of cultural or historical importance.

1.6 Environmental Evaluation of the PRODESAN and *Águas Limpas* Project

Water quality monitoring on Vitória's beaches has been conducted at 23 places since 1986, without interruption. In the other Greater Vitória regions, monitoring was initiated in 2002.



Localização dos pontos de monitoramento

The recent initiation of operation of four sewage treatment plants in Greater Vitória and another in Domingos Martins has not yet had measurable impacts. The short time that these plants have been operating does not allow for temporal correlations of the water quality of receiving bodies of water. However, it is possible to affirm that the receiving bodies receive today a smaller pollution load, thus initiating a cycle of de-pollution of the region's river waters, of the Vitória bays and adjacent coastline. In a few months, it will be possible to measure the impacts of the PRODESAN projects in

the levels of bathing water quality standards (*balneabilidade*) of the region.

For a more detailed analysis of water quality for the Jucu and Santa Maria rivers, Vitória bay and the coastal region, a hydrodynamic model will be implanted, permitting simulation of contaminant transportation in Greater Vitória's water bodies, including in the municipalities of Baía de Vitória, Gurarapari, Manguinhos and Nova Almeida. The model will simulate in an integrated fashion the river, estuary and coastal areas of the regions of interest.

With this, it will be possible to characterize through simulations, the environmental situation before and after PRODESAN and the *Águas Limpas* Project. It will also be

possible to simulate the analysis of alternatives for the release of treated sewage for new sewage plants in the greater Vitória region.

The *Águas Limpas* Project intends to contribute to IEMA's and CESAN's management and technical capacity, principally with respect to water resources and environmental management. To do so, an institutional strengthening program was designed (Item 1.7), as well as an environmental management plan (1.8), which was later perfected in meetings with World Bank consultants.

The environmental evaluation of each new project will have an environmental monitoring (specific subproject), as detailed in section 8 (§ 8.2). All the works need a detailed environmental evaluation before their implementation. These environmental evaluations have to be previously approved by the World Bank.

Thus, the following two sections (1.7 and 1.8) are interrelated, seeking to expand state actions in the environmental and water resources arenas, as a continuation of government efforts to recuperate the environmental quality of the state.

1.7 Institutional Strengthening of IEMA and CESAN

The Institutional Strengthening Program is about the development of structural subprojects that are internal to each of the two agencies and involves the following Subprojects.

PROPOSED PROGRAMS	COSTS US\$ 1000
Institutional Planning and Strategy of the SEAMA/IEMA System	170
Integrated System of Environmental Information	700
Environmental and Water Resources Monitoring Network	475
Improvements in Environmental Licensing	272
State Water Resources Management System	313
Capacitation Actions for Environmental and Water Resources Management	70
Strengthening Environmental Management in CESAN	150
Total	2,150

The functions and activities of the SEAMA-IEMA System depend on the existence of credible information and a data base both on sources of pollution and about the availability and characteristics of the state's natural resources. The Integrated System of Environmental Information sub-project has this end.

In the collection of environmental and water resources data, it will be necessary to redimension and complement the existing qualitative and quantitative monitoring network in the Espirito Santo river basins. This issue is addressed in the Environmental and Water Resources Monitoring Network sub-project.

The improvements in Environmental Licensing sub-project will incorporate one of the most important command and control instruments of the environmental system, improving registers of potentially polluting activities, establishing criteria to expand municipal environmental licensing and other measures that will allow for the modernization of the sector.

With respect to water resources management, there will be a specific sub-project that will help the state in, among other activities: the consolidation of a registry of water users based on secondary information, the implementation of a system of concession of water use rights, the implementation of criteria for charging for bulk water use rights, and in the development of criteria for the adaptation of environmental classifications to water rights criteria. There will also be efforts to build environmental and water resources capacity.

The sub-project dedicated to strengthening the environmental capacity of CESAN includes specifically the tasks of (i) water source management in the metropolitan region; (ii) sewage treatment plant residue management; and (iii) the implantation of ISO-14000 in two sewage treatment plants.

In this sense, CESAN has taken on two commitments with the World Bank:

- i) Commitment with respect to sewage treatment plant residues: CESAN, as part of the conditioning factors for environmental permits for the operation of sewage treatment plants (Mulembá, Bandeirantes, Araçãs and Praia do Morro) will, before initiating the physical interventions of the *Águas Limpas* Project, approve together with IEMA the treatment and final destination of the sludge produced by the respective plants.
- ii) Commitment with respect to SGA-ISO-14000: CESAN is committed to concluding the implementation of the SGA in the two pilot units (Carapina water treatment plant and Bandeirantes sewage treatment plant) with ISO certification within two years after beginning the contract activities.

1.8 Environmental Management Plan

The second section, "Environmental Management Plan" deals with sub-projects where both of the agencies (together with the UGP and other agencies) work in an integrated and cooperative fashion.

The Environmental Management Plan was conceived as a complement to the activities mentioned in the last section. It deals with sub-projects where both CESAN and IEMA, together with the UGP and other agencies, work in an integrated and cooperative fashion. The intention is to create an Environmental Management System that will work through various agencies, CESAN and IEMA among them, performing a central role. This system has nine sub-projects, as the illustrative chart below shows.

Environmental Management System-	Environmental Supervision of Works and Projects - UGP
	Social Communication Program
	Sanitary and Environmental Education Program
	Program to Promote Joining the Sewer System
	Program to Eliminate Crossed Connections
	Sewage Master Plan for the Vitória Metropolitan Region
	Hidrodynamic Modelling Program
	Plan for Alternatives for Treatment and Final Disposal of Sewage Treatment Sludge
	Environmental Construction Manual

1.8.1 The “Environmental Supervision of Works and Projects” sub-project intends to consolidate the institutional arrangement proposed for the administration and execution of the Program. An engineering consulting firm will be hired by the UGP to finalize designs for works, produce bidding documents and supervise construction from a technical and environmental standpoint.

1.8.2 Social Communication Program

The Social Communication Program will involve principally actions related to the coexistence of the population with the works to be carried out. The objective is to inform the target community about each stage of construction so as to minimize the disruptions caused by the physical interventions of the Program. We hope that the target community will give greater support to the construction process in the locale and to the conservation of the basic sanitation systems implanted. This is related to section 1.8.9 on the Environmental Construction Manual.

1.8.3 Sanitary and Environmental Education Program

The program intends to carry out educational activities on sanitation and environment with organized civil society, NGOs and students in the area affected by the *Águas*

Limpas Project. It intends to increase consciousness with respect to the importance of environmental sanitation and rational water use for improving quality of life.

1.8.4. Program to Promote Connecting to the Sewer System

The Program to Promote Connecting to the Sewer System intends to develop informative and educational activities, to promote perceptions of the importance of treated water and the adequate disposal of domestic sewage. These actions will also demonstrate the importance of connecting to the system, providing guidance on the correct way and deadlines for doing so. On this occasion, clients will receive communication on the financial costs of maintain the services that will be provided.

1.8.5 Program to Eliminate Crossed Connections

This sub-project has the following two objectives: (i) the identification, registration and transference to the sewage networks of lines connected to the storm drainage system; and (ii) the identification, registration and elimination of rain water running into the sewage collection network.

1.8.6 Sewage Master Plan for the Vitória Metropolitan Region

The last Sewage Master Plan for the Vitória Metropolitan Region (1978) is now out of date, obliging CESAN and IEMA to confront demand increases without adequate planning. Thus, in the same manner that the Bank promoted the updating of the Sewage Master Plan for the Serra Region, in 1998, a sub-project will update the plan for Greater Vitoria.

1.8.7 Hydrodynamic Modeling Program

This section presents a summary of the minimum requirements for a computational modeling system to be used in the context of *Águas Limpas* Project. The system is intended for environmental simulations of hydrodynamic circulation, water quality, and transport of contaminants in water bodies. The following minimum requirements must be present in the modeling system:

Integrated simulation of rivers, estuaries and coastal waters:

The modeling system must be capable of simulate rivers, estuaries, bays and coastal waters within the same modeling domain. Sub-models transferring data one to the other are not acceptable.

Dealing with regions with complex geometries:

Due to the previous requirement, it is desirable that the modeling strategy be based on discretizing techniques capable of mapping domains with complex geometries. For that, it is recommended that the models use finite elements, or curvilinear grids for horizontal discretization, and σ coordinates for the vertical direction. Similar techniques may be accepted. "Finite Differences" models, with rectangular grids will only be accepted if they facilitate automatic alignment and are capable of fulfilling item 1 above.

Minimum set of models in the system

The system must contain at least the following models:

Hydrodynamic Model: it can be a constant density 3D/2DH hydrodynamic circulation model. The model must accept inputs of variable discharges in points, cross section of rivers or distributed along shorelines. Must also comply with variable wind fields in time and space, variable tidal conditions along open boundaries, prescription of coastal currents, and consider the possibility of variable bottom stress in time and space.

The Water Quality Models: a set of dedicated Eulerian transport models for the coupled simulation of water quality parameters like generic contaminants, salt, temperature, DO-BOD, nitrogen compounds, and biomass. Simulations can be applied for 2DH flows or for selected layers of 3D flows with a given thickness.

Lagrangian Transport Model, deterministic mode: a general purpose advective diffusive transport model with kinetic reactions for selected layers of 3D and for 2DH flows. This model is especially suitable for simulation of plumes of ocean outfalls or clouds that are initially small to be well resolved by the discretizing mesh of the associated hydrodynamic model. These are usual situations in modeling plumes of outfalls and oil spills.

The Lagrangian Transport Model, probabilistic mode: the user can produce maps of isolines of probabilities base on N events or for a period of time T . Examples of required results are isolines of probability of visitation of a plume/cloud with concentrations above a given limit; ditto with lifetime below a given value; determination of critical events, e.g., the first event or first time in which a plume or cloud touches the coastline, etc.

The interfaces should be user friendly in a Windows XP environment, permitting the flow of data among system parts and generating tables with reports, maps and graphics.

1.8.8. Plan for Alternatives for Treatment and Final Disposal of Sewage Treatment Sludge
CESAN shall elaborate a plan for Sewage Treatment Sludge and submit it to IEMA before implementation, in order to satisfy the environmental conditions included in the recently installed Operation Permits of Sewage Treatment Plants.

In the context of the *Águas Limpas* Project, CESAN has made a commitment to the World Bank to finalize the Plan for Alternatives for Treatment and Final Disposal of Sewage Treatment Sludge with its own funds. The agreement is that the beginning of the physical interventions of the *Águas Limpas* Project depends on CESAN fulfilling this commitment, described in section 7.8.1 of chapter 7 of the main report.

1.8.9. Environmental Construction Manual

Many of the impacts promoted by the infrastructure is inherent to the construction phase. Among other impacts, it is worth citing: (i) increase in noise and dust levels and motor gas emissions; (ii) temporary closure of roads, sidewalks and building access; (iii) traffic detours; (iv) the circulation of strangers in neighborhoods; (v) heavy vehicle traffic; (vi) harm to public equipment; (vii) treatment and final disposal of solid and liquid residues, etc.

These impacts can be minimized through adequate construction criteria and methods, which the state government will include in the construction bidding regulations as requirements for the execution of contracted services.

1.9 Public Consultation.

The state government promoted two events to present and discuss the *Águas Limpas* Project, with widespread dissemination in the local media (radios, newspapers and television).

The most discussed and prioritized themes were:

(i) Treatment and final disposal of the sludge produced in the Sewage Treatment Plants; (ii) Population support for the sewer system; and (iii) Elimination of crossed connections. All these issues are discussed in Chapters 7 and 8 of the main report.

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