Chapter 2

WATER RESOURCE AND ENVIRONMENTAL POLICY AND LAW

2. WATER RESOURCE AND ENVIRONMENTAL POLICY AND LAW

In Brazil, water resource and environmental policy is carried out by a number of interrelated agencies, and are likewise governed by many laws that interlace very complexly with one another. This chapter provides a summary of the policy and relevant federal, state, and municipal laws.

In the 1980s, the development boom occurred at national level in water resource exploration sector led to the pressing need of controlling the multiple water resource use. In 1988, the new Brazilian Constitution was enacted, which includes a clear reference to the Federal Government's competence to *"create the national water resource management system and define water use right award criteria*". Putting this water resource management philosophy into practice underwent a long legislative process until the Water Resource Law (Law 9433/97) was enacted in 1997. This law established the organizational framework to manage the water resource per hydrographic basin unit.

The National Water Resource Counsel - CNRH is the main water resource management entity at national level, and established the water resource management guidelines. CNRH was created in 1988 as an agency reporting directly to the Ministry of the Environment.

In addition, the Brazilian Constitution established that water use right should be awarded by the federal government through the Water National Agency - ANA. ANA is the agency in charge of water resource management, which is assigned the following powers:

- Award of water resource use rights.
- Supervision and control of actions and activities related to compliance with the federal law applicable to water resource use rights.
- Charge of tariffs on water resource use.
- Supervision and regulation of water resource pollution.

ANA has been promoting the decentralization of competencies and powers within a same State, by assigning some competencies to state and local water resource control and supervision agencies. This way, each Brazilian State has now it own water resource control system similar to the national water resource control and supervision system.

On the other hand, the State of São Paulo, even before the promulgation of the Water Resource Law (Law 9433/97), had already created the State Water Resource Council focused on water resource management at state level. In 1991, the Federal Government acknowledged that the state government had competence to regulate the water resource management and supervision. In that same year, the State of São Paulo first implemented the State Water Resource Law statewide. This law provides for the creation of a water resource management system at hydrographic basin level,

hydrographic basin committees, and a fund to raise funds for relevant actions （State Water Resource Fund -FEHIDRO. In this sense, the State of São Paulo took its own initiative to enact a water resource law before the Federal Government and other Brazilian States.

2.1 Water Resource Policy in the State of São Paulo

(1) State Water Resource Council –CRH

This Council is composed of the following members:

- State water-related agencies (Secretariat of Water Resources, Secretariat for the Environment, etc.);
- Representatives of local governments;
- Representative of the local society.

CRH plays the same role assigned to CNRH, but at state level, as seen below:

- Approval of water resource development plans.
- Classification of hydrographic basins and definition of their category.
- Definition of water use right award criteria.
- Design of the water resource use tariff system.
- Definition of guidelines for incentives granted to the municipalities.
- Implementation of a water resource management information system.

(2) Hydrographic Basin Committee

The Water Resource Law 1997 clearly provides that water resources should be controlled at the level of territorial hydrographic basin units. According to that law, hydrographic basins all over the country have been classified as federal hydrographic basins and state hydrographic basins. At the same time, the law establishes that water resource management should be decentralized with the involvement of the public sector, users, and communities. ANA has promoted the organization of "Hydrographic Basin Committees" where the sector-related agencies, local users and communities will have an active participation in the discussion and deliberation of all matters associated with water resources. It also established that basin committees shall be assigned the duty of participating in all matters related to water resources in the respective hydrographic basin. In other words, it is incumbent to the basin committees to discuss and evaluate all matters related to water resource use, preservation, and recovery, in addition to deliberate on projects designed by public agencies entitled to deal with water resource issues, their regulation, water use right award, water use tariff system, and review the criteria for multiple water resource uses. Especially, Basin Committees' priority actions include deliberating on and evaluating the water resource development plans formulated by both the National Water Resource Council and the State Water Resource Council.

The difference between a basin committee and a CRH lies on the fact the latter is a governmental

agency, and the former operates for public purposes without any legal status or decision power. In the State of São Paulo, the state law provided that the approval of all new water resource-related works is subject to the Hydrographic Basin Committee's prior review and evaluation, however this does not constitute any type of power on legal grounds. Rather, this procedure implies that new projects should be thoroughly reviewed.

In Greater São Paulo, Alto Tietê River Hydrographic Basin was installed in 1991, which is in turn subdivided into five (5) subcommittees. One of them is Alto Tamanduateí-Billings Hydrographic Subcommittee that includes Billing Hydrographic Basin. Hydrographic Basin Committee in the State of São Paulo is constituted of state agencies (Secretariat of Water Resources and Secretariat for the Environment), representative of local government, representative of local residents (NGOs and representative of local communicates, etc.). Currently, Tamanduateí-Billings hydrographic basin committee is composed of 24 members, one third of which represents the state, the municipality and local residents, respectively.

(3) Basin Agency

The Water Resource Law provides that the Basin Agency will be organized within the Hydrographic Basin Committee to play the role of water recourse management executing agency. In practice, however, this role is actually played by federal or state agencies; as such, there is currently no evidence that a Basin Agency shall have been created within any Hydrographic Basin Committee.

EMDP is prepared by a working group created by Alto Tietê - Billing/Tamanduateí Hydrographic Basin Subcommittee, which is composed of the municipal governments of Santo André, São Bernardo do Campo, São Caetano do Sul, Diadema, Mauá, Rio Grande da Serra, Ribeirão Pires, and part of São Paulo.

This Working Group for the Environmental Protection Development Plan and Specific Technical Subcommittee Planning and Management Chamber Law is responsible for the submission of the draft Specific Law.

(4) Representative Local Community Agencies

All over the area covered by Alto Tamanduateí-Billings Basin, most known representative agencies are ABC Regional Chamber and the Intermunicipal Consortium. The latter is composed of 7 municipalities and dates back to 1990, when such 7 municipalities joined together to solve problems related to waste treatment and disposal in each of those municipalities. The consortium has continued to date and still keeps the structure to discuss and address any kind of matters that could contribute for the development of the region. Such initiatives have developed into ABC Economic Development Agency and Greater ABC Citizenship Forum or Special Billings Basin Water Source Protection Committee. Such entities actually constitute advisory agencies with no decision power,

which operate as civil entities that widely reflect the local inhabitants' voice.

2.2 State Water Resource Policy

The water resource policy executing agency is the Secretariat of Energy, Water Resources and Sanitation (Note: in 2002, SRHSO merged with the Secretariat of Energy), whose duties are assigned by ANA.

The State Water Resource Policy is set by Law No. 7,663 of 12/30/1991, which establishes its regulations and guidelines, as well as those of the Integrated Water Resource Management System.

Article 3 of that Law provides that the State Water Resource Policy should comply with the following principles:

- Decentralized, participative and integrated management, without disassociation of quantitative and qualitative aspects and meteoric, surface and underground phases of hydrological phases;
- Adoption of the hydrographic basin as a physical-territorial planning and management unit;
- Recognition of water resources as a public good of economic value, the use of which should be charged, taking into account its quantity and quality aspects, and the hydrographic basin peculiarities;
- Apportionment of costs of multi-exploration works of common or collective interest among the stakeholders;
- Precaution and prevention of causes and adverse effects from pollution, floods, droughts, soil erosion, and silt deposit;
- Compensation of municipalities affected by floods resulting from the construction of reservoirs and restrictions imposed by water resource protection laws;
- Compatibility of water resource management with regional development and environmental protection.

Based on such principles, the Law establishes:

- The State Water Resource Policy Guidelines;
- The State Water Resource Policy Instruments provide for *Water Use Right Award* (establishing that the use of water resources - either collection of effluent discharge - will depend on the prior approval, authorization of license by the appropriate agencies and entities), *Sanctions for Non-Compliance*, *Water Resource Use Charge*, and *Sharing of Costs of Multiuse Works or Common or Collective Interest Works*;
- The State Water Resource Plan – PERH as the water resource planning and management instrument. This Plan should be updated on a periodical basis, and is based on Hydrographic Basin Plans, environmental protection laws, and environmental planning and management guidelines;

- The Integrated Water Resource Management System – SIGRH focused on the execution of the State Water Resource Policy, and formulation, update, and application of the State Water Resource Plan, comprises state and local agencies and the civil society. SIGRH is composed of the State Water Resource Council – CRH (at central level) and Hydrographic Basin Committees (with decentralized operation at each hydrographic unit established by PERH).

The State Law provides that the water resource management in hydrographic basin should be entrusted to the respective committee of each hydrographic basin; however both committees and subcommittees still remain collegiate entities and therefore cannot operate as implementation agencies. As such, the State Secretariat of Water Resources is actually the main water resource policy executing entity.

(1) Water and Electric Power Department -DAEE

ANA assigned the Water and Electric Power Department – DAEE of the Secretariat of Water Resources of the State of São Paulo – SERHS powers to award water use rights. Water resource use will follow the guidelines set out by the Water Resource Law No. 9433 of 01.08. 1997. This law institutes and awards the water use right for all water-dependent economic activities, such as agricultural, industrial, fishing, power generation activities, and also includes sanitation, as both water supply and discharge of sanitary effluents are subject to award process as economic activities. DAEE, in its capacity of implementation agency for water resource development and maintenance plans, is empowered to award water use rights in the State of São Paulo.

The Water Resource Law provides for water use tariffs. Practically in most cases there are no tariffs other than those charged by the Electric Power Utility. Both ANA and the Secretariat of Water Resources are required to inspect and supervise the concessionaries of economic activities even after the water use rights have been awarded, with the purpose of checking the strict compliance with the provisions of the water use award.

When a license application is filed, the relevant agencies forward the request to the Hydrographic Basin Committee, which will review the project from validity and convenience view. One of the items considered if the legitimacy of the water collection volume. In specifically, for water use right award in basins with strong water demands, experts may be requires do evaluate the case. Results of the committee's evaluation will be reported to the licensing agency

(2) EMAE（Empresa Metropolitana de Água e Energia S.A.）

EMAE is the owner of the Billings Lake, which was inherited from the former Eletropaulo. Currently, EMAE is an administrator of assets, but is also involved in the control of Tietê and

Pinheiros river water discharges, operations of Billing and Canal de Pinheiros dams, and the operation of Henry Borden hydroelectric plant in the Billings Lake.

(3) SABESP (Basic Sanitation Company of the State of São Paulo)

SABESP is the major sanitation company in South America serving over 22 million inhabitants. In the area covered by the Billings Lake, SABESP serves the municipalities of São Paulo, São Bernardo do Campo (since January 2004), Ribeirão Pires, and Rio Grande da Serra. The municipalities of Santo André, Diadema, São Caetano do Sul and Mauá purchase treated water for their piped water system, but both distribution and services are provided by the municipalities. SABESP collects water from the Billings Lake to supply the whole area. To discharge sanitary effluents out of the basin, SABESP has made a great contribution using buried trunk sewers and ABC sewage treatment plants. SABESP participation in water resource management implantation is deemed indispensable.

2.3 Environmental Policy in the State of São Paulo

2.3.1 Organization Chart of the Secretariat for the Environment (SMA) cabinet

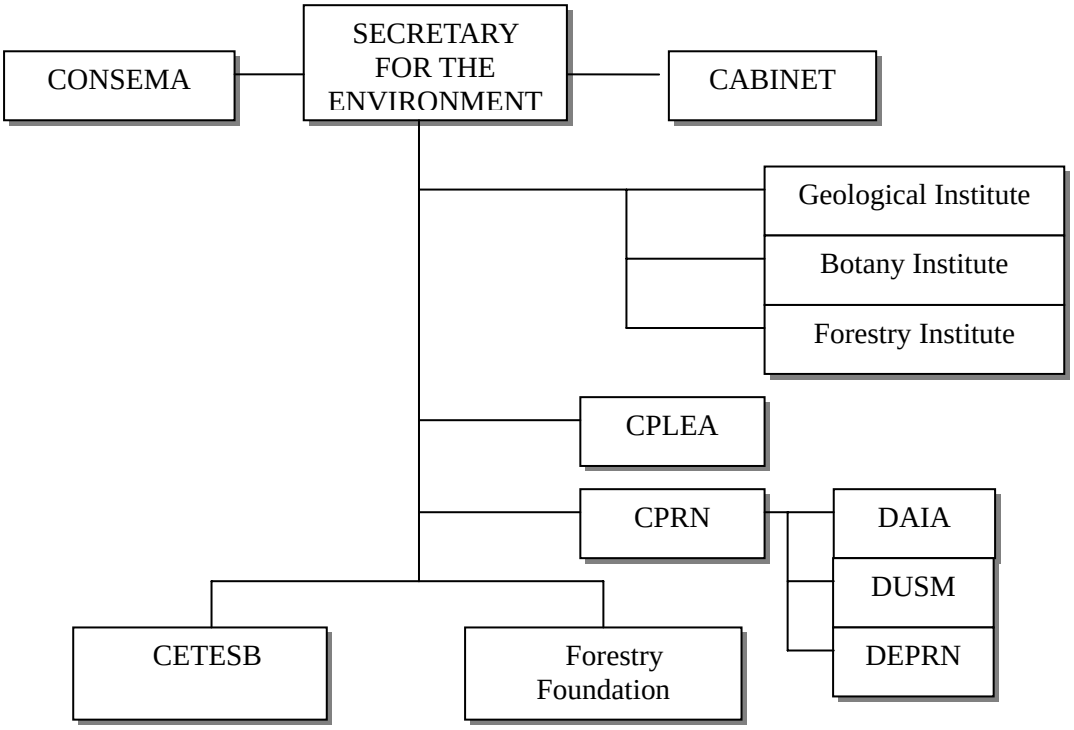

Figure 2.3.1 Organization Chart of the Secretariat for the Environment

Agency and their respective duties include:

(1) CONSEMA – State Environmental Council

This is the democratic forum for discussion of environmental problems, and the body that catalyzes demands and proposed actions to improvement the State's environmental management. It is the utmost level where licenses for large and/or complex projects are discussed, approved or rejected. CONSEMA is composed of 36 members, half of them from State agencies and the other half from the civil society. It is always chaired by the Secretary for the Environment.

(2) Geological Institute

This is a research institution engaged in the development of geosciences and environment skills. It develops institutional programs related to geotechnique, geology, paleontology, groundwater resources, mineral resources, climatology, geomorphology, and the environment.

(3) Botany Institute

This is a research institution engaged in the development of botany skills to support the environmental policy of the State of São Paulo.

(4) Forestry Institute

The Forestry Institute is responsible for the management of a number of preservation units in the State of São Paulo. It develops researches focused on forest preservation, management, production, and recovery.

(5) CPLEA – Strategic Environmental Planning and Environmental Education Coordination Unit

This coordination unit makes the environmental planning, develops coastal and inland macrozoning works to harmonize regional development and natural resource protection. It is responsible for the implantation and regulation of APAs – Environmental Protection Areas.

It also promotes actions for protection and recovery of hydrographic basins by participating actively of the formulation of the State Water Resource Plan and Basin Plans, in addition to providing technical, administrative and legal support to Basin Committee operations. It participated in the implementation of the Water Source Protection Law and Guarapiranga Basin Recovery Program. Currently, it is involved in the development of PDPAs and Specific Laws for the Billings Lake Hydrographic Basin.

(6) CPRN – Natural Resource Protection Coordination Unit

This coordination unit comprises three departments that are responsible for project licensing and environmental supervision. These are:

(7) DAIA – Environmental Assessment Department

This is the department that analyzes environmental studies and issues technical opinions to support the licensing project for potentially impacting projects.

(8) DUSM – Metropolitan Soil Use Department

This department is responsible for soil use and occupation control, and license of projects located in Water Resource Protection Areas in São Paulo Metropolitan Region.

(9) DEPRN – State Natural Resource Protection Department

This department is responsible for the license of activities and works that cause the suppression of

native vegetation, felling of native trees, intervention in permanent preservation areas, and wildlife management.

(10) CETESB – Environmental Sanitation Technology Company

This company is responsible for the process of license and control of pollution sources, and air, surface water, groundwater, and beach water quality monitoring. To perform its institutional duties, CETESB has 34 Environmental Agencies grouped into 11 regional offices distributed all over the State.

(11) Forestry Foundation

The objective of Forestry Foundation is contributing for conservation, management, and expansion of the State's protective and productive forests. With this purpose, it supports, promotes and implements integrated actions focused on the environmental protection, biodiversity protection, sustainable development, reclamation of degraded areas, and reforestation of environmentally vulnerable areas through partnerships with governmental agencies and civil society institutions. It is also responsible for commercialization of products extracted from forests managed by the Forestry Institute - timber, resin, and forest seeds.

2.3.2 Policy of the Secretariat for the Environment (SMA)

The following items stand out in the scope of the environmental policy of the Secretariat for the Environment of the State of São Paulo:

- Integrating the drawing up of guidelines and management of activities focused on the ecological system of the State of São Paulo.
- Improving the technology for atmospheric pollution, soil contamination, and water pollution control, and developing adequate counteraction techniques.
- Integrating and standardizing all environmental management system programs of the Secretariat and associated agencies.
- Raising funds for improvement, recovery, and preservation of the environment quality.
- Designing the projects necessary to achieve the targets of the ecological system of the State of São Paulo.
- Organizing a business system for private companies that participate in environmental quality improvement, recovery, and preservation programs.
- Fostering the participation of civil entities in ecosystem-oriented projects.

- Introducing and managing information systems (especially GIS) that would support the adequate implantation of the environment improvement system.
- Making an environmental impact assessment and awarding environmental license to projects designed to benefit the environment.
- Managing the environmental protection areas and important ecosystem areas, and defining their respective zoning.

2.3.3 Secretariat of Housing and Environment of SBC Municipality

The Secretariat of Housing and Environment of São Bernardo do Campo addresses environmental issues and implements the following environmental policy:

- Promoting the environmental education through the continuity of "ecologically correct housing" project, and disclosing its relevant information.
- Preventing the squatting increase in environmental protection areas.
- Promoting the participation of local communities, and introducing legal procedures to regularize the situation of illegal occupiers or remove irregular occupiers.
- Constructing a final treatment plant that would use the primary treatment plant and the pumping station.
- Expanding the "ecological areas" through the education and participation of local communities.
- Environmental improvement of Alvarenga sanitary landfill.
- Expansion of Projects: “rubbish and the citizen”, “environmental education”, “recycling”, “selective collection”, “clean city’.

2.3.4 Environmental Licensing

In Brazil, any new project is required to obtain environmental license at three stages: Preliminary License, Installation License, and Operation License. The first two licenses should be obtained prior to the publication of start of works, as only after such licenses are granted the installation of works is allowed to start.

Criteria for obtaining such licenses (environmental license criteria or permission procedures) are established by CONAMA in the Ministry of the Environment.

In the State of São Paulo, CONSEMA, an agency reporting to the Secretariat for the Environment of the State of São Paulo, is authorized by CONAMA to grant environmental license at state level. CONSEMA, in turn, is empowered to issue complementary regulations to adjust to the peculiar conditions of each State without, however, breaking CONAMA regulations at federal level. This way, in case of a state-level project, it is incumbent to CONSEMA of the Secretariat for the Environment of the concerned State to grant the environmental license. At municipal level, the license may be obtained from the relevant local government. Nevertheless, projects implanted in the capital city of a State may require licenses from both the State and the municipality, as the nature of the work is unclear: either a state or a municipal work. When the project also comprises federal areas, as in environmental preservation areas or indigenous reservations, it may necessary to obtain another license at federal level, and therefore the project shall be required to obtain federal, state, and municipal licenses.

Current criteria adopted by CONAMA for granting environmental licenses are established on a sector-by-sector basis in terms of procedures and requirements. For the basic sanitation sector, such criteria are set out in Resolution 01/86, 05/88 and 237/97. Under such Resolutions, environmental license for basic sanitation is required for the construction of a new dam for collection and storage of water resources, water treatment plants, general sewerage systems (sewerage system including collection, interception, and treatment plant), construction of new waste treatment facilities and its management. On the other hand, repair and expansion works for exiting basic sanitation systems are exempt from obtaining further environmental licenses. Currently, expanding the areas exempt from environmental license and streamlining the procedures for obtaining that license is under consideration.

The basic environmental license procedure in the State of São Paulo is shown below.

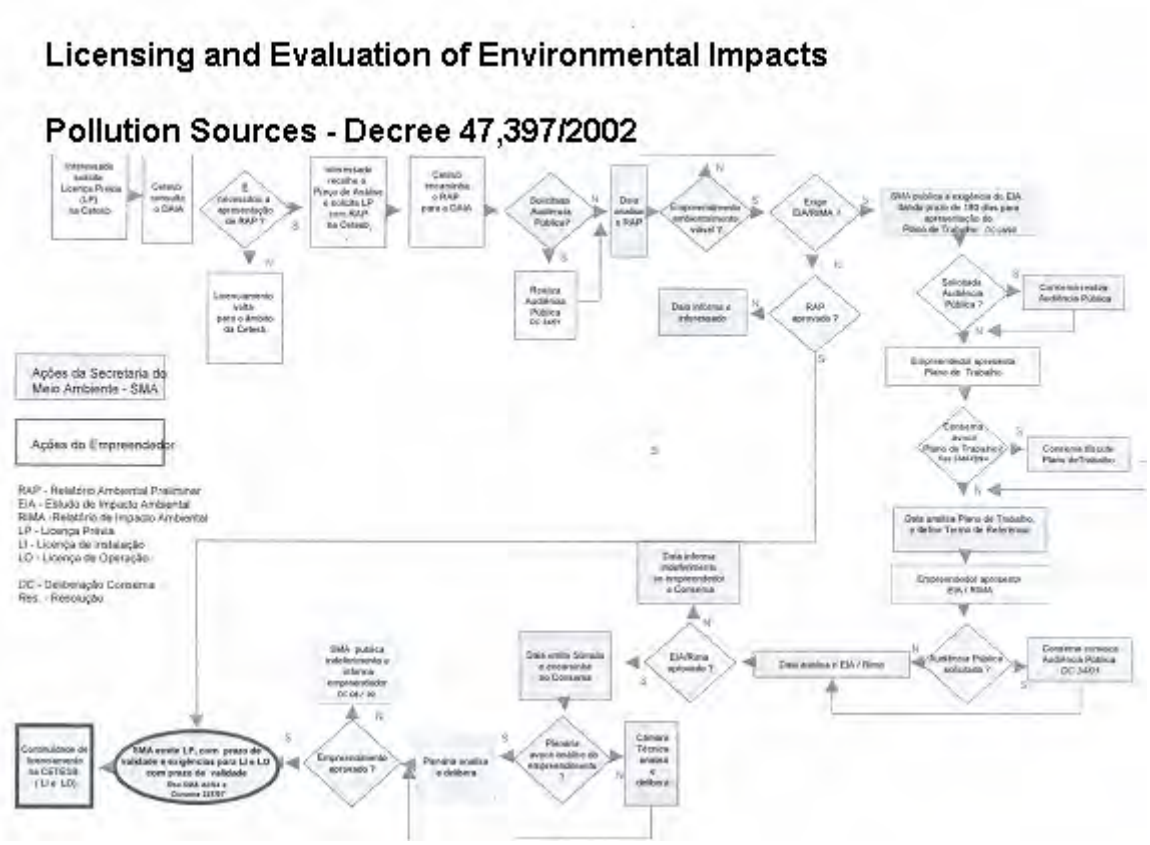

Figure 2.3.2 Flowchart of Environmental License and Impact Assessment

2.3.5 Water Quality

Quality standards of human consumption waters are based on "Water Quality Standards" established by Decree No. 1469/2000 (published on 22/02/2001) of the Ministry of Health. This decree sets out the national water guidelines and requirements, including quality standards and checking procedures. It also establishes that the States and the Federal District should control and supervise the compliance with such standards, and even (including the municipalities) establish more restrictive complementary guidelines consistent with the general national standards.

Water quality inspection is under the responsibility of the National Health Foundation – FUNASA. FUNASA is responsible for the implementation of environmental sanitation actions, control of contagious disease and germ carriers, as well as for the inspection of human consumption water quality. However, concrete monitoring and inspection actions are assigned to the sanitary authorities of each State by specific agreements. Upon the occurrence of water-borne diseased, the Secretariat of Health of the concerned State intervenes to protect the local population and prevent infection and proliferation.

In the State of São Paulo, control and supervision of quality of piped water and wastewater the whole hydrographic basin (lakes, dams, and rivers) is assigned to *Companhia de Tecnologia de*

Saneamento Ambiental (Environmental Sanitation Technology Company) - CETESB. CETESB was established in 1973 as an autonomous state company reporting to the Secretariat for the Environment. Its objective is operating in environmental preservation and improvement areas. In its capacity of implementation entity, it complements the State Secretariat for Environment actions by supervising and monitoring the pollution level of the natural environment (atmospheric air, soil, and water resources). It has 34 Environmental Agencies grouped into eleven regional offices distributed all over the State.

Such regional agencies and offices are interlinked online, what allows their headquarters to make the general supervision of atmospheric, soil and water pollution status monitoring all over the State of São Paulo. Quality standards for human consumption water comply with the standards established by the Ministry of Health. Wastewater characteristics comply with the sanitary effluent standards established by CONAMA Resolution No. 20/86 (MMA). Whenever a CETESB monitoring detects a worse water quality as compared to the Ministry of Health standards, CETESB is empowered to take administrative measures against the polluting sources. Transgressors are subject to penalties, and the inspection agencies are authorized to apply such penalties.

CETESB is authorized to grant environmental license to projects focused on environmental pollution.

State basic sanitation utilities (SABESP in São Paulo) hold full responsibility for human consumption water quality control. Sanitation companies perform by themselves regular water quality tests; should any water quality irregularity be detected, the companies shall take the measured required to maintain the same quality standard. Service providers must submit the result of water quality tests to the Secretary of Health of the relevant State on a regular basis.

2.3.6 Environmental standards for water quality and effluent standards

(1) Environmental standards for water quality

There are two Environmental standards for water quality established by the federal government, and the state government of Sao Paulo. The relationship between both standards in terms of water quality class is shown in **Table 2.3.1**.

Table 2.3.1 Relationship of water quality class between federal and state environmental standards

Freshwater		Seawater		Brackish water	
SP state law(1)	Federal law(2)	SP state law(1)	Federal law(2)	SP state law(1)	Federal law(2)
1	Special	-	Special	-	Special
-	1(3)	1(5)	1(3)	1	1(3)
2	2(3)	-	2(4)		2(4)
3	3(4)	-	3	-	3
4	4	-	-	-	-

(1) Law No. 997/76, approved by cabinet order No.8468/76
(2) CONAMA No.357/05
(3) Not detect organic chrome
(4) Not detect organic agricultural chemical

Water quality classes are set by the Sao Paulo State cabinet order No.10755 (22/11/1977) which are modified below in accordance with the federal standards (see **Figure 2.3.3**)

- Taquacetuba Arm (raw water of conveyance to the Lake Guarapiranga) Class Special
- Rio Grande Arm (raw water for Rio Grande WTP) Class 2
- Pinheiros River (water pumping discharge) Class 4
- Lake Guarapiranga Class Special

Environmental standards for freshwater quality of the federal government are shown in **Table 2.3.2**.

(2) Effluent standard

There are two effluent standards established by the federal government, and the state government of Sao Paulo. The relationship between both standards is shown in **Table 2.3.3** and **Figure 2.3.4**, and more stringent standard by parameter in **Table 2.3.4** is applied.

Table 2.3.3 Relationship between federal and state effluent standards

	Federal law CONAMA 357（17/03/05）	Sao Paulo State law Law 997（31/05/76）
Water body	Article 34(2)	Article 18(1)
Public sewerage system(3)		Article 19A(4)

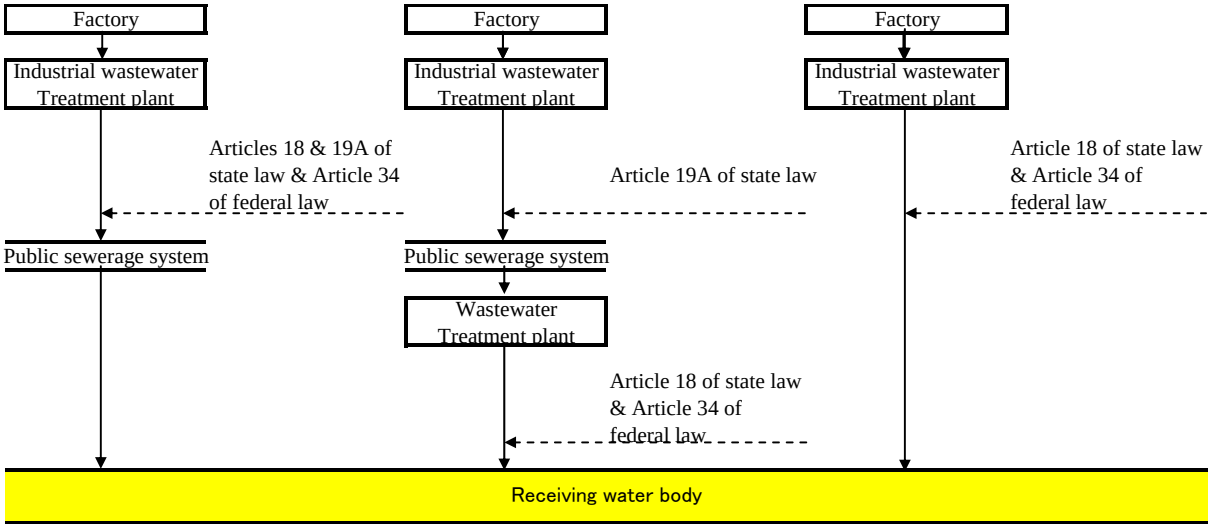

Figure 2.3.4 Effluent standards application by situation

For the Pinheiros River, there is no problem in Case 2, since wastewater drained into a sewer system is discharged downstream of the confluence of the Tiete and Pinheiros Rivers after treatment at the Barueri Wastewater Treatment Plant. Therefore, two cases, or Case 1 in which wastewater is discharged into the Pinheiros River via a sewer system and Case 3 in which wastewater is directly discharged into the Pinheiros River are considered.

It should be noted that Environmental standard applied to the Pinheiros River is Class 4. Use of Class 4 is for navigation and harmonious landscape and not for water supply which is included by Class 3. The regulated parameters of Class 4 are only 4 as shown in **Table 2.3.5**, or floating material, taste (odor), DO and pH in addition to the effluent standards. A value of pH is narrowed to a range of 6.0-9.0 in Class 4 from a range of 5.0-9.0in the effluent standards. Therefore, if water has no apparent problem and DO of more than 2.0 mg/L and meets the effluent standards, it can be discharged into the Pinheiros River. Class 4 seems to be the requirement as a drain.

Table 2.3.5 Environmental standards Class 4

Parameter	Limit
Floating material	Invisible
Taste or odor	Not objectionable (odor and appearance)
DO (mg/LO_2)	≥2.0
pH	6.0～9.0

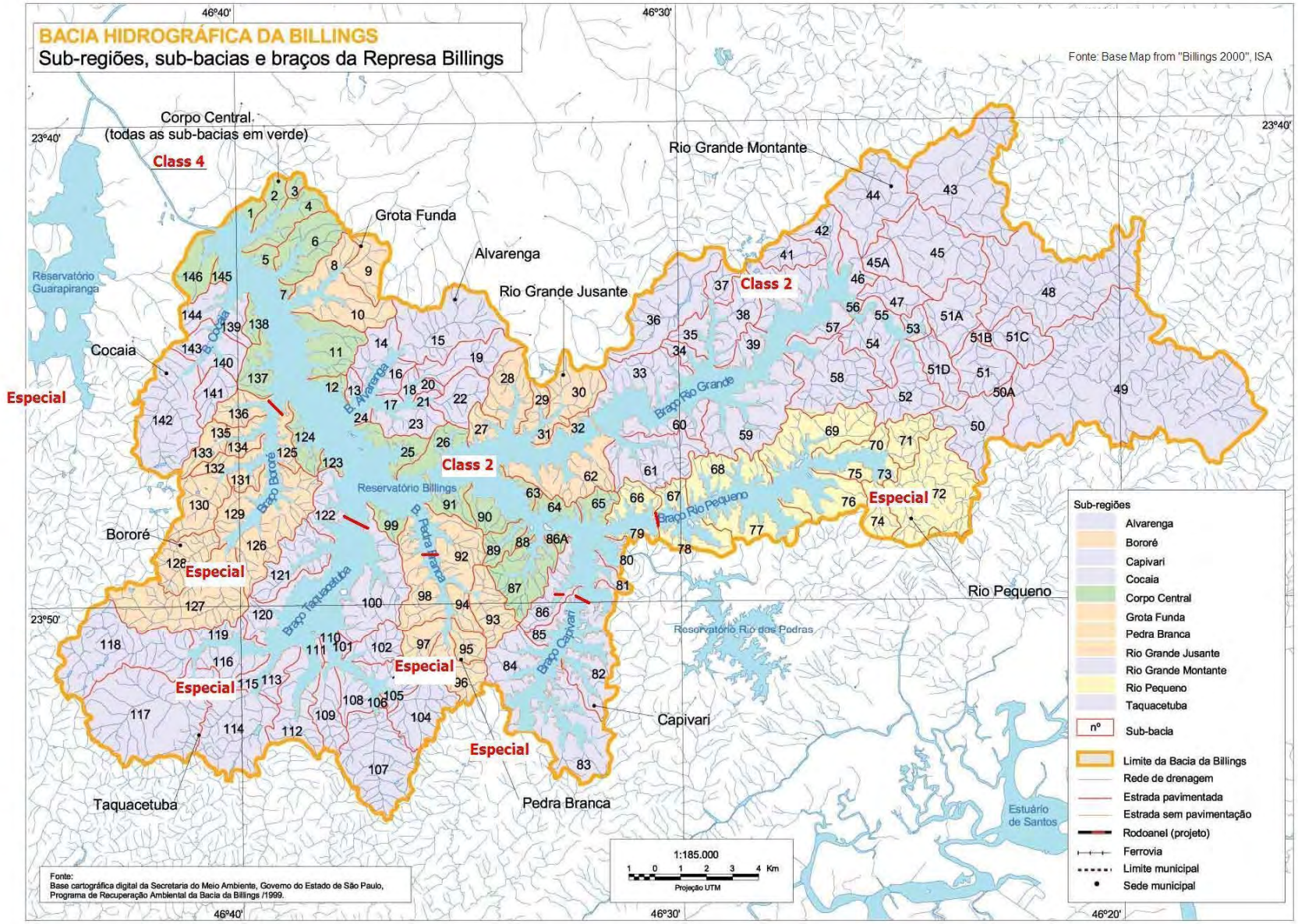

Figure 2.3.3 Environmental standard

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IN THE CATCHMENT AREA OF LAKE BILLINGS

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Table 2.3.2 Environmental standards for freshwater quality of the federal government

CLASSE DO RIO	1	2	3	4
Resolução CONAMA n° 357/05 (Condições/Padrões)	**Artigo 14**	**Artigo 15**	**Artigo 16**	**Artigo 17**
Condições				
Toxicidade crônica aos organismos aquáticos	Não detectado	Não detectado	Não detec-tado (aguda)	-
Materiais flutuantes	Virtualmente ausentes	Virtualmente ausentes	Virtualmente ausentes	Virtualmente ausentes
Óleos e graxas	Virtualmente ausentes	Virtualmente ausentes	Virtualmente ausentes	-
Substâncias que comuniquem gosto ou odor	Virtualmente ausentes	Virtualmente ausentes	Virtualmente ausentes	Não objetá-veis (odor e aspecto)
Corantes (fontes antrópicas)	Virtualmente ausentes	Não será permitida a presença	Não será permitida a presença	-
Resíduos sólidos objetáveis	Virtualmente ausentes	Virtualmente ausentes	Virtualmente ausentes	-
Coliformes termotolerantes	Conama 274/00 (recreação)	Conama 274/00 (recreação)	2500/100 mL (recreação de contato secundário)	-
	200/100 mL (demais usos)	1000/100 mL (demais usos)	1000/100 mL (dessedentação de animais)	
	E.coli – valor a critério do ór-gão ambiental)	E.coli – valor a critério do ór-gão ambiental)	4000/100 mL (demais usos)	
			E.coli – valor a critério do órgão	
$DBO_{5,20}$ (mg/L O_2)	≤ 3,0	≤ 5,0	≤ 10,0	-
OD (mg/L O_2)	≥ 6,0	≥ 5,0	≥ 4,0	≥ 2,0
Turbidez (UNT)	≤ 40,0	≤ 100,0	≤ 100,0	-
Cor verdadeira(mg Pt/L)	Natural	Natural	≤ 75,0	-
pH	6,0 a 9,0	6,0 a 9,0	6,0 a 9,0	6,0 a 9,0
Padrões / Parâmetros				
Clorofila a (mg/L)	10,0	30,0	60,0	-
Densidade de cianobactéria	20.000,0 cel/mL	50.000,0 cel/mL	100.000,0 cel/mL	-
	2,0 mm^3/L	5,0 mm^3/L	10,0 mm^3/L	-
Sólidos dissolvidos totais (mg/L)	500,0	500,0	500,0	-
Padrões / Parâmetros Inorgânicos				
Alumínio dissolvido (mg/L Al)	0,1	0,1	0,2	-
Antimônio (mg/L Sb)	0,005	0,005	-	-
Arsênio total (mg/L As)	0,01	0,01	0,033	-
	0,14 mg/L (1)	0,14 mg/L (1)		
Bário total (mg/L Ba)	0,7	0,7	1,0	-
Berílio total (mg/L Be)	0,04	0,04	0,1	-
Boro total (mg/L B)	0,5	0,5	0,75	-
Cádmio total (mg/L Cd)	0,001	0,001	0,01	-
Chumbo total (mg/L Pb)	0,01	0,01	0,033	-
Cianeto livre (mg/L CN)	0,005	0,005	0,022	-
Cloreto total (mg/L Cl)	250,0	250,0	250,0	-
Cloro residual total (combinado + livre) (mg/L Cl)	0,01	0,01	-	-
Cobalto total (mg/L Co)	0,05	0,05	0,2	-
Cobre dissolvido (mg/L Cu)	0,009	0,009	0,013	-
Crômio total (mg/L Cr)	0,05	0,05	0,05	-
Ferro dissolvido (mg/L Fe)	0,3	0,3	5,0	-
Fluoreto total (mg/L F)	1,4	1,4	1,4	-
Fósforo total (ambiente lêntico) (mg/L P)	0,020	0,030	0,05	-
Fósforo total (ambiente intermediário, com tempo de residência entre 2 e 40 dias, e tributários diretos de ambiente lêntico) (mg/L P)	0,025	0,050	0,075	-
Fósforo total (ambiente lótico e tributários de ambientes intermediá-rios) (mg/L	0,1	0,1	0,15	-
Lítio total (mg/L Li)	2,5	2,5	2,5	-
Manganês total (mg/L Mn)	0,1	0,1	0,5	-
Mercúrio total (mg/L Hg)	0,0002	0,0002	0,002	-
Níquel total (mg/L Ni)	0,025	0,025	0,025	-

Table 2.3.2 Environmental standards for freshwater quality of the federal government

CLASSE DO RIO	1	2	3	4
Resolução CONAMA n° 357/05 (Condições/Padrões)	**Artigo 14**	**Artigo 15**	**Artigo 16**	**Artigo 17**
Condições				
Nitrato (mg/L N)	10,0	10,0	10,0	-
Nitrito (mg/L N)	1,0	1,0	1,0	-
Nitrogênio amoniacal total (mg/L N)	3,7 p/ pH ≤ 7,5 2,0 p/ 7,5 <pH≤ 8,0 1,0 p/ 8,0< pH ≤ 8,5 0,5 p/ pH ≥ 8,5	3,7 p/ pH ≤ 7,5 2,0 p/ 7,5 <pH≤ 8,0 1,0 p/ 8,0< pH ≤ 8,5 0,5 p/ pH ≥ 8,5	13,3 p/ pH ≤ 7,5 5,6 p/ 7,5 <pH≤ 8,0 2,2 p/ 8,0< pH ≤ 8,5 1,0 p/ pH ≥ 8,5	-
Prata total (mg/L Ag)	0,01	0,01	0,05	-
Selênio total (mg/L Se)	0,01	0,01	0,05	-
Sulfato total (mg/L SO_4)	250,0	250,0	250,0	-
Sulfeto (H_2S não dissociado) (mg/L S)	0,002	0,002	0,3	-
Urânio total (mg/L U)	0,02	0,02	0,02	-
Vanádio total (mg/L V)	0,1	0,1	0,1	-
Zinco total (mg/L Zn)	0,18	0,18	5,0	-
Padrões / Parâmetros Orgânicos				
Acrilamida (mg/L)	0,5	0,5	-	-
Alacloro (mg/L)	20,0	20,0	-	-
Aldrin + Dieldrin (mg/L)	0,005	0,005	0,03	-
Atrazina (mg/L)	2,0	2,0	2,0	-
Benzeno (mg/L)	0,005	0,005	0,005	-
Benzidina (mg/L)	0,001 0,0002 (1)	0,001 0,0002 (1)	-	-
Benzo(a)antraceno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	-	-
Benzo(a)pireno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	0,7	-
Benzo(b)fluoranteno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	-	-
Benzo(k)fluoranteno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	-	-
Carbaril (mg/L)	0,02	0,02	70,0	-
Clordano (cis + trans) (mg/L)	0,04	0,04	0,3	-
2-Clorofenol (mg/L)	0,1	0,1	-	-
Criseno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	-	-
2,4-D (mg/L)	4,0	4,0	30,0	-
Demeton (demeton-O + demeton-S) (mg/L)	0,1	0,1	14,0	-
Dibenzo(a,h)antraceno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	-	-
3,3 Diclorobenzidina (mg/L)	0,028 (1)	0,028 (1)	-	-
1,2-Dicloroetano (mg/L)	0,01	0,01	0,01	-
1,1-Dicloroeteno (mg/L)	0,003	0,003	30,0(mg/L)	-
2,4-Diclorofenol (mg/L)	0,3	0,3	-	-
Diclorometano (mg/L)	0,02	0,02	-	-
DDT (p,p'-DDT+p,p'-DDE+p,p'-DDD) (mg/L)	0,002	0,002	-	-
Dodecacloro pentaciclodecano (mg/L)	0,001	0,001	0,001	-
Endossulfan (a+b+sulfato) (mg/L)	0,056	0,056	0,22	-
Endrin (mg/L)	0,004	0,004	0,2	-
Estireno (mg/L)	0,02	0,02	-	-
Etilbenzeno (mg/L)	90,0	90,0	-	-
Fenóis totais (substân-cias que reagem com 4-aminoantipirina) (mg/L C_6H_5OH)	0,003	0,003	0,01	-
Glifosato (mg/L)	65,0	65,0	280,0	-
Gution (mg/L)	0,005	0,005	0,005	-
Heptacloro epóxido + heptacloro (mg/L)	0,01 0,000039(1)	0,01 0,000039(1)	0,03	-
Hexaclorobenzeno (mg/L)	0,0065	0,0065	-	-
Endeno (1,2,3-cd) pireno (mg/L)	0,05 0,018 (1)	0,05 0,018 (1)	-	-
Lindano (g-HCH) (mg/L)	0,02	0,02	2,0	-
Malation (mg/L)	0,1	0,1	100,0	-

Table 2.3.2 Environmental standards for freshwater quality of the federal government

CLASSE DO RIO	1	2	3	4
Resolução CONAMA n° 357/05 (Condições/Padrões)	**Artigo 14**	**Artigo 15**	**Artigo 16**	**Artigo 17**
Condições				
Metolacloro (mg/L)	10,0	10,0	-	-
Metoxicloro (mg/L)	0,03	0,03	20,0	-
Paration (mg/L)	0,04	0,04	35,0	-
PCBs-Bifenilas policloradas (mg/L)	0,001	0,001	0,001	-
	0,000064(1)	0,000064(1)		
Pentaclorofenol (mg/L)	0,009	0,009	0,009	-
	3,0 (mg/L)(1)	3,0 (mg/L)(1)		
Simazina (mg/L)	2,0	2,0	-	-
Substâncias tensoativas que reagem com o azul de metileno (mg/L LAS)	0,5	0,5	0,5	-
2,4,5-T (mg/L)	2,0	2,0	2,0	-
Tetracloreto de carbono (mg/L)	0,002	0,002	0,003	-
	1,6 (mg/L)(1)	1,6 (mg/L)(1)		
Tetracloreteno (mg/L)	0,01	0,01	0,01	-
	3,3 (mg/L)(1)	3,3 (mg/L)(1)		
Tolueno (mg/L)	2,0	2,0	-	-
Toxafeno (mg/L)	0,01	0,01	0,21	-
	0,00028(1)	0,00028(1)		
2,4,5-TP (mg/L)	10,0	10,0	10,0	-
Tributilestanho (mg/L TBT)	0,063	0,063	2,0	-
Triclorobenzeno (1,2,3-TCB+1,2,4-TCB) (mg/L)	0,02	0,02	-	-
Tricloroeteno (mg/L)	0,03	0,03	0,03	-
2,4,6-Triclofenol (mg/L)	0,01	0,01	0,01	-
	2,4(mg/L)(1)	2,4(mg/L)(1)		
Trifluralina (mg/L)	0,2	0,2	-	-
Xileno (mg/L)	300,0	300,0	-	-

(1) Padrões para corpos d'água onde haja pesca ou cultivo de organismos para fins de consumo intensivo.

Table2.3.4 Effluent standard

		Sao Paulo State law	Federal law	Sao Paulo State law
		Water body	Water body	Public sewerage system
Law		Law 997	CONAMA357	Law 997
		(31/05/76)	(17/03/05)	(31/05/76)
Article		Article18-4	Article34-5	Article19-A6

Condições / Padrões	**Unidade**	**Artigo 18** (4)	**Artigo 34** (5)	**Artigo 19-A** (6)
Condições				
pH	-	≥ 5,0 e ≤ 9,0	≥ 5,0 e ≤ 9,0	≥ 6,0 e ≤ 10,0
Temperatura	°C	< 40	< 40 (1)	< 40
Materiais sedimentáveis (teste de 1 hora em "cone Imhoff")	mL/L	≤ 1,0	≤ 1,0 (7)	≤ 20,0
Óleos e graxas	mg/L	≤ 100,0 (8)	-	≤ 150,0 (8)
Óleos minerais	mg/L	-	≤ 20,0	-
Óleos vegetais e gorduras minerais	mg/L	-	≤ 50,0	-
Materiais flutuantes	-	-	Ausência	-
DBO (demanda bioquímica de oxigênio)	mg/L O_2	60,0 (2)	-	-
Solventes combustíveis, inflamáveis etc.	-	-	-	Ausência
Despejos causadores de obstrução na	-	-	-	Ausência
Substâncias potencialmente tóxicas	-	-	-	Ausência
Padrões / Parâmetros Inorgânicos				
Arsênio total	mg/L As	0,2	0,5	1,5 (3)
Bário total	mg/L Ba	5,0	5,0	-
Boro total	mg/L B	5,0	5,0	-
Cádmio total	mg/L Cd	0,2	0,2	1,5 (3)
Chumbo total	mg/L Pb	0,5	0,5	1,5 (3)
Cianeto total	mg/L CN	0,2	0,2	0,2
Cobre	mg/L Cu	1,0	1,0 (dissolvido)	1,5 (3)
Crômio hexavalente	mg/L Cr	0,1	-	1,5
Crômio total	mg/L Cr	5,0	0,5	5,0 (3)
Estanho total	mg/L Sn	4,0	4,0	4,0 (3)
Ferro solúvel	mg/L Fe	15,0	15,0(dissolvido)	15,0
Fluoreto total	mg/L F	10,0	10,0	10,0
Manganês solúvel	mg/L Mn	1,0	1,0 (dissolvido)	-
Mercúrio total	mg/L Hg	0,01	0,01	1,5 (3)
Níquel total	mg/L Ni	2,0	2,0	2,0 (3)
Nitrogênio amoniacal total	mg/L N	-	20,0	-
Prata total	mg/L Ag	0,02	0,1	1,5 (3)
Selênio total	mg/L Se	0,02	0,30	1,5 (3)
Sulfato	mg/L SO_4	-	-	1.000,0
Sulfeto	mg/L S	-	1,0	1,0
Zinco total	mg/L Zn	5,0	5,0	5,0 (3)
Padrões / Parâmetros Orgânicos				
Clorofórmio	mg/L	-	1,0	-
Dicloroeteno	mg/L	-	1,0	-
Fenóis totais (substâncias que reagem com 4 – aminoantipirina)	mg/L C_6H_5OH	0,5 (fenol)	0,5	5,0 (fenol)
Tetracloreto de carbono	mg/L	-	1,0	-
Tricloroeteno	mg/L	-	1,0	-

2.4 State Water Source Development and Environmental Protection Law

2.4.1 Summary of Main Laws

(1) Law no. 898 of 18/12/1975, and Law no. 1,172 of 17/11/1976

Law 1,172, known as "SPMR Water Source Protection Law" delimits the protection areas of water sources, water courses and reservoirs referred to in article 2 of Law 898, and sets out guidelines and restrictions for the use of soil in such area. This Law intended to preserve 1st class strips free from any occupation, and allow a controlled low-density occupation in other areas. Due to strong restrictions and lack of an efficient inspection by the public authorities, that region has been subject to squatting and illegal settlements to meet the housing demands of those inhabitants set apart from the market and neglected by official housing programs. That led to an occupation contrary to the Law objectives, where 1st class areas have been occupied, and urbanistic rates of that Law have not been considered.

It should be mentioned that, as long as specific laws for hydrographic basins of water sources in São Paulo Metropolitan Region are not approved, as provided in Law 9,866/97 discusses below, the regulations and restrictions established in Law 1,172 of 17/11/1976 shall remain in force.

(2) Law no. 9,866 of 28/11/1997

This law provides for guidelines and standards for environmental quality protection and recovery in hydrographic basins of water sources of regional interest for water supply to current and future populations of the State of São Paulo. Unlike previous laws, this law is not limited to São Paulo Metropolitan Region, but to the whole State.

Water Source Protection and Recovery Area – APRM means one or more hydrographic sub-basins of regional interest for public supply. The law establishes that APRM should be included in one of the Water Resource Management Units – UGRI.

The Project area includes the constitution of Billings Water Source Protection and Recovery Area – APRM-B, which comprises other neighboring water sources in addition to the Billings Lake.

The law provides the setting up of regional environmental, urbanistic guidelines and standards for each APRM, taking into account the specificities and environmental functions of different Intervention Areas, with the objective of ensuring raw water quality and quantity standards that subject to conventional treatment for public supply.

Article 18 provides that APRMs, their Intervention Areas, and respective regional environmental and urbanistic guidelines and standards should be established by State Law (Law specific to each

APRM).

Article 19 establishes that municipal planning and control of urban soil use, parceling and occupation provided in article 30 of the Federal Constitution of 5th October 1988, should incorporate regional environmental and urbanistic guidelines and standards for preservation, conservation, and recovery of water sources described in the specific APRM law.

The Law also provides for the formulation of an Environmental Development and Protection Plan – PDPA for each APRM.

Article 44 provided that, in the event of breach of any provisions of this Law and specific APRM laws, the public authorities in charge of environmental licensing and inspection should enter into negotiations with the transgressor to sign an agreement to adjust to environmental behavior, with the effect of an extrajudicial document valid for execution proceedings, with the main objective of recovering the degraded water source toward stopping, adjusting, recomposing, correcting, or mitigating the adverse effects on the environment, regardless of any other applicable sanctions.

Article 45 establishes that in São Paulo Metropolitan Region, as long as specific APRM laws are not promulgated, the provisions of Laws no. 898 of 18/12/1975, and no. 1,172 of 17/11/1976 shall be maintained, except for item XIX of article 2 of Law no. 898 of 18/12/1975, included by Law no. 7,384 of 24/06/1991, which shall be expressly revoked as from the date of publication of this Law.

Article 47 establishes that in water sources protection areas referred to in Laws no. 898 of 18/12/1975, and 1,172 of 17/11/1976, as long as specific APRM laws are not promulgated, emergency works may be carried out whenever environmental and sanitary conditions shall present risk to life and public health or jeopardize the use of such water sources for supply purposes. For the purposes of this Law, emergency works include those works necessary for water supply, sewerage, rainwater drainage, erosion containment, slope stabilization, electric power supply, water pollution control, and revegetation.

This law appears to have brought significant advances, such as: adoption of the hydrographic basin as a planning and management unit; formulation of a law specific to each Law APRM, which will consider all peculiar characteristics of each hydrographic basin, and the participation the municipalities and other stakeholders; possibility of addressing critical issues related to environmental and sanitary conditions that would represent risk to life and public health or jeopardize the use of water sources for supply purposes.

(3) Decree no. 43,022 of 7th April 1998

This decree regulates the provisions of the Emergency Plan for Recovery of Water Sources in São

Paulo Metropolitan Region created by Law no. 9,866 of 28/11/1997, which provides for guidelines and standards for protection and recovery of regional water sources in the State of São Paulo.

The Decree defines the areas subject to emergency works, permissible works, priorities, restrictions, and conditions for intervention proposal submission. Is also establishes that actions necessary for water source recovery, which could not be included in the Emergency Plan, should be forwarded to the respective PDPAs – Environmental Development and Protection Plan of each APRM.

(4) Law no. 11,216 of 22nd July 2002

This law adds Article 37-A to Law no. 1,172 of 17/11/1976, which reads as follows: "For the purposes of application of this law and Law no, 898 of 18th December 1975, inclusion of non-adjacent land or plots to the same project, work or activity shall be allowed, provided that such areas are located in 1st or 2nd class strips, Classes A, B and C, within the respective hydrographic sub-basin.". This text is followed by several paragraphs containing requirements and circumstances for the application of this Law.

It should be mentioned that the flexibility provided by this Law allows the regularization of many settlements and other projects that are at variance with the urban parameters set out in Law 1,172 of 17/11/1976.

2.4.2 Other Environmental and Water Source Laws

Environmental laws are available at federal (Federal Constitution) and State levels, as listed below:

<Federal Constitution Laws related to the Environment>

- Cultural Heritage（Decree-Law 25 of 30/11/1937）
  - ∗ Organizes the National Historical and Artistic Heritage Protection.
- Forest Code（Federal Law no. 4,771 of 15th September 1965）
  - ∗ Amended by Provisional Measure（PM) no. 2,080-62 of 19th April 2001
  - ∗ Protection of Natural Forests and their specifications (permanent preservation area at 30-500 m from water bodies, mount peaks, land with slope angle inclination above 45º, places above 1,800 m from sea level, etc.)
- Fauna Protection Code（Law no. 5,197 of 3rd January 1967）as amended.
  - ∗ Defines wildlife chasing, holding, and export as crimes. It also establishes the procedures for reproduction and commercialization.

- Urban Soil Parceling Law（Law no. 6,766 of 19th December 1979）
    - Standard for urban demarcation, flooded areas, environmental preservation areas, and prohibition of urban demarcation in areas of risks to health.
- Law of basic guidelines for industrial zoning in critical pollution areas (Law no. 6,803 of 2nd July 1980).
- National Environmental Policy Law（Law no. 6,938 of 17th January 1981）as amended.
    - Provides for the institution of EIA/RIMA, regulated by CONAMA Resolution no. 001/1986.
    - Those who are responsible for pollution generation shall be accountable for its environmental impact.
- Law of IBAMA (Brazilian Environment and Renewable Natural Resource Institute) creation（Law no. 7,735 of 22nd February 1989).
- Law no. 7,804 of 20th July 1989（Amends Laws no. 6,938, 6,803 and 7,735）
    - Allows each State and municipality to establish environmental standards for industrial activities.
- Environmental Protection Area Law（Las no. 6,902（1981/04/27）subsequently complemented by Law no. 9,985 of 18th July 2000
    - Establishes APAs (environmental protection areas) and ecological stations, and allows their creation at Federal, State and Municipal levels.
- Law of Public Civil Proceedings（Law no. 7,347 of 24th July 1985）as amended:
    - Regulates the public civil proceedings against the person responsible for damages to the environment, consumers, goods and rights or artistic, aesthetic, and historical value.
- Environmental Crime Law（Law no. 9,605 of 12th February 1998）
    - Penal and administrative sanctions for behaviors and activities harmful to the environment.
- Water Resource Law（Law no. 9,433 of 8th January 1997）as amended.
- Law no. 9,984 of 189th July 2000:
    - Provides for the creation of the National Water Agency - ANA, a federal entity for implementation of the National Water Resource Policy, in coordination with the National Water Resource Management System.
- Sanitation Law (Law no. 5,318 of 26 September 1967）

- Institutes the National Sanitation Policy and the National Sanitation Board.

- Law of Special Areas（Law no. 6,513 of 20th December 1977）

  - Provides for the creation of Special Areas and Location of Tourist Interest, and the inventory of cultural and natural assets for tourist purposes.

- Law of the National Environment Fund（Law no. 7,797 of July 10 1989）

  - Institutes the National Environment Fund.

- Law of Reduction of Pollutant Emission（Law no. 8,723 of 23rd October 1993）

  - Provides for the reduction of pollutant emission by self-propelled vehicles.

- Environmental Education Law（Law no. 9,795 of 27th April 1999）

  - Provides for environmental education, and institutes the National Environmental Education Policy.

- Law for Regulation of Articles 182 & 182 of the Federal Constitution（Law no. 10,257 of 10th July 2001）

  - Establishes the urban policy standards from the standpoint of environmental equilibrium and national security.

＜Laws of the State of São Paulo related to the Environment＞

- Environmental Preservation Law（State Law no. 997 of 31st May 1976）

  - Provides for the environment pollution control and pollution prevention system.

- Water Source Protection Law（State Law no. 898 of 18th December 1975, subsequently complemented by State Laws no. 1,172 of 17th November 1976, and no. 9,866 of 28th November 1997

  - Regulates the use of soil to protect water sources, water courses and reservoirs, and other water resources of interest of São Paulo Metropolitan Region.

  - Institutes policies related to water source areas.

- It is related to the State Law no. 9,866 of 28th November 1997, which provided for the setting up of guidelines and standards related to the Emergency Plan for hydrographic basin protection and recovery in Greater São Paulo

- State Decree DEPRN no. 44 of 25th September 1995

  * Regulates the procedures for authorization of isolated tree felling.

- Law of Ecological Parks and Forest Parks（State Law no. 3,743 of 9th June 1983）

  * Establishes encouraging guidelines for the creation of ecological parks and forest parks in the municipalities.

- Water Resource Law（State Law no. 7,663 of 30th December 1991）

  * Sets out guidelines for the State Water Resource Policy, and the Integrated Water Resource Management System.

＜Laws of the Municipality of São Bernardo do Campo Related to the Environment＞

- Earthwork Law（Municipal Law no. 2,409 of 22nd July 1922）

  * Sets out guidelines for earthworks in the municipality.

- Zoning Law (Municipal Law no. 4,446 of 12th August 1996）

  * Establishes the Municipality of São Bernardo do Campo zoning, regulates the use of soil in several zones, and defines patterns.

- Law of Ecological Tax on the use of soil in urban land（Municipal Law no. 4,558 of 11th December 1997）

  * Institutes tax exemption (ecological tax) for those whose land includes forest and vegetation, and comply with the environmental standards.

- Tree Felling Law（Municipal Law no. 4,661 of 11th September 1998）

  * Regulates tree felling in the Municipality of São Bernardo do Campo.

- Law of Use of Soil（Municipal Law no. 4,803 of 4th November 1999）

  * Provides for Guidelines for Urban Soil Allotment pursuant to the Federal Law no. 6766 pf 19th December 1979, as amended by the Federal Law 9,785 of 29th January 1999, and creates Special Sectors for Specific Urbanization the Municipality

- Law of Construction and Maintenance of Walls and Sidewalks（Municipal Law no. 3,934 of 18th March 1992）

  * Provides for the construction and maintenance of walls and sidewalks, land cleaning, curb lowering, gutter opening, construction and waste material deposits in streets and public places.

2.5 Water Source Development and Soil Occupation Plan

2.5.1 Environmental Development and Protection Plans (PDPA)

With respect to the protection of water sources located in Billings hydrographic basin, environmental water source protections laws of 1975 and 1976 were enacted as state Laws and established rigid guidelines and restrictions for use of soil in such areas. However, inspections required by the law were not realistic and even worsened the scenario. Then, a state law was enacted in 1997, which amended the previous law. It provides for the creation of an environmental development plan (PDPA) and recommends the implementation of emergency works in cases of risks to life and health.

The Federal Water Resource Law established that water resources management should be performed at hydrographic basin unit level, the same way the State Law No.9,866 requires the formulation of an Environmental Development and Protection Plan – PDPA for each hydrographic basin that is part of the Water Source Protection and Recovery Area – APRM.

In Greater São Paulo area, Alto Tietê Hydrographic Basin Committee was established in 1991, which in turn was divided into five sub-committees. Alto Tamanduateí-Billings Sub-Committee is part of that Committee, which covers the Billings Lake basin.

The five Hydrographic Basin Sub-Committees, including Billings/Tamanduateí, are as follows.

Table 2.5.1 Sub-Committees and Related Municipalities

Hydrographic Basin Sub-Committees	Number of Municipalities	Municipalities
Cotia/Guarapiranga	8	Cotia, Embu, Taboão da Serra, Itapecerica da Serra, Embu-Guaçu, São Lourenço da Serra, Juquitiba, São Paulo
Billings/Tamanduateí	8	Santo André, São Bernardo do Campo, São Caetano do Sul, Mauá, Rio Grande da Serra, Ribeirão Pires, Diadema, São Paulo
Tietê/Riverhead	10	Mogi das Cruzes, Ferraz de Vascocelos, Itaquacetuba, Poá, Suzano, Britiba-mirim, Salesópolis, Guarulhos, Arujá, São Paulo
Juqueri/Cantareira	6	Cajamar, Franco da Rocha, Francisco Mourato, Caeria, Mairipora, São Paulo
Pinheiros/Pirapora	8	Pirapora do Bom Jesus, Santana de Parnaiba, Itapevi, Barueri, Osasco, Carapicuiba, Jandira, São Paulo

Alto Tietê Hydrographic Basin Committee is an advisory and deliberative collegiate entity that comprises the Integrated Water Resource Management System, and covers Alto Tietê Hydrographic Basin. It is the "water parliament" in São Paulo Metropolitan Region. This committee is composed of representatives of the State, basin municipalities, and civil society entities, at the same level of participation. All water resource-related issues should be discussed and decided upon in that forum. However, PDPAs in Alto Tietê Hydrographic Basin are examined by CONSEMA, in its capacity of

higher level.

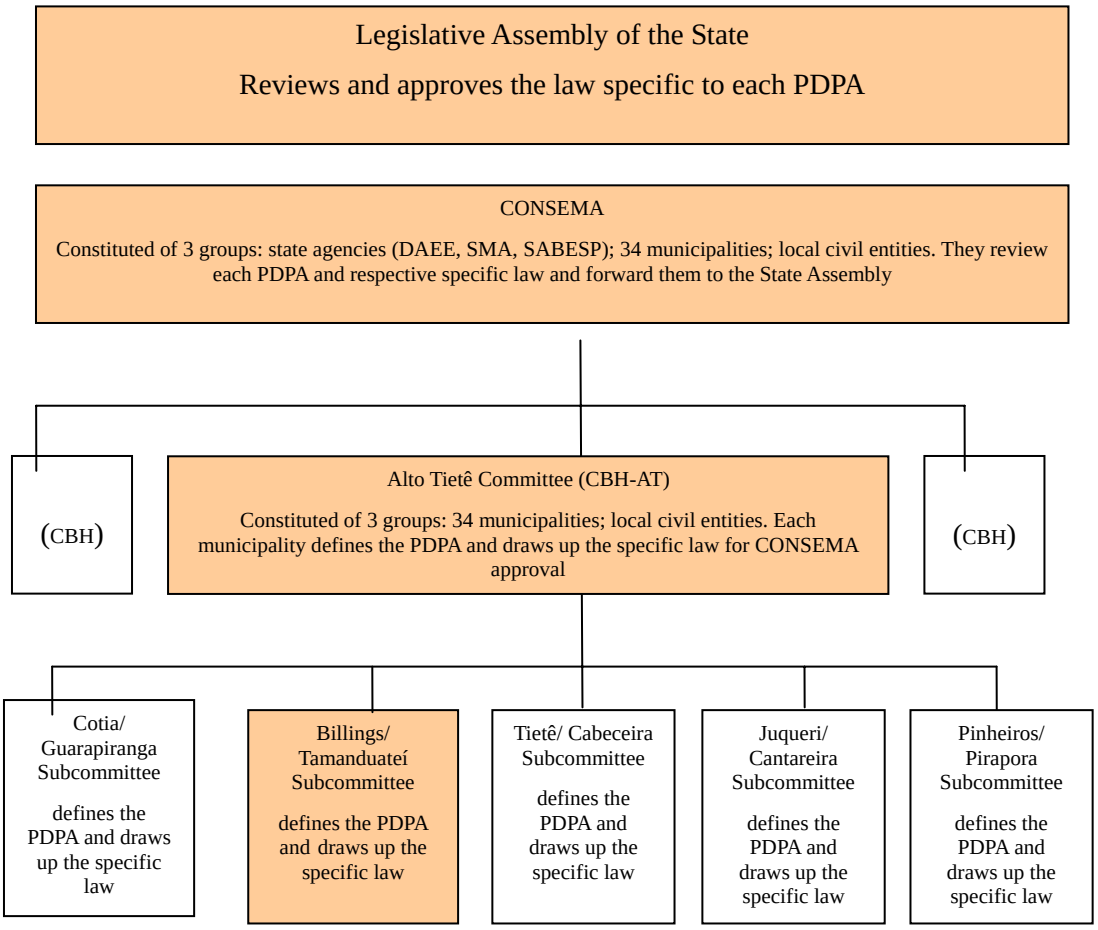


Figure 2.5.1 Process for approval of PDPA - Water Source Preservation Plan

Alto Tietê Hydrographic Basin Committee é composed of 48 members, being 16 members of each segment; in addition, it also relies on an Executive Secretary, Subcommittees and Technical Chambers. All members have a 2-year term renewable for the same period. The President, Vice-President, and Executive Secretary are members of the Committee elected by their peers. The Committee is usually chaired by one of the mayors, while the vice-president is usually a representative of the civil society and the executive secretary a representative of the State. Subcommittees are also constituted of representatives of the State, municipalities, and civil entities. Billings/Tamanduateí Hydrographic Basin Committee also relies on the participation of a NGO, in the capacity of civil society representative. One of such NGOs is *SOS Mata Atlântica*, a non-governmental environmental protection organization engaged in the preservation, protection, and sustainable exploration of the Atlantic Forest. Its experiences include leading a campaign for decontamination of Tietê River, which gave rise to the current Tietê River Decontamination Plan.

2.5.2 Guarapiranga Dam PDPA

Guarapiranga PDPA was a pioneering work that comprised a comprehensive multidisciplinary study in the period of 1995-1997, aimed to provide a diagnosis of urban and non-urban occupation in Guarapiranga basin, its impacts on the environment and water resources, recommendation of recovery / environmental protection actions, suggestion of planning strategies and actions focused on urban revitalization, and proposition of a new territory management model, including the instruments necessary for its implantation and continued operation.

The first stage of Guarapiranga PDPA works was completed in 2000 and financed by the World Bank (see **2.5.1**). However, Guarapiranga dam PDPA has not been approved yet as a statewide program.

2.5.3 Relation between the Project Implantation Process and PDPA, Master Plan, and Legislation

(1) Law No. 898 (18/12/1975) delimited the water source protection areas and established restrictions to the use of soil in such areas. Further, it forbade any kind of occupation of Class-1 strips. In Class-2 strips, only a controlled low density occupation would be allowed (Note 1).

Article 23 of Law No.1,172 (17/11/1976) forbids the discharge of liquid sanitary effluents in all water source protection areas, which should be rather discharged out of protected areas.

However, notwithstanding the rigidity of such legal restrictions, the lack of efficient inspection by public authorities has made such provisions be overlooked, and led to squatting and illegal settlements in both Class-1 and Class-2 areas to meet the housing demand of low-income population. This has increased the pollution of waters supplied to Greater São Paulo population. However, that law made impossible the implementation of development and preservation projects designed to improve the environment. As a result, it was necessary to review the law, leading to the enactment of the **State Law No. 9,866** of 28th November 1997.

This law aims to protect and recover the environmental quality of water sources intended to supply current and future populations of the State of São Paulo (Art. 1), and establishes that water from sources protected by this law "are of high priority for public supply over any other interest" (Art. 2), thus enabling the implantation of development and recovery works in such water source areas delimited by the previous law.

Article 3 of Law No. 9,866 created the Water Source Protection and Recovery Area – APRM in one or more hydrographic sub-basins of water sources of national interest for public supply (Note 1).

In addition, if obliged the formulation of the **Environmental Development and Protection Plan** (PDPA) for each APRM (Article 4) (Note 4)

PDPA is understood as a state development plan. A PDPA is proposed by the Basin Agency of the respective Hydrographic Basin Committee jointly with municipalities, representatives of local communities and relevant state agencies. The proposed PDPA is reviewed and evaluated by the Hydrographic Basin Committee (CBH); if approved by CONSEMA, it is submitted to the Legislative Assembly of São Paulo for homologation.

(2) Article 19 of Law 9,866 (28/22/97) determines that an adequate **Specific Law** is enacted for each APRM created in a particular hydrographic basin. The procedure for this deliberation is similar to that of a PDPA; however, without a defined PDPA, a special (specific) law is invalid. As such, it is necessary to formulate the PDPA and the Special (specific) Law at the same time. The Special (specific) Law for the Billings Lake/Tamanduateí Hydrographic Basin is at drafting stage.

Article 5 of that law determines that, as long as the specific APRM laws are not enacted, the provisions of Laws no. 898 of 18th December 1975, and 1,172 of 17th November 1976 shall be maintained in São Paulo Metropolitan Region. In other words, it is impossible to implement a water source development and recovery plan without the prior approval of PDPA, which is a state plan.

(3) According to the Brazilian Law, it is the Municipality that has competence to legislate on its territory. This way, the formulation of a PDPA for a particular hydrographic basin shall only become effective if and when the municipality pass a specific Municipal Law to regulate the use and occupation of soil in its territory. Thereby, to achieve the expected results from water source protection and recovery, a great consistence between PDPA and the Municipal Master Plan is indispensable.

When the Municipality has already a Master Plan in place, based on criteria focused on environmental sustainability, this will certainly give valuable contributions to the discussions on the basin PDPA to take place in Billings-Tamaduateí Subcommittee, as it will provide information on the area diagnosis and specific guidelines for the relevant territory. However, some adjustments to the Master Plan may necessary to incorporate eventual PDPA guidelines that are missing in the Plan.

If no Master Plan is available, PDPA will establish the guidelines on a macro basis, whish will later be detailed in the Master Plan. We note that in such a case the participation of the municipality in

PDPA discussions will be prejudiced by the lack of a thorough analysis of its territory. But this is undoubtedly a fact likely to occur in less structured municipalities provided with few resources to develop its Master Plan.

In the event of any discrepancies between PDPA guidelines/target and the Master Plan zoning, they should be discussed at Billings-Tamanduateí Subcommittee and eventually at a higher level for the proper adjustments.

As seen above, it is noted that there is no priority for PDPA or Master Plan formulation, as there will always be advantages and disadvantages. Perhaps their concomitant formulation would be desirable, as a greater interchange of information and the correction of their respective course would be possible.

(4) At the present time (July 2005), when the municipality of São Bernardo do Campo has no specific law for the Billings Lake, its classification as water source protection area is still subject to restrictions imposed by the State Law of 1975, as shown in **Table 2.5.2** below. There is no idea of the exact dimensions of the 1st and 2nd Class water source protection areas in the municipality of São Bernardo do Campo.

Table 2.5.2 Water Source Protection Areas in São Bernardo do Campo

Area	Surface Area（km^2）	Percent（%）
Urban Area	118.74	29.20
Rural Area	212.54	52.20
Lake Surface	75.82	18.60
Total	407.10	100.00
Water Source Protection Area	212.94	52.30

(5) Also, according to Article 25 of State Law No. 9,866（28/11/1997, discharging liquid sanitary effluents in APRM is permissible provided that they will not affect the environment (Note 3).

(6) Nevertheless, Article 47 of State Law No. 9,866（28/11/1997 provides for the possibility of implantation of emergency works “until specific laws for APRMs are enacted", whenever environmental and sanitary conditions shall represent risks to life and public health or compromise the use of water sources for supply purposes.

(7) Decree no. 43,022 of 7th April 1998 regulates the provisions of the Emergency Plan for Water Source Recovery in São Paulo Metropolitan Region covered by Law no. 9,866 of 28/11/1997, which

provides for guidelines and standards for protection and recovery of water sources of regional interest in the State of São Paulo. This made the implementation of an emergency plan viable (Note 4).

(8) At the same time, the State Laws No. 11,216 of 22nd July 2002 and No. 47,496/2003 were enacted. Law No. 11,216/2002 adds Article 37-A to Law No. 1,172 of 17/11/1976, which reads as follows:

"For the purposes of application of this law and Law no, 898 of 18th December 1975, inclusion of non-adjacent land or plots to the same project, work or activity shall be allowed, provided that such areas are located in 1st or 2nd class strips, Classes A, B and C, within the respective hydrographic sub-basin."

In addition, the State Decree No. 47,696/2003 and Law No. 11,126 delimit the protection areas of water sources, water sources and reservoirs of interest of São Paulo Metropolitan Region. The Billings Lake Basin was also included in those areas.

Pursuant to provisions (Article 45) of this law, establishing that the provisions of Laws No. 898/1975 and 1172/1975 shall be maintained until the PDPA is instituted, it could be understood that, under that law, the legal support to carry out works or activities is consolidated, provided that they are previously approved by the Secretary for the Environment.

(9) Protection areas other than the Water Source Protection Areas

Forests in the municipality cover a surface area of 52 km^2 in addition to an urban 18 km^2 tree farm managed by the State. This industrial park and the aforementioned water source protection area in São Bernardo do Campo have a juxtaposed portion. According to São Bernardo do Campo authorities, this portion covers a surface area of 14 $km^{2.}$

This industrial park houses illegal restaurants and fishing areas. Instead of removing them from that area, the municipality is considering the possibility of regulating such squatters. As to the restaurant in particular, because it is provided with no adequate sewage treatment, the municipality is considering to regularize its situation by providing sewage treatment. There are some 20 fishing areas. Both facilities and occupations are illegal. The gateway to Caminho do Mar (Sea Way) is in the city of São Bernardo do Campo, and the exit is in Cubatão. As that trail (Caminho do Mar) has not been properly maintained, the city of São Bernardo do Campo is requesting the State to ask the municipality of Cubatão to improve the maintenance of that trail.

NOTES:

(Note 1)

Water Source Protection and Recovery Areas indicate those areas demarcated by State Laws (Law No. 898 of 18/12/75 and Law No. 1,172 of 17/11/76), which establish the guidelines for use and occupation of soil toward protecting and preserving the natural environment. Pursuant to those laws, the whole State of São Paulo is classified into several categories of environmental protection areas and is provided with detailed guidelines for oil occupation and use in such areas. Water source protection and recovery areas are classified into the following categories:

A) Class 1: strips that are 50 m from the water surface or public reservoir for supply purposes; strips that are 20 m from both margins of Class-1 rivers; areas covered by class-1 vegetation; slopped area (average gradient of 60% measured at 100-m intervals from the maximum water levels of existing or projected reservoirs).

B) Class 2: water source protection and recovery areas not classified into Class-1 areas/ protection strips.

Regarding the use of soil in water source protection and recovery areas the State Law No .9,866 1997 and Decree No .43,022/1988 determine 3 intervention areas:

- Areas of forbidden occupation and permanent protection areas (ARO/APP), subdivided into:
  - (a) Areas of forbidden use;
  - (b) Ecosystem recovery areas. In areas damaged by tree felling, etc. environmental recovery measures will be taken.

- Areas of directed occupation (AOD). Areas where types of use that do not cause water pollution are permitted. They are subdivided into 6 areas:
  - (c) Areas that are subject to zoning because of their social importance;
  - (d) Areas where dam-related uses (tourism and leisure) are permitted.
  - (e) Restricted use for residential purposes;
  - (f) Areas inside AOD which do not surround the dam, with possibility of use for tourism and leisure purposes;
  - (g) Areas with possibility for large projects (such works as Rodoanel (ring road) at implantation stage);
  - (h) Areas for residential use under more severe restrictions than those mentioned in item (c).
  - (i) Environmental Recovery Areas (ARA): those that allow the implantation of environmental measures to recover the water quality.

(Note 2)

Article 31 provides that each Environmental Development and Protection Plan – PDPA should include:

(a) Guidelines for the formulation of sector-related policies focused on housing, transport, natural resource management, environmental sanitation, and infrastructure that will interfere in the water source quality;

(b) Definition of guidelines for the design of programs to foster the implantation of uses and activities that are consistent with APRM environmental recovery and protection;

(c) Short, medium, and long-term targets to achieve environmental quality standards;

(d) Proposals for update of environmental and urbanistic guidelines and standards of regional interest for specific areas;

(e) Proposals for adjustment and reclassification of environmentally recovered areas.

(f) Programs for implantation of environmental quality recovery, protection, and preservation projects;

(g) Integrated Environmental Quality Monitoring Program;

(h) Integrated Environmental Education Program;

(i) Integrated Control and Inspection Program;

(j) Investment Program.

(Note 3)

Article 25 allows wastewater (liquid sanitary effluents) discharge under the following conditions:

(a) When sanitary effluent transportation and treatment are not economically feasible, or when treatment is possible by soil infiltration. (T.N.: In Law 9866 this item was vetoed).

(b) Upon the due classification of water bodies pursuant to the current law; and

(c) Effluents will be given a treatment consistent with the host water body classification (The provisions of this article shall be restricted to the following classes: Special, 1, 2 and 3 established by article 1 of CONAMA Resolution no. 20 of 18th June 1986.), and the water quality standards of each category are satisfied.

(Note 4)

The State Law No .9866/1997 provides the possibility of implantation of emergency works until the specific APRM laws referred to in the State Laws No. 898/1975 and No. 1172/1976 shall have been enacted.

The aforementioned article establishes the following guides for the implantation of such works

(a) Applicable provisions (types of works allowed)

(b) Areas eligible fort application.

(c) Restriction factors

(d) Requirements for requesting emergency works.

(e) Priorities.

In particular, regarding the request for emergency works, Article 5 of the State Decree no. 43,022 of April, 1998 establishes the following priorities as actions against risks to life and public health or to the use of water sources for supply purposes:

(a) When domestic sewage in excess of self-purification capacity, industrial waste, and general domestic waste are discharged in areas located near riverheads in the basin, such waste should be removed from APRMs and treated outside of such areas.

(b) In dams for piped water supply, all pollution sources and eutrophication phenomenon should be controlled.

2.6 Studies and Projects developed in Water Source Protection Areas

2.6.1 Environmental Sanitation Program for Guarapiranga Basin – (1993-2000)

The objective of this program financed by IBRD funds (BR-3504), the first stage of which was completed in 2000, was ensuring the water supply to the Metropolitan Water Conveyance System after the sanitary and environmental recovery of Guarapiranga reservoir. It also aimed to improve the life quality of the basin population, in addition to develop institutional mechanisms for the environmental control of the basin.

The Environmental Sanitation Program for Guarapiranga Basin comprised a set of actions grouped into five subprograms, as follows:

Subprogram 1 - Water and Sewerage Services

• It included the implantation of domestic sewage collection, interception, and disposal in more dense occupation areas; implantation of operational safety systems to protect the reservoir against excessive load inflow; direct investments in water supply treatment system.

Subprogram 2 - Waste Collection and Final Disposal

• It included investments in urban cleaning equipment for municipalities provided with urbanized

areas in the basin; implementation of regular, selective collection; and adequacy of disposal areas.

Subprogram 3 - Urban Recovery

• It consisted of intervention to adequate the infrastructure of municipalities provided with urbanized areas in the basin, as a result of erosion control, slope stabilization, implantation of drainage pattern, and road system regularization.

Subprogram 4 - Environmental Protection

• It included re-vegetation actions along the reservoir margins, stream plains, and public areas; implantation of parks and reclamation of mined areas; provision of technical assistance to activities consistent with water production activity.

Subprogram 5 - Management Models

• It consisted of grouped studies and data surveys (Management Model and Basin Master Plan), technical capacity building, basin operation, and finally the provision of equipment for the environmental assessment system.

As previously mentioned, Guarapiranga System meets some 20% of water demand of São Paulo Metropolitan Region. The implantation of this program was critical to revert the degradation conditions of that water source.

Under this program, the whole subprogram 1 was developed by SABESP, the concessionaire of water supply and sewerage services for all municipalities of Guarapiranga Basin. Subprograms 2 & 3 were developed by the local government of the relevant municipalities and supported by UGP.

The solution adopted by SABESP for sewerage systems was collecting and transporting the effluents to Barueri STP outside the basin, through Pinheiros River interceptors. Only in two more remote locations – Cipó and Embu Guaçú – localized treatment solutions were implanted. That raised many discussions at the time, because the law in force did not allow the direct discharge of treated effluent.

2.6.2 Integrated Water Resource Exploration and Control Plan for Alto Tietê, Piracicaba, and Baixada Santista Basins – DAEE / Consortium Hidroplan (1995)

This plan included the integrated analysis of all problems associated with the use of water resources in Alto Tietê, Piracicaba, and Baixada Santista Basins, for which it made a full diagnosis of the actual situation, and projections of future scenarios based on varied hypotheses. Under this plan, alternative technically supported solutions that are consistent with the reality and socioeconomically, environmentally, legally and institutionally feasible are proposed.

This plan tried to adopt an integrated view from its adjustment to the socioeconomic scenario to the design of alternatives for resolution of use conflicts in the region under study.

As we know, water resources in Alto Tietê, Piracicaba and Baixada Santista basins are interlinked by hydraulic systems constituted of Cantereira System and Billing System, where several entities involved in the use of such waters operate very often conflictive. Thus, this plan deserved the credit of seeking to establish an integrated planning for the use of such resources.

This plan aimed to settle existing water use conflicts. The, the major emphasis was placed on water availability and proposed alternatives to meet the users' demands in surveyed basins up to 2015. Some proposals we accepted, other not. Notwithstanding some eight years have elapsed, the Plan has provided useful information on the area of interest of this project.

2.6.3 Terms of Reference of the Environmental Recovery Program for the Billings Lake Basin - CPLA/SMA (1999)

In April 1997, the Government of the State of São Paulo, through its Secretariat for the Environment and Secretariat of Energy and Water Resources, created the Billings Project Management Unit. That project gave priority to the use of the Billings Lake waters for public supply, without prejudice to other uses, provided that that guideline was followed. Contents of studies developed under Billings Project are consolidated in several documents that address:

Volume 1 – Block 1- Reference Chart related to Cartography and Database, Regional Socio-demographic Dynamics, Regional Economic and Urban Development Trends, and Area Characterization;

Volume 2 – Following the Reference Chart, this volume includes the Estimate of Pollution Load Generated in the Billings Lake Basin, the Lake Characterization, and the Prospective Situation;

Volume 3 – Block 2 – Consultation and Negotiations informing on the Formal Discussion Channel Structuring, Group Contribution Systematization, and Institutional Analysis;

Volume 4 – Block 3 – Identification of Instruments for Program Feasibility, which addresses the Principles and Strategic Guidelines for the Program Feasibility, Instruments, and Preliminary Formalization of Actions and Measures;

Volume 5 – Block 4 – Summary of Proposed Actions and Instruments for the Recovery Program, analyzing the Major Problems faced by the Environmental Recovery, providing guidelines to Revert the Degradation Picture, and finally the Summary of Proposed Actions and Instruments for the Program, which include the main conclusions of studies that gave rise to the following recommended recovery actions and instruments:

- **Actions at Metropolitan Level (off-basin) – such actions include:**
  - Control of Induction to Water Source Area Occupation;
  - Reduction and Control of Pollution Affluent to Pinheiros River Channel.
- **Actions in Billings Basin – they include:**
  - Occupation Control by Inspection and Control and Adequacy of Housing Use;
  - Development of Consistent Uses and Economic Activities; Adequacy of Urban Laws and Master Plans to Environmental Recovery;
  - Environmental Protection and Development, including Re-vegetation Actions, Implantation of Parks and other Protection Areas, Control of Erosion and Sediment Production Processes, and Reservoir Management;
  - Reduction of Pollution Affecting the Reservoir by Implanting Sanitation Systems, Flood and Diffuse Load Control, Implantation of Urban Cleaning Systems, and Control of Concentrated Polluting Loads.
- **Sustainable Economic-Social Recovery - through:**
  - Development of Consistent Activities;
  - Generation of Jobs for Environmental Recovery and Development;
  - Generation of Revenues for Environmental protection;
  - Environmental Education.
- **Follow-up and Control of Program Formulation, Implantation, and Effectiveness – including:**
  - Independent Environmental Audit;
  - Development of Program Management Studies, Model, and Indicators, comprising the Management Information System, Sanitary Surveillance, and Environmental Basin Zoning;
  - Program Management Model;
  - Institutional Development.
- **Program Feasibility – through:**
  - Political Arrangements for Program Actions;
  - Raising of Funds – Financing Application Structuring;
  - Design of Proposed Legal and Institutional Mechanisms;
  - Program Continuity.

The work consisted of preparing a Term of Reference for a quite comprehensive and ambitious project, which was not given continuity but contributed significantly for the preparation of the proposed Environmental Sanitation Project for Tietê River Water Sources discussed below. That Term of Reference provides an environmental diagnosis of the area as well as information and several thematic maps that are useful for this project.

2.6.4 Environmental Sanitation Program for Tietê River Water Sources

This Program is similar to the Environmental Sanitation Project for Guarapiranga Basin, except that its scope includes all water sources in the Metropolitan Region comprising Billings, Guarapiranga, Alto Tietê (riverhead), Juqueri-Cantareira, and Cotia sub-basins. Its major objective is preserving the water sources for SPMR supply by maintaining their operating conditions, controlling and organizing the occupation of its territory, and improving the life quality of its population, particularly with respect to sanitary and housing infrastructure. The expected duration of this program is 18 years divided into 3 phases of 6 years each. For 1st phase works US$ 355,000,000 will be invested. Annex VII shows the benefited areas.

The program contents may be learned from the letter-consultation submitted to COFIEX.

The Program provides for the development of five subprograms, as follows:

Subprogram 1 - Instruments for Project Sustainability, Monitoring, Control, and Feasibility

This subprogram is divided into five items:

- Management System Implantation or Consolidation, including the design and/or consolidation of technical instruments that would allow the territory management based on an actual relation between the use of soil and the quality of its water bodies. It comprises, without limitation, the use of geographic information systems and water quality monitoring, mathematical water quality models, monitoring and inspection of soil use and occupation;
- Sanitary Control comprising, among others, monitoring and control of sewerage system quality, solid waste collection and final disposal;
- Environmental Education and Post-Work Monitoring, comprising activities of capacity building of environmental centers and NGOs, courses and seminars, and other activities focused on actual environmental education, in addition to activities of monitoring and control of operating performance of works implanted under the Project.;
- Partnerships and Social Promotion, comprising such activities as the installation of Citizenship Integration Centers, professional job training courses and initiatives and income generation, social promotion activities (assistance to unmarried mothers, minors, fight to drug, etc.);

- Project Feasibility, comprising the study and implementation of measures focused on increasing the attractiveness of project basins for private and eventually public investments consistent with water source preservations.

Subprogram 2 – Urban Structuring and Recovery

This subprogram is constituted of six main components:

- Implementation of the Emergency Plan consisting of the construction of basic infrastructure works (water supply, sewerage, drainage, paving, among others) in illegal settlements with densities above 100 inhabitants/hectare, pursuant to authorization granted by the State Law no. 9,866/97;
- Urban Recovery Projects and Works, including slum urbanization, interventions for recovery of basic infrastructure in low-income suburbs, including street regularization, construction of flood control and sewerage networks, slope retention, rehabilitation and urbanization of free or public areas;
- Projects and Works of Resettlement Housing Units aimed to provide houses to families affected by slum urbanization works, or families that must be removed from locations subject to urban or environmental risks;
- Land Regularization, comprising the start and development of legal-administrative proceedings to regularize landed estates in illegal settlements and slums;
- Monitoring and Maintenance of Interventions in Slums through environmental education activities, surveys for evaluation of receptiveness to works, and field inspections to detect deficiencies and irregularities;
- Urban Revitalization comprising the study, proposal and implantation of works and innovating urban measures, the costs of which are shared by the private sector and public sector , which would allow the occupation and use of specific basin sub-areas to be reorganized to have the power to radiate its benefits to neighboring sub-areas.

Subprogram 3 – Environmental Preservation and Recovery Actions

- Park Project and Works aimed to preserve strategic areas for environmental protection of basins, either for their aspects directly positive for water quality, or for the need to prevent risks of predatory urban use (squatting);
- Urban afforestaion, which is a component of Billings Program, aimed to expand the green area : total basin area ratio;
- Re-vegetation, especially comprising the protection of permanent protection areas by planting

native species;

- Reclamation of Degraded Areas, comprising interventions mainly to control sediments by actions focused on Rio Grande and Taquacetuba basins (both intended for public supply in the present days);
- Control of Dangerous Loads, with preventive purpose and specifically focused on roads that cross areas of the Project basins (Imigrantes, Anchieta, Régis Bittencourt, Fernão Dias, and Dom Pedro);

Subprogram 4 – Sanitation Actions (water and sewerage)

- Water Treatment Studies and Interventions comprising specialized technical studies and actions in water treatment plants, as well as direct and complementary interventions in raw water bodies;
- Expansion of Water Distribution Systems to areas deprived of such services in Billings Basin;
- Expansion of Sewerage Services, comprising collection, disposal, interception, and reversion of effluents for off-basin treatment;
- Rehabilitation of Existing Sewerage Systems, including interventions for repairs or expansion of existing structures aiming to adjust them to demands and increase the operating performance.

Subprogram 5 – Solid Waste Actions

This subprogram includes two main actions:

- Remediation of Solid Waste Disposal Areas and Implantation of Sanitary Landfills: the former activity is scheduled for all basins, while the latter is planned exclusively for Guarapiranga Basin.
- Acquisition of Equipment to renew/expand the truck fleet and other equipment used for public cleaning.

Overall operations under this project are carried out by the Management Unit (UGP) of the Secretariat of Energy, Water Resources and Sanitation of the State of São Paulo.

To finance the first stage of activities and give operational support (administrative, financial and technological) to the Executing Committee, a total amount of US$ 1,000,000 has been allocated, of which US$ 850,000 derive from a grant from Japan Fund (RHRD) of the World Bank, and US$ 150,000 were raised at local level. Procurement for selection and employment of consultant is underway. The estimated operation period is 12 months starting in August of this year.

As seen in the summary above, this project aims to implement the extremely complex - and ambitious - policy of ensuring drinking water from water sources at 63m^3/sec for a population of some 18 million inhabitants in Greater São Paulo. To achieve this objective, adopting a high-quality

comprehensive technology is necessary.

According to the Terms of Reference ("TOR") prepared by the Management Unit for bidding purposes, the consultant's activities will comprise the execution of general operations for the World Bank loan. As mentioned in TOR, most technical operations is scheduled for the short period of 4 months, where project review, analysis, and selection required in TOR will be all operations likely to be carried out performed, as formulating a Guiding Plan that is based on local detailed information and adequate to the basin proves impracticable.

Consultant's operations during the term of the agreement financed by the Japan Fund, as indicated in TOR, may be restricted to the need of implementing the environmental and sanitary preservation program for Tietê River Basin water sources, overall planning, and operations scheduled for the first stage of activities. Concomitantly, it will be necessary to plan several operations and prepare several documents for the World Bank loan.

Because of the importance and scope of this program, it requires a detailed explanation of each item in the request to be submitted to the World Bank to assist the Management Unit, in the format required by the Bank. The term of the agreement with the consultant will be one (1) year, however technical operations should be completed in up to 4 months.

The main operational items are summarized as follows:

Report on the need of implementing the Program, taking into account the environmental, urbanization, and social problem perspectives.

Definition and reconfirmation of detailed targets, assessment of environmental, social, and urbanization impact, confirmation of the importance of each item for the achievement of overall program targets, reconfirmation of operational costs, detailed budgeting, confirmation of financing sources, etc.

Analysis of the quantitative or new model establishing a relation between land use and water quality, as well as other variation factors, such as the environmental impact likely to occur during the project implantation and introduction of simulation model establishing the preferential order of works, environmental monitoring plan, etc.

Assistance to the Managing Committee for the design of a detailed activity program that would include the definition of priority works, preparation of a financial cost schedule, surveys, implantation of works, etc.

Based on the World Bank recommendations, evaluation of financial feasibility program implementation.

Preparation of report on the environmental impact of Program.

Preparation and analysis of documentation related to the operation contract, cooperation/agreement between entities, procurement, etc., preparation of the Program Management Manual similar to that prepared for Guarapiranga Lake Project.

Assistance to the Management Unit, as required by the World Bank, for preparation of material needed by technical and financial sectors, presentation in general public meetings, participation in discussions held by the State Environment Council, Basin Committees, etc., etc.

Preparation of the following reports: Project Design Report, and Project Evaluation Report.

The Billings Lake poses as an important water reservoir together with Tietê riverhead and Guarapiranga Lake, and it is expected that some 95% of total investments will be allocated to those basins.

For the city of São Bernardo do Campo, funds for carrying out the activities will be allocated by the municipality.

Table 2.6.1 shows the general costs of the 1st stage of works and their respective financing sources. However, values appearing in this table will be reviewed for variations in the exchange rates.

Table 2.6.1 Project Cost and Source of Funds (US$ million)

SOURCES	1ª PHASE							
	Pre- Investment (*)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
External sources	7.6	13.9	26.3	29.7	32.5	38.9	29.0	177.7
Internal sources								
1. State's Counterpart	0.4	1.6	2.9	2.8	3.6	4.7	2.9	18.9
2. CDHU Counterpart	0.0	0.3	2.9	2.8	2.3	5.6	2.0	16.0
3. SABESP Counterpart	0.4	4.4	8.7	10.4	10.5	11.9	11.8	58.2
4. SPMG Counterpart	5.6	3.2	7.7	9.6	11.0	9.3	10.7	57.0
5. SAMG Counterpart	0.0	0.1	1.4	1.3	2.0	3.1	0.7	8.6
6. PMSBC Counterpart	0.1	0.2	2.3	2.3	3.7	5.1	2.0	15.7
7. DMG Counterpart	0.0	0.1	0.5	0.5	0.8	1.0	0.5	3.4
Subtotal	6.5	9.8	26.4	29.7	34.0	40.7	30.6	177.7
Total	14.1	23.7	52.4	59.4	66.5	79.6	59.6	355.5

Source: COFIEX Consultation Letter of January/2003 (not sent to COFIEX yet)

Note: Adopted exchange rate: US$ 1.00 = R$ 3.20

(*) To be estimated by the financing institution

Project Cost per Expenditure Category (US$ million)

Expenditure Category	Pre-Investment (*)			Years 1 - 6			Total		
	External Loan	Counter-part	Total	External Loan	Counter-part	Total	External Loan	Counter-part	Total
1. Works	4.7	5.8	10.5	118.0	144.2	262.1	122.7	149.9	272.6
2. Goods	0.0	0.0	0.0	2.0	2.4	4.4	2.0	2.4	4.4
3. Projects	1.2	0.2	1.4	18.1	3.2	21.2	19.3	3.4	22.7
4. Studies	1.3	0.2	1.5	15.4	2.7	18.1	16.7	2.9	19.6
5. Environ. & Fiscal Education	0.0	0.0	0.0	8.7	10.6	19.3	8.7	10.6	19.3
6. Manage-ment	0.6	0.1	0.7	13.8	2.4	16.3	14.4	2.5	16.9
Total	7.2	6.3	14.1	175.9	165.5	341.4	183.7	171.8	355.5

(*) To be evaluated by the financing institution

Investments per Program – Sub-Basins (US$ million)

SOURCES	1st PHASE							
	Pre Investment (*)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Guarapiranga	11.7	14.4	21.0	21.6	23.1	21.9	18.0	131.9
Billings	2.4	6.1	28.5	34.7	40.6	55.0	38.9	206.2
Other Sub-Basins	0.0	3.1	3.1	3.1	2.8	2.6	2.6	17.4
Total	14.1	23.7	52.7	59.4	66.5	79.6	59.6	355.5

(*) To be evaluated by the financing institution

The Program Consultation Letter, which is a document indispensable for technical preparation and negotiation of international loan, was subject to a first evaluation by both SEAIN – Secretariat of International Affairs of the Ministry of Planning, and COFIEX – External Financing Committee (a forum subordinated to SEAIN, which includes representatives of the economic ministries and Central Bank) in 2001, where its merit was approved. However, due to the need of adjusting the indebtedness capacity of some borrowers, and to the change of the project time, which had been previously scheduled for three 4-year stages and was changed to three 6-year stages, that Consultation Letter is under review for resubmission to COFIEX / SEAIN. If ratified, a loan application will be forwarded to IBRD.

2.6.5 Other Existing and Ongoing Studies, Projects and Plans

Alternative solutions for depleting the area deserve a thorough evaluation of implemented and ongoing programs at SABESP, among which Guarapiranga Program, Tietê Project, and Water Source Program should be mentioned.

The following are reference document indispensable for the development of work:

- Revised and Updated Sewerage Master Plan for SPMR – Consortium Engevix-Latin Consult 1997 – SABESP;
- Revised and Updated Water Supply Master Plan for São Paulo Metropolitan Region – Consortium Encibra-Hidroconsult 2004 – SABESP;
- Integrated Regional Plan – Consortium Cenec-Cobrape-JNS 2002 – SABESP;
- Studies and Executive Projects of Meninos ME, Ipiranga, and Bispo César D´accorso Trunk Collectors – Encibra – SABESP;
- Study and Executive Project of Couros Jusante Trunk Collector – Sondotécnica
- Survey and “as built” projects of Meninos ME, Ipiranga, dos Lima, and Bispo César D´accorso

Trunk Collectors – CCC Construtora - Contract 31,537/96 – SABESP;

- Survey and "as built" projects of Couros Jusante and Taboão Trunk Collectors – Consortium Stemag-RGM-Condic - Contract 31,544/96 – SABESP;
- Management Reports of actions developed in the municipality of São Bernardo do Campo – MSE Department of Engineering-South;
- Emergency Plan for Water Source Recovery ion São Paulo Metropolitan Region. Decree no. 43,022/98 – Government of the State of São Paulo;
- Prioritizing the Sanitation in the State of São Paulo - SABESP - SEADE / 1999;
- Preliminary Technical Report of Sewerage System. Municipal Government of São Bernardo do Compo. Geotécnica S.A. July/1997.
- Billings 2000. Participative Socioenvironmental Diagnosis of Billings Hydrographic Basin. Instituto Socioambiental –ISA. March/2002.
- FIBGE Demographic Censuses of 1970, 1980, 1991 and 2000;
- FIBGE Population Count, 1996;
- Strategic Planning of SABESP and MS - Business Unit-South;
- SABESP Institutional Policies;
- SABESP Business Policy;
- Completed and contracted Sectorization Studies at MS - Business Unit-South;
- Municipal Master Plan;
- Studies Associated with SPMR Rodoanel (Ring Road);

In addition to documents above, studies and data available in several public or private entities should be referred to, such as:

- Municipal Government of São Bernardo do Campo, through its Secretariats and Departments, where general information on sanitation, zoning, constructed areas, urban interventions, and others may be obtained.
- SRHSO – State Secretariat of Water Resources, Sanitation and Works
- EMPLASA - Empresa Metropolitana de Planejamento da Grande São Paulo (Greater São Paulo Metropolitan Planning Company)
- SEADE - State Data and Statistics Analysis System Foundation

- DAEE - Water and Electric Power Department
- CETESB - Companhia de Tecnologia de Saneamento Ambiental (Environmental Sanitation Technology Company)
- IBGE - Brazilian Geography and Statistics Institute
- SMA - State Secretariat for the Environment
- Basin Committees, Mayor Assembly, Non-Governmental Organizations, etc.

2.7 Future Additional Electric Power Generation at Henry Borden Hydroelectric Plant

In 2001, Empresa Metropolitana de Água e Energia (Metropolitan Water and Energy Company) – EMAE published the Notice of Procurement EMAE no. CC-2001/001 for the future sale of additional electric power (280 MW in average), subject to the improved quality of waters flowing to Pinheiros Canal, which would enable a volume of water compatible with the additional electric power production by Henry Borden hydroelectric plant to be pumped.

To achieve this target, the treatment of 50 m^3/sec of waters flowing to Pinheiros Canal and the reversion of such waters to the Billings Lake were scheduled. This would allow the generation of an average of 298 MW, additionally to the average 108 MW currently produced, 18 MW of which would be consumed by EMAE pumping stations.

Said treatment included the use of a technology based on the joint and sequential application of coagulation/flocculation and flotation techniques used by WTP (Water Treatment Plants) and, more recently, by STP (Sewage Treatment Plants). Such treatment plants would be implanted in the actual water course beds. Flotation mud would be removed by surface dredging technique.

The general framework provided for the implantation of seven treatment plants, three of them in Pinheiros River, ands the other four at the mouth its largest tributaries.

That is a controversial project that has raised question about its efficiency and the operational control of such plants in the period of floods in Pinheiros River. It is feared that the treatment might not be sufficiently efficient to remove nutrients, which is the major problem at the Billings Lake.
It has been reported that a pilot plant with treatment capacity for 10m^3/sec is under construction adjacent to Pedreira Pumping Station, close to the Billings Lake.

Chapter 3

CURRENT STATUS OF MUNICIPALITIES INVOLVED IN THE LAKE BILLINGS BASIN

3. CURRENT STATUS OF MUNICIPALITIES INVOLVED IN THE LAKE BILLINGS BASIN

3.1 Socioeconomic Status

Table 3.1.1 shows the magnification distribution over the minimum wage of family income per one person in the ABC area, and expresses residents' abundance. According to this, it can be said that Santo Andre and SBC are in the almost same level in affluence in the Billings Lake basin.

Table 3.1.1 Distribution of magnification over the minimum wage of family income

	Salário Mínimo – SM (%)				
Município	Ate 1	1 a 3	3 a 10	mais de 10	sem rendimento
San Caetano Do Sur	9	33	43	14	1
Santo Andre	18	39	31	8	4
SBC	20	37	30	8	5
Ribeirao Pires	24	4	23	3	5
Diadema	28	46	18	2	6
Maua	31	45	16	1	7
Rio Grande da Serra	41	40	10	0	9

Source: "Compêndio Estatístico 2004", Prefeitura do Município de São Bernardo do Campo, pp.20

Table 3.1.2 Index of Educational Medical Treatment (SBC City)

	Birth rate (%)		Infant mortality rate (/1,000)		Ave. Life	Literacy	High school going rate (%)
	1996	2002	1996	2002	2000	2000	2000
Sao-Paulo state	20.04	16.57	22.74	15.04		93.9	
Sao-Paulo metropolitan area	21.89	17.95	23.84	15.27		94.8	
The ABC area	19.63	15.31	19.16	14.41		95.1	
Sao Paulo	21.65	17.57	21.62	15.10			
SBC	20.36	15.86	21.33	14.08	69.93	95.4	37.2
Santo Andre	17.65	13.96	21.20	15.04		95.8	
San Caetano do Sur	14.17	11.45	15.02	11.29		97.2	
Diadema	27.08	20.54	21.27	16.89		93.8	
Maua						94.0	
Ribeirao Pires						95.0	
Rio Grande da Serra						92.4	

Source: "Compêndio Estatístico 2004", Prefeitura do Município de São Bernardo do Campo, pp.29 &, 37

According to the employment data of the worker in all the industry for the past 20 years, while that of industrial sections are decreasing in number, it turns out that the worker of service shows the upward tendency. Due to the site condition of SBC close to the Santos port which is an accumulation port of wood, furniture stores and wood working industries have been prosperous for many years, and have furniture specialty stores and small workshops in the city. Moreover, there are the features that foreign affiliated automobile assembly factories are concentrating, metallurgical industries are occupying the higher rank of the industrial section even now, and a lot of clothing manufactures/sewing factories is found in the city.

The unemployment rate has been increasing for the past four years with the change of the industrial structure of SBC.

Table 3.1.3 Transition of unemployment rate (SBC city)

	2000	2001	2002	2003
Unemployment rate	17.1%	17.9%	18.1%	20.3%

Source : "Compendio Estatistico 2004"

In the Billings Lake basin of SBC, as shown in **the attached data A3.1.1**, there is much automobile industry.

3.2 Financial situation

3.2.1 Scale of public finance of the municipalities relevant to the Billings Lake basin

The scale of public finance in the fiscal year 2002 for the municipalities relevant to Billings Lake is shown in **Table 3.2.1** and **the attached data A3.2.1** as well. However, since the scale of Sao Paulo excels about 10 times of SBC, it is not shown in the **Figure 3.2.1**.

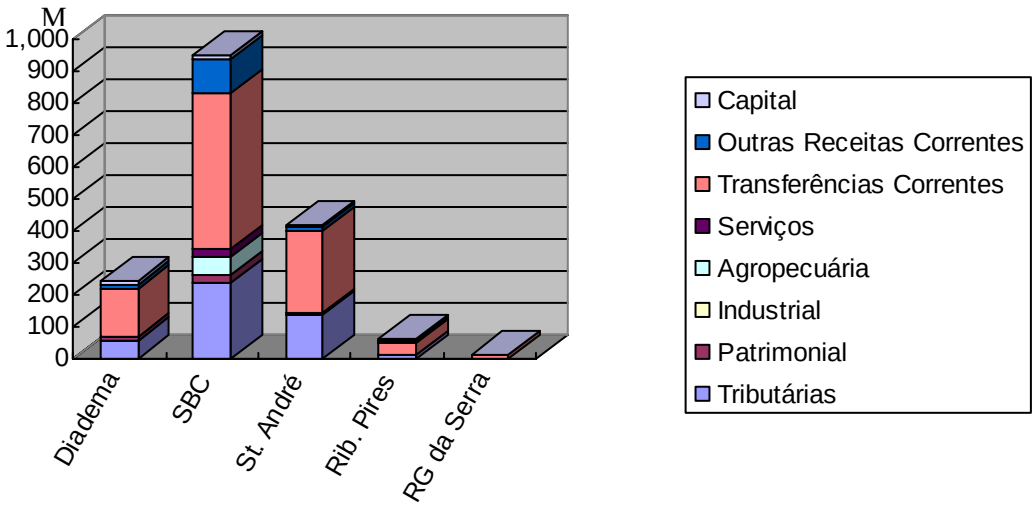


Figure 3.2.1 Scale of finance of the municipalities relevant to the Billings Lake(2002)

According to **Table 3.2.1**, when the revenue scale of SBC is set to 100, that of each municipality will become as Santo Andre 43, Diadema 27, Ribeirao Pires 6, and Rio Grande da Serra 2. Comparison of annual revenue per citizen shows, though Rio Grande da Serra and Diadema do not much differ from each other, that SBC has twice as much as annual revenue. Financial force of SBC is very large to exceed Sao Paulo greatly and it shows that the social economy status has big influence on the financial.

Table 3.2.1 Financial force of the municipalities relevant to the Billings Lake

	São Paulo	Diadema	SBC	St. André	Rib. Pires	RG da Serra
Accomplished Budget Incomes 2003 (Million Real)	10,920.77	285.97	1,073.53	464.33	65.18	16.85
Revenue Scale (SBC=100)	1,017	27	100	43	6	2
Population 2002	10,434,252	357,064	703,177	649,331	104,508	37,091
Per Capita Revenue (Real)	1,047	801	1,527	715	624	454
Gross Domestic Products 2002 (Million Real)	26,669.44	616.29	11,362.10	1,194.14	53.40	9.39
Per Capita GDP 2002 (Real)	2,556	1,726	16,158	1,839	511	253

Source: IBGE

3.2.2 Financial Status of SBC

Table 3.2.2 shows the budget for fiscal 2005 of SBC. The annual income in the fiscal year of 2005 has been estimated to be approximately 1,300 million real (691 million dollar), and the main income sources are circulation tax, fixed property tax, automobile tax and return fund from the federal government and the state government. On the other hand, annual expense has balanced the income as the 1,300 million real (691 million dollar). Thus, SBC city financial circumstances are healthy and investment for public works etc. is possible.

Transition of the peculiar profit in 2001 - 2004 has been maintained in a higher level which was 43.31% in 2001, 50.48% in 2002 and 48.76% in 2004. (It is based on the financial situation for the past four years of SBC shown in **the attached data A3.2.2**)

In particular, though the rates of a goods service circulation tax (ICMS) in 2001 was 37.07% of all annual revenue, it came out 32.58% in 2003. The fall of the amount of on the face value was covered by the increase in the peculiar profit.

Although there was some depression by reduction of annual revenue in 2002, investment of the city which was only 16.66% of the expenditure total in 2001, increased in the fiscal year 2004 to 23.79%.

Table 3.2.2 Budget for the fiscal year of 2005 in SBC

Division	Description	Amount	%
(1) Division of annual revenue			
Estimated revenue		1,301,338,000	100.00
Current profit		1,171,033,000	89.99
Tax revenue		443,403,800	34.07
	IPTU (Land and buildings tax)	162,819,000	
	ISSQN (Service tax)	172,388,000	
	ITBI (Lifetime transfer tax)	10,800,000	
	Public charges	42,318,800	
	Other incomes	55,078,000	
Contribution		15,740,000	1.21
Asset income		16,293,800	1.25
	Return on investment	8,120,600	
	Other incomes	8,173,200	
Industrial income		11,400	0.00
	Profits from public utility	0	
	Other incomes	11,400	
Service income		7,098,200	0.55
	Public health service	0	
	Other incomes	7,098,200	
Current transfer		549,931,400	42.26
	ICMS (Goods service circulation tax)	377,758,000	
	FUNDEF Deduction of (basic education maintenance development fund)	(61,743,600)	
	IPVA(Automobile possession tax)	55,899,000	
	FPM (City participating fund)	21,000,000	
	ICMS for Export	0	
	FUNDEF	76,099,000	
	Other incomes	80,919,000	
Other current profits		138,554,400	10.65
	Fines and delayed interest	35,780,800	
	Account receivable	51,869,000	
	Other incomes	50,904,600	
Capital income		130,305,000	10.01
	Margin transaction	87,675,000	
	Assets disposal	97,000	
	Capital transfer	42,533,000	
	Other capital incomes	0	
(2) Division of annual expenditure			
Total Expenditure		1,301,338,000	100
Current expenses		945,318,000	72.64
	Cost	456,814,000	35.1
	Labor cost	463,101,000	35.59
	Subsidy and contribution	1,410,000	0.11
	Payment requisition sheet	5,943,000	0.46

	Debt business	18,050,000	1.39
Capital expenditure		246,234,000	18.92
	Construction and facility	180,045,000	13.84
	Instrument	34,351,000	2.64
	Debt refund	7,980,000	0.61
	Payment requisition	23,631,000	1.82
	Other expenditure	227,000	0.02
Contingency		24,000,000	1.84
Fund transfer		85,786,000	6.59

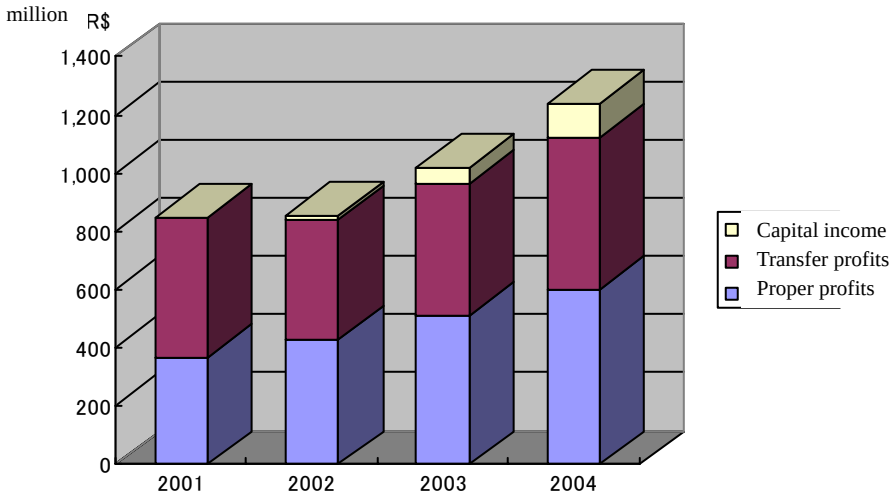


Figure 3.2.2 Annual revenue of SBC

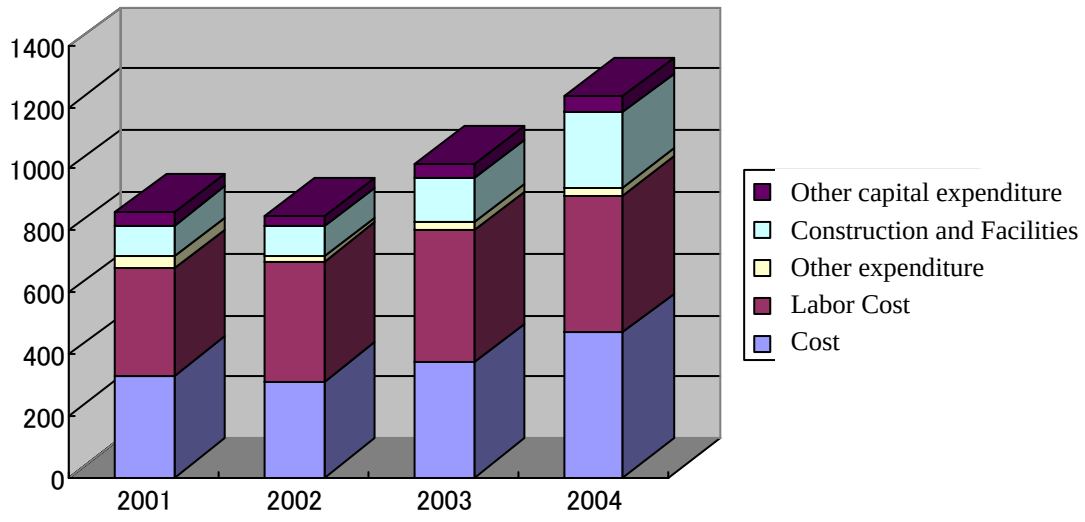


Figure 3.2.3 Annual expenditure of SBC

3.2.3 Eligibility of direct loan based on fiscal responsibility law

A fiscal responsibility law aims at maintenance of the financial order of a state or a city.

- Set of upper limit for the labor cost and debt in each state and city
- Prohibition of compilation of budget for a new business, without reservation of the source of new annual revenue, or reduction of previous annual expenditure.
- Preparation and obligation to publicize of balance sheets and financial reports

About qualification of loan (Endividamento) based on the fiscal responsibility law (Lei Resposabilidade Fiscal) of SBC, as shown in **Table 3.2.3**, being settled in the limit specified in Article 22 unary of the supplementing regulation No.10 dated May 4, 2000 is seen.

Table 3.2.3 Limit based on fiscal responsibility law of SBC city

(1) Labor cost

	2001		2002		2003		2004	
	Amount	%	Amount	%	Amount	%	Amount	%
Revenue Total	845,898,226	100.00	855,812,993	100.00	967,682,272	100.00	1,121,156,958	100.00
Personnel Expense	373,795,837	44.18	378,669,276	44.25	397,626,087	41.09	435,589,409	38.85
Limit for precaution (54% of 95%)	433,945,790	51.30	439,032,015	51.30	496,421,005	51.30	575,153,519	51.30
Legal limit	456,785,042	54.00	462,139,016	54.00	522,548,426	54.00	605,424,757	54.00
Net cost of non working persons and pensioners	55,893,015	6.60	59,977,101	7.01	74,247,898	7.67	71,534,122	6.38
Legal limit (12%)	101,507,787	12.00	102,697,559	12.00	116,121,872	12.00	134,538,835	12.00

(2) Debt limit

Division	2003	
	Amount	%
Net current revenue	967,682,272.15	100.00
Net tax liabilities	33,794,134.75	3.49
Limit (a resolution 40th / No. 2001)	1,161,218,726.58	120.00
Margin transaction (except for budget income borrowing in advance)	0.00	
Limit (a resolution 43rd / No. 2001)	154,829,163.54	16.00
Budget income borrowing in advance (ARO)	0.00	
Limit (Resolution 43rd / No. 2001)	67,737,759.05	7.00
The highest annual expenditure		
Annual expenditure for fixed bonds	11,324,071.23	1.17
Limit (a resolution 43rd / No. 2001)	111,283,461.30	11.50

(3) Primary achievements

Detail	2001	2002	2003	2004
Net budget income (A)	829,895	832,331	1,004,449	1,226,103,546
Current profit	830,954	841,298	936,332	1,124,213,466
Capital income	13,052	10,594	53,455	111,827,404
(-) Deduction	18,159	19,561	12,338	9,937,325
Margin transaction	311	5,642		3,963,749
Payment balance cancellation				
Return on investment	16,980	13,919	12,338	5,973,575
Privatization and/or disposition of assets				
Net budget expenditure (B)	795,925	803,670	956,519	1,166,442,277
Current expenses	681,617	702,014	800,378	894,599,130
Capital cost	126,418	113,109	168,910	284,381,543
* Accidental fund transfer				
(-) Deduction	20,453	11,453	12,769	12,538,395
Debt refund	2,524	2,543	4,231	5,409,111
Debt expenses	6,056	6,135	7,093	7,129,284
Paid in security purchase				
Payment balance cancellation (except for the former)	3,530	2,775	1,445	
Primary result (A-B)	33,970	28,661	47,930	59,661,268

Calculation of primary result is made according to the federal Senate parliamentary resolution No. 78/98, and the Notice No. 6749 of the Brazil Central bank.

According to the Tiete River water resource area environmental preservation program of the World Bank, Diadema and Santo Andre are classified into the direct loan debtor of the World Bank as well as SBC, and have satisfied the restriction of the fiscal responsibility law.

3.3 Issue of irregular residential area

(1) The general status of residents move

According to the housing environmental agency of SBC city, housing relocation work has been made by the reasons of hazardous condition such as landslides or floods, or the reasons of social projects implementation such as roads and flood control reservoir.

Although the alternative apartment was built and provided with close to the area of original households in these cases, a part of this expense utilized the fund of the Morar melhor project constituted from the federal government and the city. In addition, as soon as apartments which are constructed by a partial financing from federal savings bank along the Joan Café Filho street will be completed, the families subject to relocation due to the road expansion work are expected to move into the apartments.

Houses demolished for the moves are generally irregular shabby ones which are made by trespassing. It is difficult for them to buy new houses due to low income.

Water service, electrical and electric equipment, etc. which are the minimum necessaries required for a life are furnished to the new apartments, and the most important thing is the apartments are authorized to live by city administration.

According to city administration personnel, the residents are not gratuitous but monthly installments system which is balanced with resident's income level along with some financial aid of the city is introduced. Since the city loan is taken, the resident is forbidden to sell it to others arbitrarily. The personnel of habitation and environmental agency shall perform the aid which organizes an association and a self governing body of the area by the time they can support their own completely.

There were not confirmed any irregular houses of category 1 in the normalized area by the manner of TAC method (housing conformity agreement) such as Jordin Pinheiros area and Feimizuho area, which were under control of a civic organization, a city, and environmental Secret Service. Strong request to normalize the area was submitted to the city from some un-normalized area that includes category 1 houses partially, even if residents would share the cost of moving out to the normal houses.

According to city administration, steadfast data do not exist about the number of residents which lives in the 1st category. However, it is presumed that about 500 families reside in this zone.

According to city personnel, strong request of improving irregular state and to have better life environment are seen in the residents owing to culture movement about the importance of the environmental preservation performed through the regional organization in the environmental preservation area is felt. Therefore, city personnel understand that move out of the residents who live in the first category and hazardous spot would not become public problems in the implementation. The residents themselves who live in these zones wish to make their households regular and to realize better living environment.

(2) Experience regarding the residents move in the project of Reservatorio de Guarapiranga basin of the World Bank loan

In the talk of the loan project-management secretariat Mr. Yamazaki of the World Bank, in the Reservatorio de Guarapiranga basin project, although the move of at least 1,000 families was implemented in the first stage among irregular population of about 17,000 families, no problem had occurred in the move. It is because they were recognizing themselves to have had no legal basis to fight against authority. On the contrary, an irregular resident said as mentioned above that desires to live in regular households by assistance of the city or the state government are very strong among them, and most desires move to such house. While, there were a lot of dialogs with the resident behind the scenes, spending many days to get their understandings. And of course, considerable investment was required for the background of the successful move in this way. Incidentally, the

expense of US$4,000-5,000 per family was required for urbanization construction of the favela of the Reservatorio de Guarapiranga basin. The move at other points (not the original location) took the cost of US$20,000 per family. The expense of this case was 50% beyond the initial budget.

(3) The example of the formation of an eco-city in the existing irregular residential area by SBC

The cases of Jordin Pinheiros and Empreedimento Feimizuno are taken up as such irregular area. In this area, residents were sued for the irregular real estate.

In the resolution, by statutes 9.866/97, obsolescence 43.022/98, and also the CONSEMA (state environmental council) resolution of 20/98, operating adjustment (so called TAC) was attained between residents, the city, and the environmental Secret Service to reach the following agreements.

Subject resident organization observes the following items.

- Environmental education shall be continuously implemented including children and youth.
- Dumping of wastes shall be strictly forbidden in the specified protective area, and the effective land use corresponding to the environment shall be organized and implemented.
- Waste collection shall be strengthened under the monitoring and reuse shall be promoted as much as possible.
- About 45% of pavements shall be reconstructed as rain infiltrating type, and foresting shall be implemented to decrease the direct drainage.
- Each house will be monitored and supervised to keep one family for one house to avoid densification and prevention of residential area expansion.
- The area which is equivalent to about 30% of the residential area within the Billings Lake basin shall be purchased for compensation measure to transfer the area to the preservation area.

City administration promises to keep the following stipulations;

- In order to prevent expansion and densification of a residential area, it superintends periodically the subject area.
- When there is a complain or claim about the above, management supervisor shall be dispatched immediately to settle the problem.
- Staffs, material, etc. shall be offered for progress of environmental education for the resident.
- Construction supervision for the facility such as permeable pavement shall be

conducted.

- Construction of suitable collection network and treatment plant for sewage shall be implemented by the city or with participation of resident.
- The plan of rationalization or normalization for the road shall be submitted to proceed.
- Construction of storm water and drainage system shall be advanced.
- Permeable road pavement and land slide protection work shall be implemented.
- The environmental standard of area of preservation for each house shall be disclosed.
- Priority for the commercial activity shall be given to resident within the limit of 1% of housing area. (No. of shops/no. of houses)

Regarding Jordin Pinnheiros area, the city implemented sanitary sewer construction and residents shouldered construction cost of the treatment plant. In Feimizuho, the sewage is treated in another basin.

It has been encouraged by the city to promote creation of the environmental residential area by means of citizens' participation in various places in the city other than those 2 areas. Such activity extends construction of storm water drainage facility, sewerage, ecological walking pass, tree planting campaign, and monitoring the illegal settling.

Although many irregular residential areas are still left in the Billings Lake basin of the city, such areas are changing to ecological residential area now.

(4) The example of normalization of the first category irregular residence

The cases of Jordin Detroit and Cullmenha are taken to explain instances in which the irregular housing clusters (favela) were developed in the preservation zone (the first category) in SBC.

The population of these two favelas was 2,700 persons built up along the Alvarenga stream with the poor sanitary status. The areas had problems of flooding at the heavy rainfall, deposited a lot of garbage, rats and no streetlight. The street was pitch-black at night and violence thrived over the areas

(Process of reform)

In 1997, the city applied for the economic aid from PROINFR program to the federal savings bank.

The city investigated residents' society and economic conditions after conference with residents on this matter in 1998.

Since the land price of this area was very high-cost, it was economically impossible to move out 614 families to other areas. In order to solve this situation, the approach of urbanizing the favela

was adopted.

After consultation with Secret Service regarding the measure that enables to urbanize the favela in the first category zone legally, the authority permitted it on the conditions that the city and residents would implement environmental countermeasures such as environmental education, afforestation, construction of recreational open space, pavement of the roads and treatment plant construction.

It was a judgment of Secret Service to approve urbanization of the area, which would be the only solution since many residents were already in the place.

Since these 614 families needed to leave the house temporarily for construction work for urbanization, they were made to transfer to rickety huts. During this period, the people were instructed to make a part of family participate in the construction work. Social supporting activity and environmental education for them were also made strenuously.

The cost for the urbanization work and the construction of the barracks/ subsequent actual houses were supported by the various department of the city. Promotion of environmental education and classified waste collection were advanced by participation of residents and NGO simultaneously.

(Result)

Deliberations between environmental Secret Service and the city/residents resulted in making this regulatory authority bear a new role. That is, the role of arrangement for getting environmental destruction under control.

Instruction of use of the material which improves infiltration of rainfall in paved roads and planting lawns became important teaching materials for environmental education for transmitting the concept of water recycle and preservation of water resource basin.

Moreover, collection of waste became easy by the improved road network by urbanization, and that also enabled commercialization of waste recycling. All of the 614 favelas became houses built of bricks matching the neighboring street scenes.

Potable water and power were formally supplied in the area. Discharge of rain fall was made to the drainage channels avoiding landslides and hygiene problem.

It was a significant event that secured the citizenship of 2700 resident by the normalization of the area in which mail delivery, shopping by bank cards, vehicle transportation got started with decrease of crime rate.

(Comment)

Residents who lived in the first category area have been continuing the life in exactly the same

place with the improved residential conditions compared with before. Only a part of the residents who lived in the dangerous area was moved to new places. The decision of this urbanization was made by consensus in residents meeting. After this normalization, the area has been getting better by their efforts.

The agreement assigned between Secret Service, the city and residents suggested the legal and technical possibility of the measure against environmental preservation under such a special situation, and became the force to proceed the argument on a preparation of a statute for the Billings Lake basin. Now, not only this urbanized area but the residents around the area have cooperated towards implementation of separated refuse collection.

Moreover, the minimum income program was also introduced into the home of low income raising children. According to city administration, there was no need for compensation to the residents in urbanization construction, since the houses were small and made of timber which made possible to utilize supplied material by the city for reconstruction of new houses. Points were that new houses were constructed at the same location of old one as before with definitely better environment.

The favela urbanization procedure adopted in this area will be applied to implement four more favela improvements in Jardin Detroit and Calmenha as well by the loan program of the World Bank.

The irregular habitation of 75 is confirmed and their population is presumed to be around 250,000 in the SBC around the Billings Lake basin.

Furniture, rubber products, auto-parts, electric appliances, cement manufacture, plaster work, and ink factory are the main industries in the SBC city. Sewage from these industries is generally little as a result of recycling activity in each company and sewage treatment is also in good state, since CETESB has been monitoring the industries and controlling the sewage discharge to the Billings Lake basin severely.

3.4 Sanitary facilities

This chapter describes current status of municipalities involved in the Lake Billings basin in connection with the sanitary facility for households and factories except for the sewerage system. Sewerage systems are existing and in operation in four areas in the Lake Billings basin

1) Riacho Grande system (SBC): 12 L/s = 1,037 m^3/day

2) Pinheirinho system (SBC): 7 L/s = 605 m^3/day

3) Ribeirao Pires system (Ribeirao Pires): 44 L/s = 3,802 m^3/day

4) Rio Grande da Serra system (Rio Grande da Serra): 12 L/s = 1,037 m^3/day

3.4.1 Existing Condition of Sanitary Facilities

The sanitary facilities status in the related municipalities in the basin is made clear in the former national census in 2000. **Table 3.1.4** shows the data regarding population and sanitary facility in the Billings lake basin.

There was a population of 863,000 in the basin in 2000. Population of Sao-Paulo city occupies the 54%. Subsequently, SBC occupies 22% and Ribeirao Pires occupies 10%. When the population is classified according to the type of sanitary facility in this basin, it is possible to make three rough classifications. Namely, sewerage connection including storm sewer connection, septic tanks including infiltration type pit and direct discharge to the outside of house hold. Approximately 400,000 people (about 46%) had connection with sewerage service. Approximately 360,000 people (about 42%) were using the septic tank including infiltration type pit. Remaining 100,000 people (about 12%) were direct discharge.

It is emphasized that the rate of sewerage connection was comparatively high in this data. Sewerage connections do not necessarily mean conveyance sewage to some sewage treatment plant, but direct run off to rivers or lake by pipelines. Pollution load flows into the Billings Lake in this case. The sewage treatment amount by some sewage treatment plants is approximately 6,481 m^3/day in a daily average base, and the rate of sewage treatment is rather low compared with the total sewage generation in the basin. Although the degree of superannuation of sewers might be a problem, about 46% of direct sewage discharge can be reduced by using these sewers to transfer the sewage to the sewage treatment plant. Since the data is also including connection with storm sewers, cautions will be required when plans are made for the pipeline to collect sewage toward sewage treatment plant. This is considered to become an important point in the efficient sewerage facility construction plan in the Billings lake basin, as it is concerned with the route choice, construction cost and efficiency of the facility.

Table 3.4.1 Current status of sanitary facilities in the Billings Lake

	Total	Rede geral de esgoto ou pluvial	Fossa séptica	Fossa rudimentar	Vala	Rio, lago ou mar	Outro escoadouro	Não tinham banheiro nem sanitário	Remarks
São Paulo									
Household(nos.)	127,804	42,593	28,647	30,121	10,258	11,178	4,242	765	
Equivalent Population	469,041	156,318	105,133	110,544	37,647	41,023	15,568	2,808	
Share(%) in basin	54.3	33.3	22.4	23.6	8.0	8.7	3.3	0.6	
Diadema									
Household(nos.)	16,295	10,949	2,364	1,350	405	792	357	78	
Equivalent Population	59,804	40,184	8,676	4,955	1,486	2,907	1,310	286	
Share(%) in basin	6.9	67.2	14.5	8.3	2.5	4.9	2.2	0.5	
São Bernardo do Campo									
Household(nos.)	52,272	31,829	8,002	4,628	2,741	3,950	767	356	
Equivalent Population	188,181	114,583	28,807	16,661	9,867	14,220	2,761	1,282	
Share(%) in basin	21.8	60.9	15.3	8.9	5.2	7.6	1.5	0.7	
Santo André									
Household(nos.)	6,889	396	320	2,331	52	3,051	318	421	
Equivalent Population	25,283	1,453	1,174	8,555	191	11,198	1,167	1,545	
Share(%) in basin	2.9	5.7	4.6	33.8	0.8	44.3	4.6	6.1	
Ribeirão Pires									
Household(nos.)	23,561	18,307	1,938	1,233	633	1,188	180	82	
Equivalent Population	86,470	67,187	7,113	4,525	2,323	4,360	661	301	
Share(%) in basin	10.0	77.7	8.2	5.2	2.7	5.0	0.8	0.3	
Rio Grande da Serra									
Household(nos.)	9,723	5,769	1,591	658	1,021	579	79	26	
Equivalent Population	34,225	20,307	5,600	2,316	3,594	2,038	278	92	
Share(%) in basin	4.0	59.3	16.4	6.8	10.5	6.0	0.8	0.3	
Grand Total									
Total(nos.)	236,544	109,843	42,862	40,321	15,110	20,738	5,943	1,728	
Equivalent Population	863,004	400,032	156,503	147,556	55,108	75,746	21,745	6,314	
Share(%)	100	46.4	18.1	17.0	6.4	8.8	2.5	0.7	

Rate of sewerage connection in the entire Billings basin including storm water

3.4.2 Classification of sanitary facilities

Sanitary facilities are classified into the following six types. Configurations and structures are shown in **Table 3.4.2**.

1) Sewerage Connection (Rede Geral)

Although it shows having connected with some sewerage system, it does not necessarily mean sewage treatment in the sewage treatment plant. Except for the 4 areas which have sewage treatment plants as stated above, sewage is discharged untreated. It becomes the cause of public waters contamination.

2) Septic Tank (Fossa Septica)

To install septic tank is prescribed by law in the zone which is not connected to sewerage. For this structure, laying brick or concrete block has been used traditionally. Direction has been made to use impermeable material and structure to avoid leakage of foul water from tank. Septic tank with anaerobic filter or infiltration well can be observed in the area, although one chamber type septic tank is dominating. Overflow from septic tank is discharged to the water body or sub-ground by infiltration. Non-fecal home drainage is drained by the direct discharge to the outside.

3) Pit Toilet with Infiltration (Fossa Rudimentar)

Pit toilet with infiltration is made after excavation of ground of the site. Distance from pit bottom to ground water level must be beyond about 150cm according to the rule. This type must be used for the permeable ground. Non-fecal home drainage is drained by the direct discharge to the outside.

4) Septic Tank / Pit Toilet with Underground Infiltration Pipelines (Vala)

This is the type with installation of underground infiltration tubing to septic tank / infiltration type pit toilet. It is the same as that of 2) and 3) fundamentally. Permeation quantity is increased by extending the infiltration range.

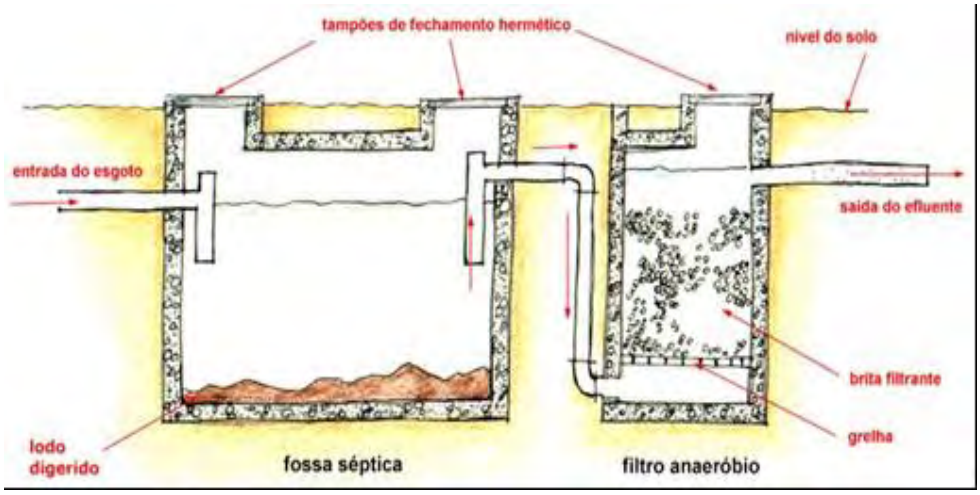
5) Direct discharge to channels, rivers and the lake

This is the type of direct discharge of sewage. Construction of wooden house on the small channel to discharge sewage is the typical manner of direct discharge in the irregular households in Sao Paulo around the Billings Lake. The toilet itself is mostly equipped with a flash tank for flashing.

6) Reservoir (Not included in **Table 3.4.2**)

This method uses some reservoir/pit for sewage, and the entire content of the reservoir/pit is transported to a SABESP sewage treatment plant for treatment by vacuum truck when it becomes full. A golf course and membership crab in SBC city are confirmed to employ this method in the Billings lake basin. In this case, sewage discharges to outside do not occur at all.

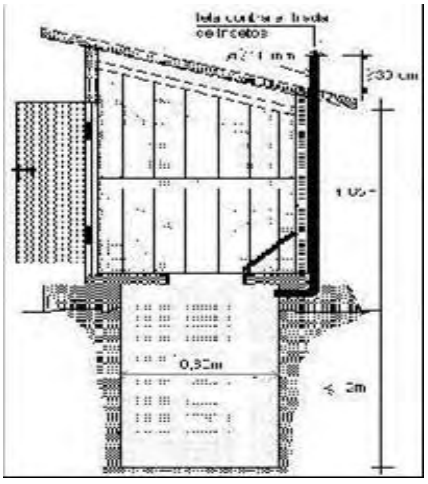
Table 3.4.2 Typical sanitary facilities currently used in Brazil

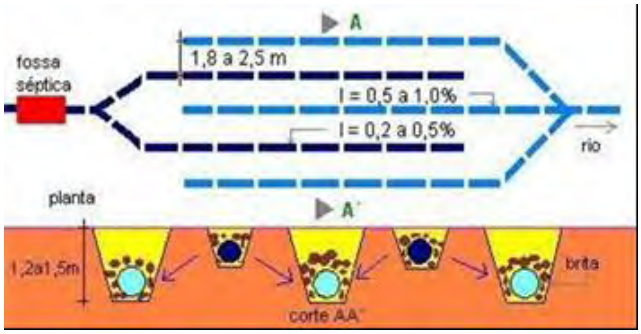


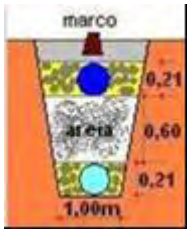
(a) Septic tank with one compartment(left), anaerobic filter (right)

Excrement is separated into solid content and liquid in the septic tank. And organic matter of settled sludge is decomposed by bacterial action. Layer of scum will be formed on the surface of contents, and this layer maintains the inside of a tub at an anaerobic state. Since decomposed residue accumulates as sludge, periodical sludge withdrawal is required mostly once a half year.

Although treated water quality becomes good when an anaerobic filter unit is furnished, one-room type septic tank is commonplace for domestic use.







(b) Pit type toilet with infiltration

This type is called Fossa Seca or Negra. Solid content deposits in the pit, while liquid part permeates into the earth. Soil will be put on the pit to stabilize the contents when the pit is full with the sludge. It will be left for 2 or 3 years by using other pit toilet, and will be re-excavated for reuse after stabilization.

(c) Septic tank with infiltration pipes

Infiltration and collection pipe are arranged in three dimensional manners. Ditches (Vala) are excavated to install infiltration pipes. Collection pipes will be installed in case good drainage is necessary, which is mostly single pipeline.

3.4.3 Organization and Legal Regulation for Administration of Sanitary Facilities

1) Organization

The governing legal authority of sanitary facilities is SABESP from January, 2004 in SBC. Concerning dispute about the sewage, Secretaria de Obras is dealing in SBC. About inspection works for the sewage-related facility, Sanitary Vigilance for each area is taking charge under the surveillance and operation arrangement of CETESB. It is thought that other cities are also the same.

2) Legal Regulation

Regulation by law for the sanitary facilities of common households is summarized as follows;

"Sewage connection must be made in the area with sewerage service. Installation of an independent purification facility is enforced which suites regulation in the area out of sewerage service. Such facility consists of a septic tank and its supplemental structure. Supplemental facility must be chosen appropriately according to requirements for the location and other condition." According to this article, what does not hold the septic tank becomes illegal.

According to **Table 3.4.1**, as a whole Billings lake basin, 70% of the population is connected with sewerage services or septic tanks. Although connection to sewerage is enforced by law in the serviced area, most of the area is not necessarily connected with sewage treatment plants in which sewage is treated. That is, it is a problem that connection to sewerage does not mean necessarily environmental conservation. In the Billings lake basin, only four areas are connected to sewage treatment plants, that is, the JD Pinheiros treatment plant and the Rio Grande treatment plant in the SBC, the Pires treatment plant and the oxidation pond in the Rio Grande da Serra. There are only 7,000 populations in the treated area. This figure is only 0.8% to a total population in the basin of 863,000 in the year of 2000.

Moreover, according to **Table 3.4.1**, it is supposed that 90% of the population has not connected with both of sewerage and septic tank in Santo Andre which has big influence on the water quality of the Rio Grande arm in the Billings lake basin.

Contractor removes the pit contents with the vacuum car to transfer to the sewage treatment plant in case of the large reservoir type. This activity is confirmed at a golf course and the membership crab.

3.4.4 Sanitary Facilities Issues

The Lake Billings basin is categorized into Class 2 (Class special for inner part of arms). Sanitary facility to meet the environmental standards Class 2 is (1) advanced sewage treatment meeting Class 2, (2) infiltration type septic tanks, (3) full storage and conveyance by a vacuum car. In a

septic tank, liquid is infiltrated and the solid content is transferred for disposal.

< Septic Tank >

The infiltration of effluent from a septic tank to the ground is allowed if it is installed in a legal way. As the infiltration well of septic tank may clog, it is common to use multi-wells alternatively. Although the distance between a well for drinking and a septic tank is regulated, there is a fear of pollution. The density of sanitation facilities in the area is substantially limited by the regulation for an occupational area per house in accordance with a category for land use. The removal efficiency of BOD5 is considered at the same level as the Johkasou in Japan which has BOD5 removal rate of 50%. As effluent is not discharged into the water bodies directly, it is considered that the influence on water pollution in the lake is less than direct discharge.

The sludge stored in a septic tank is regularly removed by a vacuum car. But there are problems in its operation in terms of license and manifest. Management of such wastes dumping and controlling such companies by regulatory agencies must be established immediately. The actual status should be investigated and organizational aspect should be studied.

< Sewerage Facilities >

As mentioned previously, the percentage of treatment at sewage treatment plant is very low and raw sewage is mostly discharged into the Lake Billings without any treatment, especially in Alvarenga area. It is influencing greatly on water pollution of the lake and urgent improvement is required.

There are four sewage treatment plants in the basin of the Lake Billings and they are operated and maintained by SABESP.

The sewage treatment plant provided with a tertiary treatment facility using a wetland process is only the Pinheirinho STP in Alvarenga, but its effluent does not meet the required water quality. The effluent quality from other three STP is likewise not appropriate for discharge judging from their treatment processes and treatment efficiencies. For the STP in Ribeirao Pires and Rio Grande da Serra, a trunk sewer line to convey sewage outside the basin is under construction. (Connection to Solvay Industry was expected to be completed by July 2006.)

For STP in Riacho Grande and Pinheirinho, their improvement is also necessary due to their possible continuance in the future

3.5 Storm water and Drainage Facility

3.5.1 Existing Condition of Storm Water and Drainage Facility

In the Billings lake basin, drainage is mostly made by small natural rivers or channels by excavation owing to undulating geographical feature. Man made underground storm water drainage is not widely developed. Frequent small scale floods by run off on roads surface at rainfall is confirmed in a part of Alvarenga's irregular residential area.

Investigation was done for the man made storm water facility. Since storm water drainage facility is built in connection with pavements for the purpose of surface drainage in many cases, it has a structure relevant to pavement structure. The pavement found in the Billings lake basin is as follows;

(1) Current Status

1) Asphalt Road

The roads for automobiles and trunk roads have this pavement structure.

2) Stone Paved Road

Old established city areas have this pavement structure commonly. The city area in the Riacho Grande area is typical example. Storm water drainages are mainly made by the gradient of road surface. In this pavement, it is back fill of natural soil between paving stones. Since the width of a joint is not large, infiltration is low. The example is shown in **Photo 3.5.1**.

3) Unpaved road

This is mostly observed in irregular residential area. There is sometimes no storm water drainage facility.

4) Storm water inlet

A large-sized storm water intake is found in the lowlands area to which rain water gathers. The example of Riacho Grande's residential street is shown in **Photo 3.5.1**. It is rain water taking in opening installed in the stone pavement.

It has a unified structure with road curbstones. The concrete lid for maintenance is installed in the upper part. The infiltration from the joint earth filling between paving stones is not much expectable by clogging as it is judged from the state of stone pavement in the photo. It is thought that it is necessary to assume the run-off coefficient of stone pavement be comparable as asphalt paving.

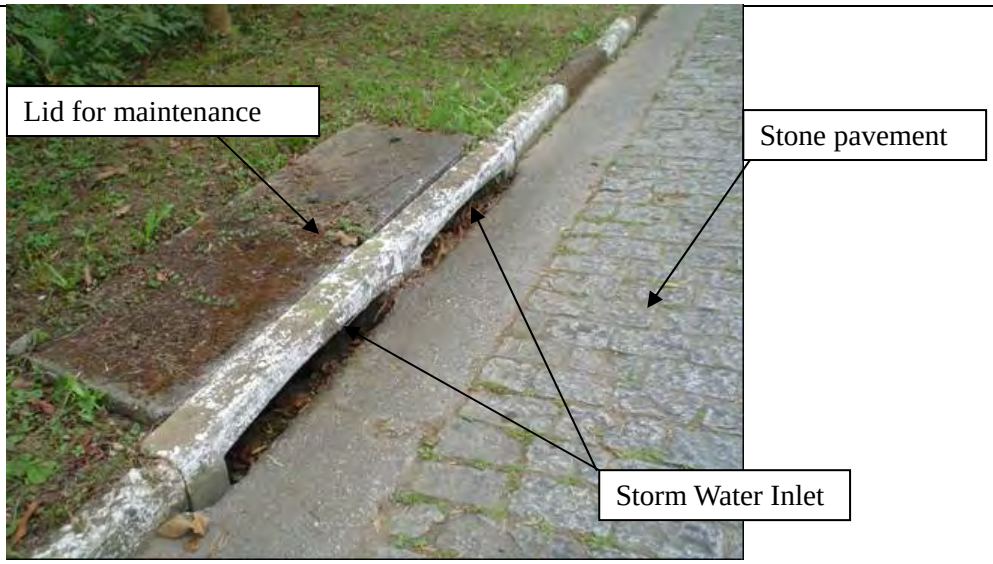


Photo3.5.1 Stone pavement and storm water inlet

5) Combined system storm sewer

It is the pipeline for the floe of sanitary sewage and the storm water.

(2) Problems

The problems in the present situation are as follows:

- The basin of the Lake Billings is characterized with abundant topographical undulation and less stagnant locations. Accordingly, storm water is drained through manually-excavated water channels or streams and storm water drainage system by closed conduits is not well developed.
- Many unpaved roads and streets are observed in the sub-normal residential area without storm water drainage facilities
- In the sub-normal residential area, sewage discharges into storm water pipeline are sometimes found at site.

3.5.2 Current status of storm water drainage facility

An as-built drawing of the storm water drainage facility in the SBC city area is shown in **Figure 3.5.1**. The location of this rain water facility is in the J.Laura area in Arvalenga. (The area in which the 24-hour study was conducted to study unit rate of sanitary sewage and pollution loading)

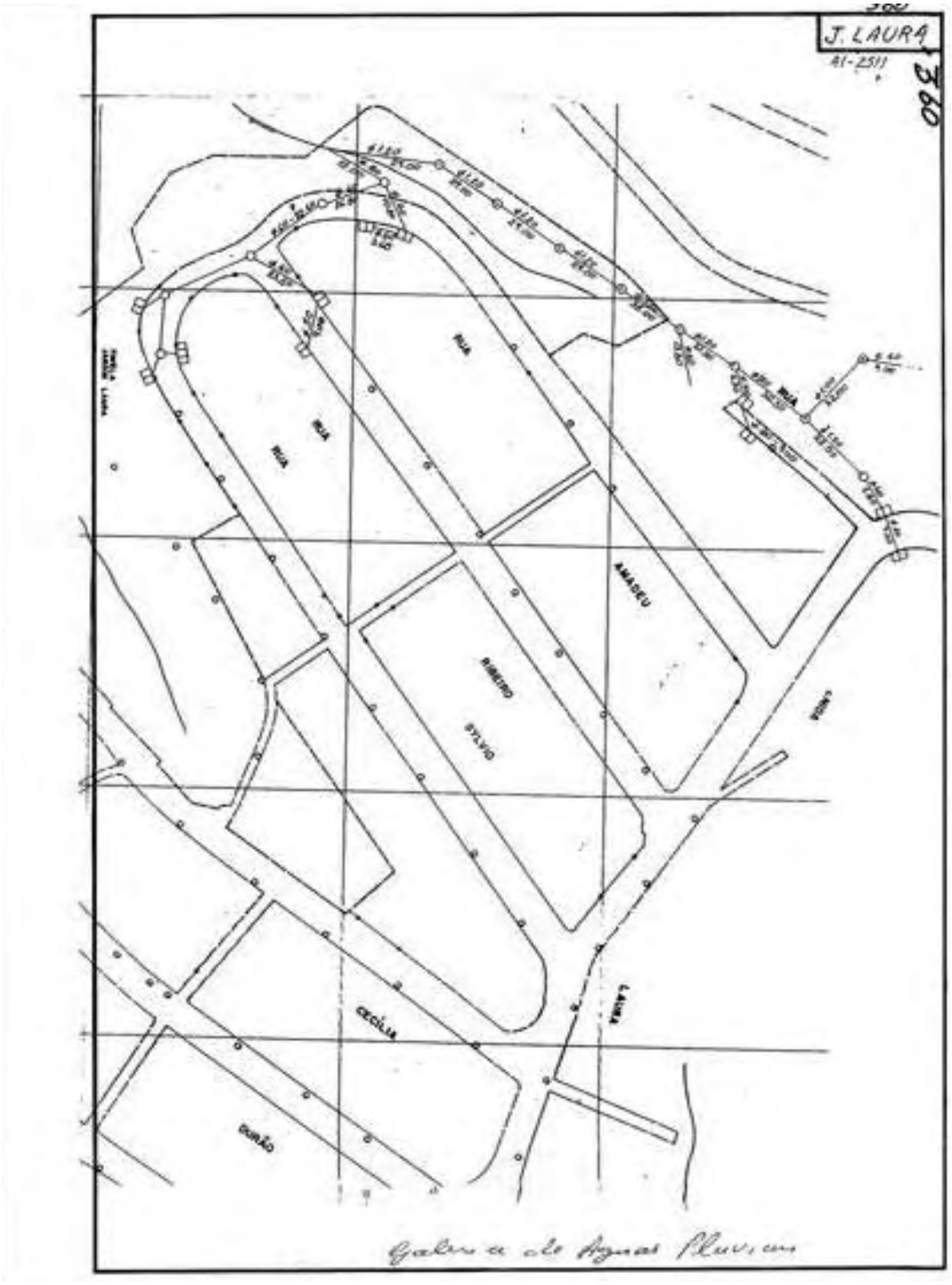


Figure 3.5.1 J. Laura area in Alvarenga As-built drawing of storm water

3.6 Waste Disposal

3.6.1 Waste Disposal of the Basin

Current status of waste disposal including related cites surrounding the Billings reservoir basin is summarized in **Table 3.6.1**.

ABC each city except Santo André carries the collected waste to the private landfill of LARA in Mauá and are reclaiming. The Santo André has the own landfill, and is reclaiming the collected waste in the landfill under SEMASA management.

The Parelheiros, Socoro and Cidade Ademar each district in São Paulo transports the general waste to the Banderantis landfill via the relay ground in Santo Amaro and carries the construction waste to the Itaquera landfill.

Table 3.6.1 Waste Disposal of Each City Surrounding Billings Reservoir Basin

Municipal	Management Organization	Operation Company	Disposal Amount (ton/year)	Landfill	Remarks
São Bernardo do Campo	SU2	VEGA ATT	211,030(*1)	LARA (Private Landfill)	
Diadema	SAMED	SANURBAN	90,433(*1)	LARA	
Santo André	SEMASA	H.GUEDES ATT	237,250(*2)	SEMASA Own Landfill	Management of landfill; PAJOAN
Riberrão Pires	Dep. Meio Ambiente	SANURBAN	19,418(*1)	LARA	
Rio Grande da Serra	Dep. Meio Ambiente	SANURBAN	5,627(*1)	LARA	
Mauá	SAMA	SANURBAN	76,758(*1)	LARA、BOAHORA	
São Paulo Parelheiros Socoro Cidade Admar	Dep.	ECOURBIS and Consortium	1,754,857(*2) (Whole of the city)	BANDERANTIS ITAQUERA (Construction waste)	

Remarks; *1 Acceptance amount in the landfill in 2003 (epend on Caderno Ambiantal Mauá 2004)
*2 Hearing amount in 2004

(1) San Bernardo do Campo

1) Waste Collecting Organization

SU2 (Serviços Urbanos Segundo) of SBC is the management organization to control waste disposal in the city. SBC commissions VEGA of the civil corporation to collect general waste and bulky garbage and transport to the landfill, and ATT of the civil corporation to collect hazardous waste such as hospital garbage and disposes of them. The consignment company has been decided by the public bidding every year.

2) Waste collecting situation

(a) General waste

The household garbage in the city is collected separately for the collecting region of Monday, Wednesday and Friday, and for the another collecting region of Tuesday, Thursday and Saturday. It is collected in the town core and the specific over crowdedness living quarter every day of Monday to Saturday. As for the waste collection, the whole area of living quarter in the city is covered regardless of a regular region or irregular region.

The garbage put in the plastic bag at each home is put out to the pickup point place, and collected by the garbage truck of VEGA goes round a prescribed route. The container (capacity 10m3,700 piece) for a large-scale capture is put on the prescribed pickup point place of the square that the garbage truck doesn't enter into the narrow road in the over crowdedness residential area of the irregular quarter. The garbage is carried from each home there and collected from the container. VEGA transports to the landfill of the private company (LARA) in Mauá and processes the collected waste.

The collection rate is 95% or more. Though the garbage that had been left on the road can be collected as soon as the garbage truck finds it, the garbage that the resident renounces without permission in a part of irregular region cannot be managed (remark of the person in charge of SU2).

(b) Road cleaning

The road cleaning is consigned to VEGA similarly, and done in 300 all places in 8 times on the business area and 1 times a day on the center and main streets. The resident is obliged to clean road around the private house

(c) Separated waste collection and recycling

The collection boxes divided into paper, the plastics, the PET bottle, the can, and others is set up in public utilities and shopping centers, and the separated garbage collection are carried out in shape to cooperate by the citizens bring in there. The collection from there is done by a day by VEGA.

Brazil is being said to hold high collection rate in the world because of the progressive recycling market for paper, the PET bottle and the can. The scenes that some residents collect waste for the living is seen well.

The separately collected garbage is transferred to Recycle Center to be managed by the union chiefly organized as irregular resident's employment measures, and then is classified and delivered as a recycling raw material by the resource recovery trader. The garbage useless to recycle is sent to the landfill.

Recycle Center is managed by the union, and wages of labor are covered by the income from the recycle goods and the recycling raw materials. Although necessary facilities for buildings and

equipments for this work are being provided by the municipalities in the mean time, complete and independent management of this organization is aimed in the future. There are two Recycle Centers owned by municipalities and besides, there are also private traders.

The household garbage that VEGA collected is not classified, and comes in the landfill as it is.

(d) Bulky garbage

Bulky garbage is collected by VEGA coming around each home at three months interval, and transferred to Recycle Center to sell valuables in recycling merchandise.

(e) Hazardous waste such as medical garbage

Hazardous waste, chiefly medical garbage is collected from the registered hospitals and other medical institutes by ATT in the civil corporation. The collected medical treatment garbage is put the microwave in ATT, processed, and transported to the Landfill.

3) Amount of waste collection

The collected amount of the general waste, the road cleaning garbage and the hazardous waste is respectively about 500 tons, 8.9 tons and 16.6 tons on the average per month in 2004 (depend on the hearing investigation to SU2). It becomes 204,800 tons a year.

Table 3.6.2 General Solid Waste Generation in Sao Bernardo do Campo

Ano	Domiciliar (kg)	Hospitalar (kg)	Bota-Fora (kg)	Outros (kg)	Total (kg)
1988	107,987,460	624,130	213,880	46,780	108,872,250
1989	112,402,640	687,780	-	-	113,090,420
1990	119,785,020	787,650	395,010	133,680	121,101,360
1991	134,939,840	886,140	503,290	145310	136,474,580
1992	131,900,550	959,625	438,575	96,980	133,395,730
1993	136,117,430	1,111,650	449,405	2,784,570	140,463,055
1994	139,705,715	1,207,296	496,860	8,719,670	150,129,541
1995	163,501,200	1,466,990	854,230	10,101,640	175,924,060
1996	185,896,700	1,692,910	1,073,470	19,377,580	208,040,660
1997	193,911,900	1,763,200	1,833,050	14,572,980	212,081,130
1998	196,962,510	1,669,545	2,324,440	11,019,040	211,975,535
1999	200,375,040	1,784,252	2,314,840	8,204,410	212,678,542
2000	203,967,860	1,599,870	2,065,420	6,216,130	213,849,280
2001	203,223,750	1,407,630	2,599,040	6,196,380	213,426,800
2002	199,344,450	1,294,090	2,642,880	34,143,039	237,424,459
2003	185,047,887	1,224,785	2,214,038	82,017,781	270,504,491
2004	195,090,541	1,267,476	2,053,500	64,229,631	262,640,648

Table 3.6.3 Per Capita Domestic Solid Waste Generation (SBC)

	1980	1991	1996	2000	2003
Population	425,602	566,893	660,396	703,177	745,164
Solid Waste Generation (ton/yr)	106,710	134,940	185,897	203,968	185,048
Per Capita Solid Waste Generation (g/capita·day)	685	652	769	793	680

Table 3.6.4 No. of Eco-stations for Valuables Collection Installed (SBC)

	Quantidade de Ecopontos Instalados no Município
2000	145
2001	199
2002	202
2003	203
2004	203

Table 3.6.5 Collection of Valuables for Recycle（SBC）

Ano Fafeilao	Papelço (kg)	Papel (kg)	Lata-Aço (kg)	Alumínio (kg)	Vidro (kg)	Plástico (kg)
2000	-	-	-	-	-	-
2001	83,401	328,970	31,539	46,312	366,525	148,967
2002	105,000	427,070	63,000	60,000	310,000	26,000
2003	97,006	396,442	58,340	55,611	288,637	241,209
2004	86,263	352,536	65,142	36,139	256,665	214,495

4) Cost of waste disposal

The cost of waste disposal of the city is 3.5 million Reais per month, and 42 million Reais a year in 2004. The reclamation cost is 54.87 Reais per ton and the hazardous waste treatment cost is 1742.28 Reais per ton The citizens taxes includes 80 Reais per person as a charge-off of waste (depend on the hearing investigation to SU2).

(2) San Paulo

The per capita garbage generation in Sao Paulo is now in the range of approximately 0.8 to 1.3 kg in the area with big spending power and the daily regular collection volume is about 160,000 tons. Out of them, 82.8% is derived from domestic garbage and disposed at two garbage landfill sites, namely Sitio São João located estsmost of the municipality and Bandeirantes in Perus. They also receive the Class II industrial waste almost with an amount of approximately 2,000 ton/day.

The medical waste is treated by the electro-thermal deactivation process at Jaquaré Treatment Plant to convey to Sitio São João Treatment Plant or partly treated at Vergeuiro Incineration Plant for final deactivation.

Separate collection of garbage, although established by the municipal legislation, has not been almost functional by the year of 2000 and collected recyclable material of only 110 ton/month in 2001.

This situation was changed by the introduction of door-to-door recyclable material collection system through 212 routes at 45 districts for a Sao Paulo population of about three million (approximately 30% of total population).

Recyclable material of 990 ton/month was collected through separate collection by the end of October 2003.

Besides this, the separate collection solidarity program was in effect since February 2004, which was managed by the forum representing the municipality and recyclable material scavengers. The program expectedly brings the reduction of solid waste and income to three thousand people by generating working opportunity. The municipality decentralizes the authority taking into account the diversity of scavenger groups. The solid waste recycle center was placed at ten locations in the city.

The operational suspension of the Vergeiro Incineration Plant, which has incinerated medical waste of 4 ton/day by July 2001, is the landmark of the present administration. At present, these wastes are treated sanitarily at the plant equipped with filtration units for environmental pollution control.

Table 3.6.6 Solid Waste Collection by Source（SP）

Source	Monthly Generation (ton)	Annual Generation (ton)	%
Domestic & Cleasing	295,745	3,548,934	77.83
Industrial	9,385	112,620	2.47
Medical	2,789	33,472	0.73
Waste Material	59,666	715,986	15.70
Others	12,386	148,637	3.26
Total	379,971	4,559,649	100.00

Table 3.6.7 Solid Waste Collection by Disposal Method（SP）

Disposal Method	Monthly Generation (ton)	Annual Generation (ton)	%
Sanitary Landfill	326,472	3,917,661	58.999
Composting	40,896	490,750	7.391
Incineration of Animals	49	590	0.009
Incineration of Surplus Medicals	44	522	0.008
Conveyance	185,791	2,229,489	33.576
Landfill	96	1,148	0.017
Total	553,348	6,640,160	100.0

(3) Issues

In relation to solid waste in Sao Paulo in the Billings Reservoir basin, attention be paid for the fact that in some areas, garbage may be dumped or that left on the streets without collection may be washed out into the reservoir by storm water. Garbage is scattered on the lakeside near the Pedreira Dam, which gives the concern if the reservoir is really used for drinking water source.

Not only Sao Paulo but also other municipalities have basic policies to collect garbage placed on the designated locations accessible by a garbage collection vehicle. It means that garbage is left uncollected, if the resident does not bring it to the designated locations. In such areas, it is necessary to take urgent measures through the improvement of living environment and/or environmental education so as not to occur such garbage discharge into the reservoir.

The former municipal solid waste dumping site located in Alvarenga near the boundary of SBC and Diadema has some problems that leachate is still discharged into the sub-normal residential area at the downstream valley due to the incomplete measure at the time of its closure.

3.6.2 Solid Waste Landfil Site

Two large operating landfill sites exist in the surrounding area of the Billings reservoir basin. The one is the private landfill of LARA in Mauá, and another is the public landfill of Santo André. Both are in the upper Tieté river basin outside of the Billings reservoir basin. The small private landfill of BOAHORA also exists in the vicinity of LARA in Mauá. Their location are shown in **Figure 3.6.1**.

(1) LARA landfill

1) Outline

The landfill LARA is in the southwest of the Mauá municipal, and cursed from the earth and sand quarry to the landfill. The landfill has been operating since 1987, and was bought out by LARA in 1990.

Premises of about 1,500,000m^2 are possessed, and a present amount of the acceptance is 2,500 to 2,600 ton/day, that is 75 to 78 thousand ton/month. The waste reclamation capacity from now is ten years, and the extension area close to present reclamation area is possessed after the occupied. The business license is acquired until 1980. SO9000 and Brazilian standard NBR1004 of the waste landfill are acquired, and the ISO1400 purchase motion. The waste collection business is done by SANURBAN of the subsidiary.

2) Users

The general waste and hazardous waste of SBC, Diadema, Ribeirão Pires, Rio Grande da Serra, Mauá, São Caetano do Sul, and São Vincent municipals, and industrial waste from the enterprise are accepted.

3) Amount of acceptance

The acceptance from each city is 536,674 ton/year in 2003. The growth rate is 18% and the mean annual mean growth rate is 3% since 1998 (454,424 ton/year).

The measurement of the amount of the waste acceptance is a system that makes a garbage truck run on the measuring equipment at the moment of entering and participating, and confirms the enrollment number plate automatically, accumulates automatically the measurement records, and demands to the registrar organization.

4) Reclamation treatment

The waste layer of 4m and the earth and sand layer of 0.3m shall be paled up as one step. At the bottom, the high- standard polyethylene sheet 2 mm thick is installed at first and the drain is set up. Though the methane exhausted through gas drainage is burnt now, the plan to collect methane and to generate electricity is under discussion.

5) Leachate treatment

Leachate is collected from drain and purified in the leachate treatment facilities, and the treatment water is discharged into a river nearby. The process capability is 400m^3/day, and removal rate of 99% is attained in spite of 70% processing standard required in the state law. The leachate of coffee brown color is changed to transparent colorless water. It is said this facility has become exemplary facility in South America.

6) Monitoring

The ten monitoring wells of average 10m in depth are set up to monitor the river water quality and under ground condition around the landfill. Water quality monitoring is carried out once a week, and managed by the inspection once a month of CETESB. IQR 9.7 which is good result in CETESB standard is obtained.

(2) Santo André landfill

1) Outline

The Santo André landfill is in the southeast of the Rio Tieté basin region in Santo André municipal, and is comparatively near also the LARA Landfill in Mauá.

It has been operating since 1980, and the license was acquired in 1986. Premises of 217,000m^2 are possessed, and a present amount of the acceptance is 650 ton/day, that is 1.95 ton/month. The waste reclamation capacity from now is nine years in the calculation in 2003, and the extension area outside the landfill and the business license after the occupied is required. There is no suitable landfill site because of 57% occupation of the environmental protection zone (Mananciais) in Santo André municipal.

A fertilizer mill was operated, and the compost of 250ton a day was manufactured in 1982-1998. But, It was discontinued because the house approached the surrounding, and the stink occurred in. It was a conclusion that the profit was not able to be taken though the introduction of the new model machine was discussed.

The microwave facilities for the hazardous waste of mainly medical garbage disposal are set up in 2001.

H.GUEDES of a civil corporation is consigned for the waste collection, ATT is consigned for the hazardous waste, and PAJOAN is commissioned for the management of landfill under the whole management of SEMASA.

2) User

The landfill doesn't accept from other cities after 1998, though the general waste of SBC, Diadema, Ribeirão Pires and Sâo Caetano do Sul municipals had been accepted before. The general waste, the hazardous waste of mainly medical garbage and the separated collecting garbage of Santo André municipal are accepted.

3) Amount of acceptance

The amount of the acceptance is 650ton/day, that is 230,750ton/year. Most of it is household

waste and hazardous waste is 4-6 ton/day.

The measurement of the amount of the waste acceptance is carried out by counting the number of the entering garbage truck because the garbage truck is used the registered city ownership vehicle, and the amount of each garbage truck is checked by an occasional inspection.

4) Reclamation treatment

The bottom layer was constructed by the clay layer mixed with sand and the drains were set on because there was no sheet in the 1980's. The sheet was introduced in 1992, and the sheet was paved in the leachate pond.

The waste layer of 5m and the earth and sand layer of 0.2-0.3 m is paled up as one step. The gas drainage pipe is set up, and the exhausted methane is burnt.

5) Leachate treatment

Leachate is collected from drain, it purifies in the leachate treatment facilities, and the treatment water is thrown into a near river. The decanter of five days and the aeration of 18 days in the leachate pond is carried out according to the standard of CETESB. Sewage is dried and carried to the landfill.

Experiments by a consultant contracted are now on going for producing a phosphoric ammonia fertilizer from ammonia gathered from the leachate.

6) Monitoring

The water quality monitoring is carried out at observation points. The eight monitoring well is set up near the flowing river of the processing leachate and the surrounding of the landfill.

The problem pointed out in the inspection of CETESB basically is consigned to the outside organization, tested, and the countermeasure is discussed. The microwave is inspected once every three months by CETESB.

The consequence of IQR 9.3 of CETESB standard is obtained. A demerit is irregular resident's area close to the landfill.

3.6.3 Old Landfill Sites

The rather large-scale old landfill in the Billings reservoir basin is the Alvarenga old landfill and the old landfill near boundary SBC and Santo André.

The old landfills also exist in Santo André and Ribeirão Pires and the problem such as irregular resident area situates on the landfill or the pollution of river water with the leachate etc. But the both is located in

Rio Tieté Basin.

On the contrary, Filled up landfills exist in Pedereira and Socoro sub prefectures of São Paulo. The Pedereira landfill exist in the Billings reservoir basin and the construction waste was reclained. The Socoro landfill exist close to Pinheiros waterway out of the basin and the household waste was mainly reclaimed. Both has foundation treatment and are managed the civil cooporations consigned as relay yard of waste transportation. Further, another landfill in Pedreira sub prefecture is operated and accepts only excavated soil and sand in order to reclamation for recovery of quarry site.

(1) Alvarenga old landfill

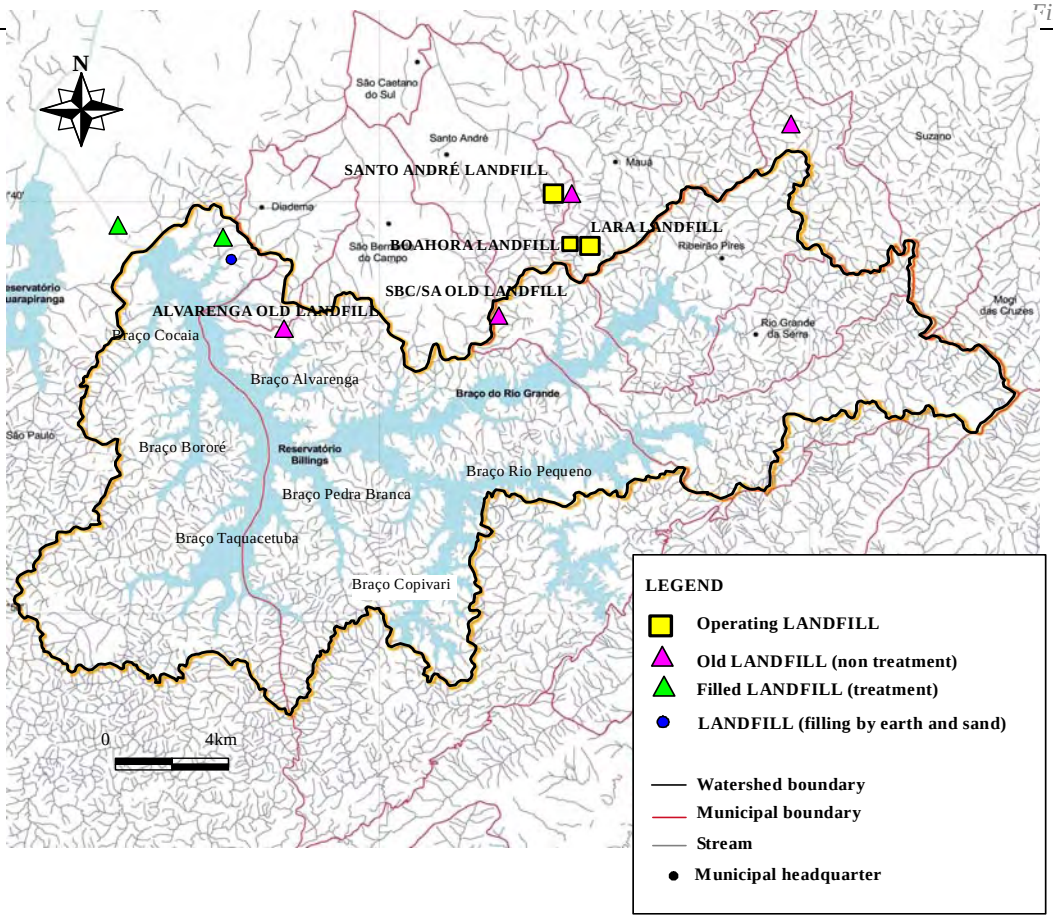
The Alvarenga old landfill exists in SBC close to the boundary of Diadema, and the waste from both cities was carried and reclaimed until about 1984. The household garbage about 65% and the construction waste 35% are renounced in the range of 25ha.

The bottom in the reclaimed land is untreated, and the contaminated water has oozed to Alvarenga's irregular residential area. Irregular residents live in the right downstream of the old landfill site, and the investigation has not been carried out and the solution is not presented though the problem is aware.

(2) Old landfill near boundary SBC and Santo André

The old landfill near boundary SBC and Santo André is located in Santo André side in the vicinity of both city boundary, and both cities were renouncing household garbage until 1973.

The confirmation such as the range of reclamation is difficult to find out because of vegetation recovered. The dimension of the landfill is said that the extent is small and a part of one stream was buried. There is no house in the downstream of the old landfill, and the problem of the pollution of river water is not talked about.



(Base map: Billings 2000 João Paulo Ribeiro Capobianco, Marussia Whately

Figure 3.6.1 Location Map of Main Landfill in Surrounding Area of Billings Reservoir Basin

Table 3.6.8 Garbage collection in the basin of the Lake Billings

Subprefeituras e Distritos	Total de Domicílios Particulares Permanentes	Coletado por Serviço de Limpeza	Coletado em Caçamba de Serviço de Limpeza	Queimado ou Enterrado na Propriedade	Jogado em Terreno Baldio, Logradouro, Curso d'Água ou Outro Destino	Remarks
São Paulo						
Pedreira	33,605	28,993	4,004	15	-	
Marsilac	2,114	1,185	305	506	77	
Parelheiros	25,960	23,359	1,495	852	89	
Cidade Dutra	51,091	48,309	2,629	39	1	
Grajaú	86,223	79,115	5,410	510	19	
Diadema						
Eldorado	10,351	9,632	504	102	215	100%
Serraria	7,556	7,055	488	4	13	
Inamar	6,129	5,345	753	12	31	
SBC						
Alves	7,214	6,061	1,142	5	11	
Cooperativa	4,595	3,968	513	33	114	
Santa	6,981	6,547	434	-	0	100%
Bairro	11,861	10,943	909	5	9	
Demarchi	6,905	6,549	354	1	2	
Montanhão	21,406	16,423	4,763	32	220	
Botujuru	3,056	2,848	187	3	21	
Balneária	173	172	-	1	1	100%
Alvarenga	14,507	13,925	396	74	186	100%
Batistini	7,343	6,173	1,134	19	36	100%
Rio	1,719	1,647	63	4	9	100%
Cinco	2,526	2,509	14	3	3	100%
Santo André						
Capuava	27,350	26,919	417	10	14	
Paranapiacaba	859	801	52	4	6	100%
Ribeirão Pires						
Rio Grande da Serra						
Rio Grande da Serra	9,722	8,961	155	426	606	100%

3.7 Parks

In the general conception, the word of "Park" is considered by various understandings and used in different terms with various significations, for instance, Sports Park, Ecological Park, Recreational Park, Neighborhood Park, Regional Park and etc.

However, in Brazil, Parks are considered as a category of Conservation Unit (UC), which are areas of land and/or sea, especially dedicated to the protection and maintenance of biodiversity, of their associated natural and cultural resources, and which are managed by legal instruments or other effective means.

The conservation units (UC) mentioned above, a special type of protected area, are territorial space (including their environmental and jurisdictional waters) with relevant natural characteristics, legally instituted by the Public Power, with the objectives of conservation and defining boundaries under the special regime of administration, to which the proper guarantees of protection are applied.

3.7.1 Government attributions of Park Administration

In general, it is up to the Federal Government through the Environmental Ministry (MMA), to promote the adoption of principles and strategies for protection and use of the environmental resources and the insertion of sustainable development in the formulation and implementation of public policies with a participative and democratic way in all levels and instances of government and society.

The State Government, through the State Environmental Secretary (SEMA), is tasked with the administrative environmental realty of the State. And for each environmental issue, the Secretary has interaction mechanisms with that specific reality.

The City (Municipality) Government are tasked with administrating and creating the municipal parks and green areas, issuing report on environmental impact caused by construction works in the city (including pavement, maintenance and planning of city road system (streets, avenue, pedestrian way and etc)

3.7.2 Parks of Federal Level

The Environmental Ministry and its Secretary and authorities regulate parks at federal levels. Brazil has an extensive frame of conservation units (CUs) today, summing up to about 8.13% of national territory.

The federal conservation units administrated IBAMA (*1) sum up 45 million hectares approximately, being 256 conservation units of direct and indirect use:

- 29 Federal Environmental Protection Areas-APAS

- 34 Extraction Reserves - RESEX
- 26 Biological Reserves
- 30 Ecological Stations
- 64 National Forests -FLONA
- 19 Areas of Important Ecological Interest -ARIE
- 53 National Parks
- 01 Wild Life Refuge

There are also 364 Private Natural Heritage Reserves (RPPNs), but there are no Federal Conservation Units in the area of the Billings lake basin.

(*1) Brazilian Environmental and Natural Renewable Resources Institute –IBAMA is an autarchy bound to the Environmental Ministry (MMA), was created by Federal Law No. 7,735 of February 22, 1989. IBAMA was formed from the merger of four Brazilian entities that had worked in the environmental area, Secretary for the Environment –SEMA, Rubber Superintendence –SUDHEVEA, Fishing Superintendence–SUDEPE and the Brazilian Forest Development Institute- IBDF.

3.7.3 Parks of State Level

In the territory of the São Paulo State, 26 State parks are registered; however, 2 small land areas of the Municipality São Bernardo do Campo in the Billings lake basin are registered as Serra do Mar State Park.

(1) Serra do Mar State Park (PESM)

The PESM are delimited geographic areas of exceptional natural qualities, and object of permanent preservation. And PESM is intended for cultural, educational and recreational purposes with continuous assets of the State and intended for popular use, and has main objective of preservation of ecosystems and genetic diversity.

The PESM has almost 315 thousand hectares of land, in an extension that goes from São Paulo State boundary to Rio de Janeiro State until Itariri in the south of this State, passing through the entire sea coast forest on the Atlantic coast.

And the PESM include 28 municipalities, including the municipalities of this Study, Rio Grande da Serra, Santo André, São Paulo and São Bernardo do Campo.

Of the total area of the PESM, about 30% of the land is of State domain, the remaining about 70% is under discriminatory action by initiative of the State's General Procurator (PGE) and the State's Land Institute (ITSP), which is operating bodies under the Secretary of Justice or judicial custody.

And also, inside of the PESM there are 3 Guarani tribe (Índio) villages, Aldeia Boa Vista in Ubatuba,

Rio Silveira in São Sebastião and Rio Blanco in Itanhaén.

Due to the area and extension, the PESM is administrated by Administrative Units (Núcleos), which are installed in areas under State domain; with the exception of the São Sebastião Administrative Unit that implementation is underway. And PESM is divided into following Administrative Units, Cubatão, Caraguatatuba/ São Sebastião, Santa Virgínia and Picinguaba.

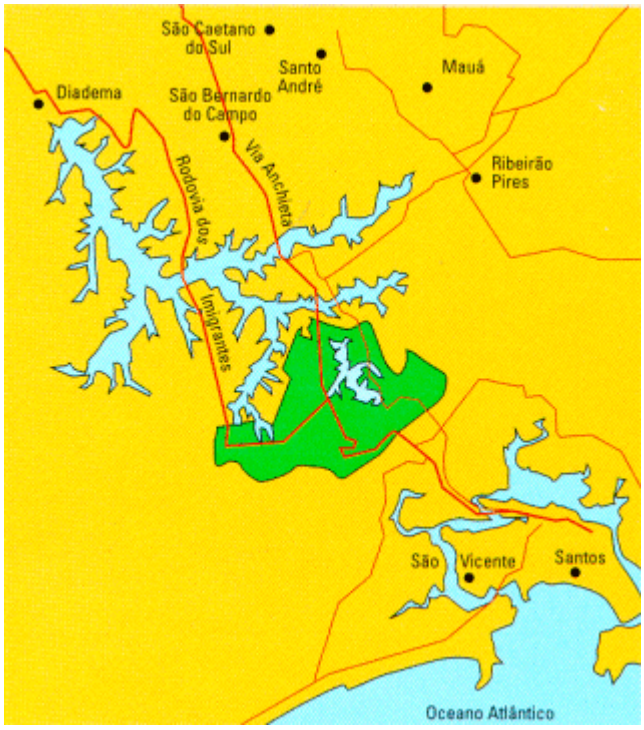


Figure 3.7.1 Location of the Administrative Area of the Cubatão Administrative Unit of PESM

Part of the Billings lake basin which is covered by the PESM administrated by Cubatão Administrative Unit that administrates about 115 thousand hectares involving 15 municipalities of the São Paulo Metropolitan Region and the costal area of Santos.

This is one of the important Administrative Unit of the PESM, because this region covered by the PESM is crossed by several highways and roads (Anchieta, Imigrantes, Caminho do Mar, among others), railways, transmission lines and oil pipelines, which have inflicted great pressure on the fragile ecosystem of the Serra do Mar covered by Atlantic forest.

In relation to physical environment, the Cubatão Administrative Unit covers entire Atlantic escarpment areas of Serra do Mar, which extending to plateau areas. The cliffs of the ridge areas are extremely unstable, and landslide and erosion evolve naturally. Due to such factors, there are many events of nature in this administrative area, especially in the rainy season, when the authorities and Civil Defense bodies stay on high alert.

The human occupation in this region is mainly noted from the expansion of outskirt districts to land

lots in the low areas and cliff areas.

For the Cubatão Administrative Unit, 5 focus points are established in the Environmental Management Plan (PGA), 1) management and infrastructure, 2) protection, inspection and recuperation, 3) characterization and research, 4) public use (environmental education and eco-tourism), 5) socio-economic integration. In addition to these aspects, an approach or result, was added to the land use with evaluation of the current situation and recommendations to ensure the sustainability of this area.

(2) The Land Section of the State Park in the Territory of Municipality São Bernardo do Campo

Two land sections are located on the left margin of Capivari River, one is close to the Forest Institute (Land-A) and another (Land-B) is on the bottom of the river. Their characteristics are shown in **Table 3.7.1** and their locations are shown in **Figure 3.7.2**.

Table 3.7.1 Land Section of the Serra do Mar State Park (PESM) per Municipality and per Micro-Basin

No. of Micro	Name of	Name of		Land Use		
Basin	Municipality	Park	Area (m^2)	Category	(%)	Note
81, 82	São Bernardo do Campo	Serra do Mar State Park (Land-A)	381,387.43	Preservation Area	100.0	
82, 83	São Bernardo do Campo	Serra do Mar State Park (Land-B)	3,569,750.44	Preservation Area	100.0	

Note-1:
Land-A is divided per 2 Micro-Basin as No. 81: 42%, No. 82: 58%
Land-B is divided per 2 Micro-Basin as No. 82: 07%, No. 83: 93%

3.7.4 Parks Development in Municipality Level

(1) Master Plan in Each Municipality and the Development of Municipal Parks

In the past, the development of municipal parks tended to implemented individually by each municipality's special laws or ordinances. However, all municipalities in the lake basin were required to establish new master plan or review their existing basic plans by 2006 based on the federal law of "*Estatuto da Cidade-Lei Federal 10,257/2001*" which was enacted in 2001.After the federal legislation, the designation and its development was implemented in conjunction with the land use zoning which was the important elements in the master plan in each municipalities.

The legal background and the current situation on public parks development is mentioned as follows in each municipality in the lake basin.

1) Sao Paulo Municipality

The strategic master plan (*PDE –Plano Diretor Estratégico do Munícipio de São Paulo*) was enacted and announced officially in accordance with the city ordinance as the date of September 13th, 2002. The strategic regional master plan of the 31 sub municipal halls, "*PREs –Planos Regionais Estratégicos das Subprefeituras do Munícipio de São Paulo"*, was also enacted and announced officially as October 6th 2004 by adding the regional social nature and particularities into above municipal hall master plan.

A municipal network of park is planned by the concept of the water environmental network (*Rede Hídrica Ambiental*) in two step master plans mentioned above, and the municipal parks were established as the following two types;

a) a park which is established in the special zones for environmental preservation (*Zona Especial de Preservação Ambiental*) and spreads in a spatial space, and

b) a park in linier (*Parque Lenear*) and green road (*Caminho Verde*) which is connected between each regions

2) Sao Bernado do Campo Municipality

In the past, the development on municipal parks was based on the following laws or ordinances;

regulation on land use zones based on the municipal ordinance No. 4,446 dated August 12th 1996, which was named as "*Dispõe sobre o Zoneamento de Uso e Ocupação do Solo*", and

regulation on land classification for urban areas and the special areas based on the special notes on urbanization based on the municipal ordinance No. 4,803 dated November 4th 1999, which was

named as "*Dispõe sobre o Parcelamento do Solo Urbano e os Setores Especiais de Urbanização Específica*"

Currently, the enact for establishing new master plan by the end of current year is ongoing

The lake basin based on above proposed master plan is going to classified into three types, (a) urban areas for environmental improvement (*Área Urbana de Recuperação Urbana*), (b) development control areas (Área de Ocupação Diridida) and (c) areas for prohibition of the development (*Área de Restrição á Ocupação*).

The designation of 9 special zones for environmental interest (*ZEIA -Zona Especial de Interesse Ambiental*) is ongoing, which are 2 zones in area (a): (Micro basin No. 11 and 14) and 7 zones in area (b): (Micro basin No. 29, 33-34, 59-69, 60, 79, 94-96, 100-107). Also, establishment of several new municipal parks is under planning in above special zones for environmental interest, therefore their names, location, area and boundaries have not yet decided.

3) Diadema Municipality

The master plan was enacted and announced to public based on the supplemental ordinance of No. 161 dated August 2nd 2002. In relation to establishment of municipal parks, three municipal parks are ongoing for establishment in the lake basin after the regulation of the special areas for environmental preservation (*AP-Área Espacial de Preservação Ambiental-1, 2,*).

4) Santo Andre Municipality

The new master plan was enacted and announced to public based on the municipal ordinance of No. 8,696 dated December 17th 2004, and 2 municipal parks (one includes biological garden) were established based on the environmental conservation zones (*Zona de Conservação Ambiental*).

5) Ribeirao Pires Municipality

The master plan on tourism resort of Riberon Pires (*Plano Diretor da Estância Turística de Ribeirão Pires*) was established in accordance with the municipal ordinace No. 4,791 dated on September 14th 2004 and the special zones for environmental resources (*Zona Especial de Interesse do Patrimônio Ambiental*) was regulated for establishment of the municipal parks as the areas of natural resources.

6) Rio Grande da Serra Municipality

No master plan and land use plan has been established in the 6 municipalities in the lake basin and

it follows the state laws of Sao Paulo state. No municipal parks has been established neither.

(2) Future Development of Municipal Parks

The municipal parks were established or under planning in accordance with each master plan or special municipal ordinance in each municipalities except Rio Grande da Serra as mentioned above. However, the establishment of municipal parks is greatly affected by each financial situation since it requires land acquisition observing the legal process with a large scale of investment of Municipal authority, prior to the construction of parks. For the reasons, each municipality intends to prevent the reduction of the green space for environmental conservation based on the regulations on the special zones for environmental conservation and land use control such as environmental conservation areas, and the establishment of large scaled municipal parks or the increase of large number of municipal parks is not prospective.

However, for the redevelopment of large number of irregular residential areas, it would be essential to apply above approach on linier parks (*Parque Lenear*) or green road (*Caminho Verde*) which was introduced in the establishment of master plan in Sao Paulo.

The detail of the current municipal parks and outline of municipal parks which has already been projected is shown in **Table 3.7.2** and **3.7.3,** respectively. And **Figure 3.7.2** shows all location of municipality parks including the state parks and their locations as shown in **Table 3.7.1.**

Table 3.7.2 Current Municipal Park per Micro Basin and Municipality

No.of Micro Basin	Name of Municipality	Name of Park	Area (m^2)	Vagetation		Note
				Category	(%)	
60	Sao Bernardo do Campo	1. Municipal Park of Estoril	371,012.45	Forest Land Secondly Forest Bare Land	60 35 5	
49	Santo Andre	1. Natural Municipal Park of Panarapiacaba Riverhead	4,261,179.10	Forest Land Secondly Forest Shrub Bare Land	86 10 3 1	
35,36 e 37		2. Regional Municipal Park and Pedroso Botanic Garden (*1)	8,423,400.00	Mixed Forest Land Other	99 1	
46	Ribeirao Pires	1. Municipal Park of Milton Marinho Moraes	121,000.00	Forest Land Secondly Forest Shrub Bare Land Other	50 20 0 8 22	

(*1) : The municipal regional park of Santo Andre and Pederoso botanic garden extends to three micro basins, a) No. 35(5%), b) No. 36(92%) and c) No. 37(3%)

Table 3.7.3 Municipal Parks ongoing by Sub Basin and Municipality

No.of Micro Basin	Name of Municipality	Name of Park	Area (m^2)	Vagetation		Note (Area or Zone)
				Category	(%)	
1,2	Sao Paulo/ Cidede Ademar Submunicipality hall	1. Mar Paulista Park	216,000	Forest Land Secondly Forest Grassland Other(Industry)	15 9 62 14	Special Zone of Environmental preservation (ZEPAM/01)
4		2. Bandeirantes Park	260,000	Grassland Secondly Forest	4 96	Same as above (ZEPAM/02)
4		3. Sete Campos Park	84,000	Secondly Forest	100	Same as above (ZEPAM/04)
4		4. Itatinga Aterro Park	255,000	Grassland	100	Same as above (ZEPAM/05)
6		5. Apura Park	482,000	Forest Land Secondly Forest Grassland Bare Land	4 89 5 2	Same as above (ZEPAM/03)
6		6. Pedereira Park	326,000	Forest Land Secondly Forest Grassland Bare Land	18 49 25 8	Same as above (ZEPAM/06)
9	Diadema	1. Eucalipt Garden	4,461.00	Forest Land Secondly Forest Shrub Bare Land Other	35 15 10 10 30	Special Area of Environmental preservation-1
9		2. Eldorado Park	99,166.13	Bare Land Other	50 40	Special Area of Environmental preservation-1
10		3. Santa Fe 4. South Park 5. Eldorado Calango	2,980,000.00	Mixed Forest Other(facility)	99 1	Enviromental Strategic Macro Zone

1) In Sao Paulo, the following municipal parks are ongoing for establishment;

a) 4 linier parks and 3 green roads in Cidade Ademar sub municipal hall jurisdiction area

b) 14 linier parks and 4 green roads in Capela do Socoro sub municipal hall jurisdiction area

c) 7 linier parks in Parelheiros sub municipal hall jurisdiction area

2) The area or land use which was established by Sao Paulo city was estimated in reference to “Uso do Ocupação do Solo da Região Metropolitana de São Paulo e Bacia Hidrofráfica do Alto Tiete-Janeiro de 2005 which was prepared by EMPLASA-Empresa Paulista de Planejamento Metropolitano SA”

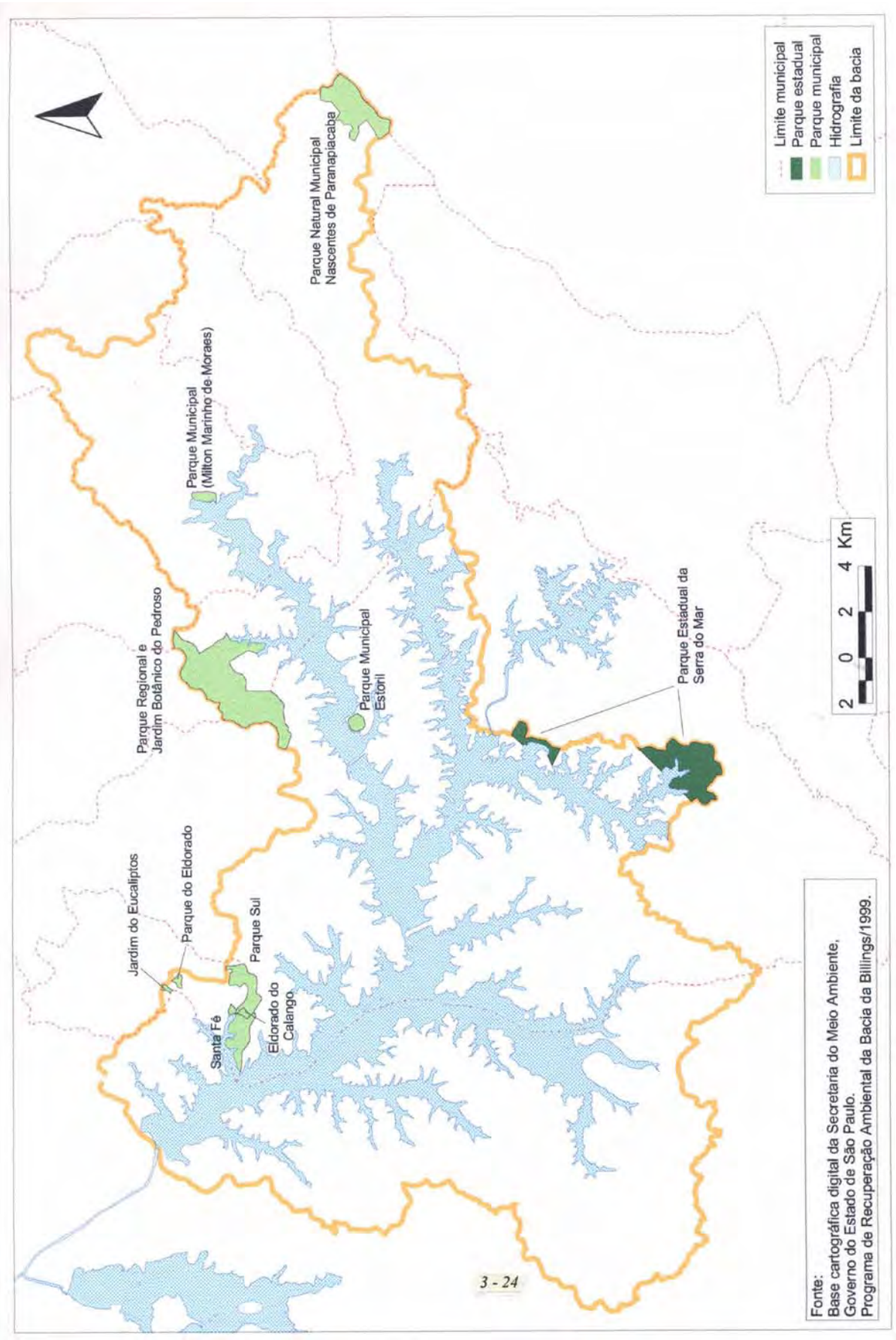


Figure 3.7.2 Municipal Parks by Sub Basin and Municipality

3.8 Road and Street System

3.8.1 General Description of Road and Street System

The billings lake Basin is cut through by 2 (two) main State highway namely Rodovia Anchieta and Rodovia Imigrantes, as well as the plateau interconnection. In addition, there is the South Section of the Ring Road Project by State (Rodoanel) which connecting Avenue Papa Joao XXIII in Maua Municipality to the east and Federal highway, namely Regis Bittencourt to the west. A long distance of new section of the Ring Road will be contained in this Billings lake basin.

We also point out, in the system in question, the Secondary State Roads, namely Índio Tubriça (SP-31) and Caminho do Mar (SP-148).

And also, within this basin there is the municipal street network system which will be treated separately. And No federal highways pass through this basin.

3.8.2 Government Attributions for Road and Street System

In general terms, it is up to the Federal Government, through the Ministry of Transport and its corresponding departments and authorities to establish a national transportation policy of railway, road and highway, waterway, merchant navigation, ports and navigable waterway.

And also these organizations establish a national policy of participation and coordination in air way transportation.

The State Government, through the Transport Secretary with it's corresponding departments and autarchies, is tasked with the coordination of responsible transport means in the State, promotion of organization, operation and re-equipping of the transport departments or systems owns by State, and is tasked to analyze, propose and inspect tariff alteration of the various transport means, and to approve, control and run the technical-economical, financial and administrative plans and projects corresponding to the various transport systems.

The Municipality Government is tasked with the administration of all collective transport system, paving of Street, maintenance, planning and projecting of the network of street system (Street, avenues, pedestrians, squares and etc.).

3.8.3 Federal Road System

The federal road system is regulated by the Ministry of Transport (MT), its Secretaries and autarchies. Therefore, by Federal Law 10,233, of June 05, 2001, the Federal Government provide for the restructuring of roadway and waterway transport management system, creates the National Council for the Integration of Transport Policies (CNIPT), the National Land Transport Agency (ANIT), the National Waterway Transport Agency (ANTAQ) and the National Department of

Transport Infrastructure (DNIT).

The National Department of Transport Infrastructure (DNIT) is the main operational department of the Ministry of Transport which implemented in February 2002 to perform the functions related to constructing, maintenance and operation of the infrastructure of the Federal Road System segment under the direct administration of the Union in the roadway, railway and waterway modalities.

This department, mentioned above, is tasked with operating and administrating of transport infrastructure, creating of plan and project, supervision and inspection of the activities of entities delegated to conduct infrastructure works and services.

Federal Roads remain under the administration of the DNIT, with the exception of 4% of the road network which are under concessions. Consequently, most of DNIT's investments will be destined in this modality which involves 56 thousand kilometers (km) of roadway network nationwide.

3.8.4 State Road System

The State Roadway system is regulated by the State Secretary of Transport (SET), its departments and autarchies, which composed the Roadway Department (DER), the Airway Department of the State of São Paulo (DAESP), The Waterway Department (DH), the Roadway Development S.A. (DERSA) and Transport regulating Agency of the State of São Paulo (ARTSP).

Each unit performs an important role for the integration of the State transport systems to be a continuous and efficient effort.

(1) Current and Future System of Main State Highways of Interest of the Billings Lake Basin

1) The Anchieta state highway (SP-150) connects the Metropolitan region of São Paulo and the Santos Coast area, passing through the municipalities of São Paulo, São Bernardo do Campo, Cubatão and Santos which has its 55.9 km extension with average width of road belt as 54m and average pavement width of 21.5m. Anchieta state highway was one of the first highways built in Brazil following the modern and rigorous technical standards for the time.

2) The Imigrantes state highway (SP-160) connects the Santos Coast area to the Plateau region (Planalt) which has its 58.54 km extension with average width of road belt as 80m and average pavement width of 40.0m, passing through the municipalities São Paulo, Diadema, São Bernardo do Campo, Cubatão, São Vicente and Praia Grande. Its implementation was aimed at catering to the large traffic flow between the Metropolitan region of São Paulo and the Santos Coast area, since Anchieta highway had practically exhausted its capacity by the end of 1960's.

As the part of the State Government Concession Program, the Anchieta-Imigrantes System began to be administrated by the concessionaire Ecovias Imigrantes for a 20-year period, according to

contract signed on May 27, 1998.

3) Project of Mario Covas Ring Road

The current system of truck cargo in Sao Paulo Metropolitan Area has the following issues;

- Transportation of industrial products in the major industrial areas of Rio de Janeiro state, Sao Paulo state, Parana states and etc.
- Transportation of mining and agriculture products in Sao Paulo state, Minas state, Goias state, South Mat Grosso state and etc.
- Increase of regional truck cargo among above industrial and agriculture areas
- Increase of truck cargo connected to Santos harbor, which is biggest in Brazil and its location of south part of Sao Paulo Metropolitan Area and the south part of Billings Lake basin
- Existing traffic volume exceeding its capacity of Tiete Ring Road which terminates and connects the federal and state main road network in Sao Paulo Metropolitan Area.

The implementation of the program was commenced in order to settle above existing system of truck cargo issues in nationwide, Sao Paulo statewide and in Sao Paulo Metropolitan Area. And one of the priority parts of the north section has already been opened to traffic.

a) Outline of South Section of the Program

The outline of this section is shown as follows;

- It starts from the point of 278.8 km (the vicinity of Embu municipality) of Federal Road 116 (Regis Bittencourt) which is located in the west part of Sao Paulo municipality, and
- Enters Billings Lake basin from the vicinity of Capela do Socorro sub municipality hall jurisdictional area in Sao Paulo municipality (No.130 micro basin), and
- Runs through Billings Lake twice, and
- Lands in Sao Bernardo do Campo municipality (No.25 micro basin) and runs through the this municipality in almost parallel to the Billings lakeside, and
- Enters Santo Andre municipality (No.35 micro basin), and
- Skips Ribeirao Pires municipality (No.40 micro basin), and
- Terminates at the point of 4.4km of Avenue Papa Joao XXⅢ in Maua municipality

The total road extension of this section is about 57 km with minimum width of road belt as 130m and average pavement width of about 42m.

3.8.5 Road System in Municipalities

(1) Management System on Municipal Road Network

Generally, the municipal road network management is composed of two departments, one is the department for technical review for license for residential development project and the section responsible for road management including road maps, and another department is the supervising of construction and its works for road pavement works of its road networks, rainwater drainage works and repair works. Each municipally operates the general service for municipality road networks of his jurisdictional area in his operational departments, while they differs slightly, a management department for the public roads and supervisory department of public works.

1) Components of Municipality Road Network

The road network of each municipality is generally composed of a) arterial road in district or residential area (*Avenida*), b) street (*Rua*), c) plaza adjacent to road *(Praça)*. However, d) passageway (*Travessa*) and narrow space for public utilities (*Viela*) are also its important elements, and it includes f) road (*Estrada*) which passes through the low populated area such as small-scaled plantation area called "*Chacara*", agricultural area and forest area.

3.8.6 Current Status and Subjects of Roads

(1) Current Status

The current road situation is studied for the purpose of survey on current municipality road network, situation of road pavement and road permeability as the following methods in order to adjust to other sectors in the study.

1) Preparation of Survey Sheets for Road Area by Municipality and Micro Basin, and for Road

Pavements and Road Permeability

a) Transform the sub-basin map in Format-Shapefile used in the existing report of "Billings 2000"into Format-Maptitude 4.7 by keeping unchanging its coordinates.

b) There was an adjustment made to the micro-basin boundaries map over the street system axis map (streets)-LogiMap, of Logit, and the procedure used was geoprocessing, aimed at ensuring the same projection and boundaries.

c) The sections of the street system axes were segmented into micro-basin boundaries with the purpose of separating each street's proportion in each micro-basin, and also conducted by geo-processing (clip) function.

d) Through attribution command, per geographic location (Tag command), for each street system

segment (street), the identifier of the micro-basin to which this street belongs was attributed.

e) Survey Sheets were prepared basing on the table of segmented (divided) sections of the street system (streets), added by their respective micro-basins, names, districts, extensions, width of with pavement, width of without pavement.

2) Calculation of extension road length, road width and pavement / permeability by micro basin and municipality

The road dimensions were calculated based on the survey sheet as mentioned above 1), e) in collaboration with each municipality road departments.

However, the dimensions of the unregistered roads by the road departments of municipality because of the existence of large amount of illegal housing lots and irregular residential areas in this basin were estimated based on the interview survey with the staffs of road departments of each municipality

3) Area, Pavement and Permeability of Existing Roads

The current road situation by municipality and micro basin based on above survey is shown in **Table 3.8.1,** which indicates the remarkable regional differences regarding i) ration of paved road and ii) per capita road area.

(2) Subjects

The mounds or steep sloped hills continue undulate and intermittently in the most parts of densely populated area of i) the vicinity of Cidade Ademar sub-municipal office jurisdictional area in Sao Paulo Municipality, ii) the north lakeside of Lake Billings in Sao Bernardo do Campo municipality, iii) the vicinity of Capela do Socorro sub-municipal office jurisdictional area in Sao Paulo municipality and iv) region of Diadema municipality, where are not suitable for housing areas.

The ratio of paved roads is low in the areas of i) and ii), which may cause possible risk for the pollutants wash-out including roadbed materials.

In the latter iii) and iv), the appropriate treatment measures for road surface including permeable roads is necessary, since it may cause the possible local flood at heavy rainfall in spite of its high ratio of road pavement.

Table 3.8.1 Current Road Situation by Municipality

No. of Micro Basin	Name of Municipality	Region or Submunicp. Office	Extension of Road	Area with Pavement (m^2)	Area without Pavement (m^2)	Total Area of Road (m^2)	Ratio of Pavement (%)
001-009	Sao Paulo	Cidade Ademar	178,010	902,275	891,659	1,793,934	50.30
107-118		Parelheiros	181,072	728,177	1.098,438	1,836,615	39.85
119-146		Capela do Socorro	443,666	4,478,844	779,806	5,256,650	85.17
		Sub Total	802,748	6,107,296	2,769,903	8,877,199	68.80
009-010	Diadema	North Region of Billings	56,320	558,739	95,435	654,083	85.72
011-034	Sao Bernardo do Campo	North Region of Billings	262,750	2,249,029	2,314,695	4,563,724	49.28
059-107		North Region of Billings	299,570	1,755,149	3,399,288	5,138,475	34.16
		Sub Total	562,320	4,004,179	5,713,983	9,702,199	41.27
034-040	Santo Andre	North Region of Billings	73,882	49,730	483,553	533,283	9.33
049-075		South Region of Billings	199,613	182,435	1,336,446	2,052,611	12.01
		Sub Total	273,495	232,165	1,820,446	2,052,611	11.31
040-048 053-058	Ribeirao Pires	South Region of Billings	349,589	2,708,006	1,743,223	4,451,230	60.84
048, 051-053	Rio Grande da Serra	South Region of Billings	168,003	575,270	1,443,449	2.015,719	28.50
	Total of Billings Basin		2,212,476	14,185,655	13,586,349	27,756,041	51.11

Table 3.8.2 Per Capita Road Area

Name of Municipality	Region or Sub-municipality Office	Population (2000)	Area of Road (ha)	Per capita of Road Area (m^2/person)
Sao Paulo	Cidade Ademar	142,894	179.39	12.55
	Parelheiros	29,945	182.66	61.01
	Capela do Socorro	295204	525.66	17.81
	Sub Total	468,043	887.72	18.97
Diadema	North Region of Billings	54,201	65.41	12.07
Sao Bernardo do Campo	North Region of Billings	157,866	456.37	28.91
	South Region of Billings	27,634	513.85	185.95
	Sub Total	185,500	970.22	52.30
Santo Andre	North Region of Billings	28,240	53.33	18.88
	South Region of Billings	5,763	151.93	263.63
	Sub Total	34,003	205.26	60.37
Pibeirao Pires	East Region of Billings	86,383	445.12	51.33
Rio Grande da Serra	East Region of Billings	37,740	201.87	53.49
Total of Billings Basin		865,870	2,775.60	32.06

3.8.7 Future Situation on Road Network

(1) Increase of Road Area caused by Population Increase in Lake Basin

The road area is estimated to increase largely to be caused by the increase of residential area since the future basin population will increase as shown in **Chapter 10.1** as approximately 990,000 as

year of 2005 (increase by about 124,000 from 2000), 1,205,000 as year of 2015 (increase by about 215,000 from 2005), 1,393,000 as year of 2025 (increase by about 188,000 from 2015)

(2) Estimation of Road Ratio in Residential Areas and Urban Area

The development and sales of housing lots are implemented by private companies in the periphery parts of Sao Paulo Metropolitan Area and the surrounding local cities. The ratio of land use in these developments, net area of housing lots is estimated as 45 to 55 % and net road area is 20 to 25 % respectively. These figures are estimated as by the assumption of the future prospect of road and green coverage increase since the effective residential ration will be hard to increase, while the ratio of residential use varies depending on its topographic conditions and the scale of its residential lot (250 – 300 m^2/lot in middle income class and 300 -500m^2/lot in high income class).

The road area will be required as approximately 24 m^2/person for a net developed housing lot and 25 to 30 m^2/person for an urbanized housing district, respectively, when the minimum housing lot area and the average family number are assumed as 250 m^2 (average area of housing lot: about 260 m^2) and 5 person, respectively. Therefore, the future road area is estimated by setting the average road area of 32.06 m^2/person in 2000 (which is shown in **Table 3.8.2**) as a basic unit in the lake basin, and the estimated road areas by micro basin and municipality in 2005, 2015 and 2025 are shown in **Annex 3.8.2.**

(3) Influence of Extensive Transportation and Road Development Project to Lake Basin

The following two programs are ongoing as the extensive transportation and road development project in the lake basin which may affect the future road area in the basin.

1) Urban Transportation Program of Sao Bernardo do Campo Municipality

This program is the Urban Transportation Improvement project (named as Programa de Transporte Urbano se Sao Bernardo do Campo) which Sao Bernardo do Campo municipality commenced for the purpose of its implementation financed by the IDB (Inter-American Development Bank) loan since 2001. The program was also promoted by the Program Coordination Unit (UCP) as same as the JICA study which was established in the city hall.

The objects of the program is a) the completion of the ring road and connection parts located in Sao Bernardo do Campo municipality, b) improvement of mass transit system using of bus, c) improvement of signal system and road safety and d) capacity building of relevant organizations, and its current situation is in the stage of preparation of the tender for the construction works of 1st construction zone area.

However, the road parts of the program in the lake basin aims mainly at the road pavement in the right-of way of the existing arterial roads, promotion of increase of traffic lane number and the

increase of the connection parts between their arterial roads and highway, which is estimated to cause no influence on the captioned plan since the program includes no plan for new road development.

2) Project of Mario Covas Ring Road

A background and framework of this project is written in Section 3.4.5-(3), and current situation, affected area and influence for basic unit of estimation on future road area were shown as follows;

a) Current Situation

An Environmental Impact Assessment (named as EIA) and a Report of Environmental Impact (named as RIMA) regarding to this project were completed and distributed to all relevant public organization, and the Public hearing which is obligated in procedure for obtain Previous License (named as LP) has been prepared.

However, the two type of information, a) the State Council of Environment (named as CONSEMA) approved these Environmental Reports recently and b) the Public Procurator jurisdictional area in Sao Paulo Municipality will prepare to bring this case before the court, were published. And it means that it is very difficult and very delicate to estimate the future situation of this project.

b) Affected Micro Basin and Influence on Estimation of Basic Unit for Future Road Area

The total road extension in the lake basin is about 21.3 km, and the sub basins which will be affected by the proposed project is estimated as 19 micro basins, Capela do Socorro sub municipality hall jurisdictional area (micro-basin number: 123, 124, 126, 129, 130 and 131), Sao Bernardo do Campo municipality (micro-basin number: 22, 23, 25, 28, 29, 30, 33 and 34), Santo Andre municipality (sub-basin number: 35, 36, 37, 38) and Ribeirao Pires municipality (sub basin number: 40).

However, it has not reason to modifier the basic unit (m^2/person) for estimation of future road area affected by this project as mentioned in item a).

3.8.8 Permeable Pavement

(1) Permeable Pavement in Brazil

1) Traditional Pavement

Granite is produced in nationwide in Brazil. Therefore, the carriageway pavement (stone pavement), which pave the natural stone bricks (named as Paralelepípedo) on the underlying roadbed, was traditionally carried out. And the pavement remains in many local cities even now. The stone bricks were shaped in the size of about 20cm x 15cm x 10cm from the black, red or brownish-red granite.

2) Concrete Brick Permeable Pavement

Above traditional pavement was replaced with the present concrete brick pavement. And, generally, the carriageway pavement by the interlocking method using the hexagonal concrete bricks (named as Lajota de Concreto Sexta Vado) is carried out in small-scaled housing area or the area with high level of subterranean water.

3) Asphalt Permeable Pavement

The asphalt permeable pavement in Brazil originated two test construction, the test construction which was carried out by concessionaire Ecovias Imigrantes (which is mentioned in Chapter 3.5.1), another test construction which was carried out by concessionaire Nova Dutra who is a highway management company of Presidente Dutra Highway (Rodovia Presidennte Dutra) connecting between Sao Paulo and Rio de Janeiro. The object of the test construction by Ecovia dos Immigrantes was a) to reduce the road splash caused by running vehicles at rainfall, b) to secure the safety of highway by improving the visibility road sign at rainfall. The test construction by Ecovia dos Immigrantes was also conducted c) at the two surface pavement parts in parallel in Immigrantes Highway, one was the pavement part by the traditional asphalt pavement, and another was porous asphalt the pavement (named in Brazil as CPA-Camada porosa de Atrito).

However, the object of above two permeable pavement was basically to drain the seepage water at the pavement surface, the base layer was constructed as an impermeable layer by the traditional method, which was slightly different from the concept on permeable pavement because the surface seepage rainwater was drained to the side zone (named as Acostamento) at both sides of the traffic lane.

(2) Attempt to Permeable Road Pavement in Sao Bernardo do Campo Municipality

The road related departments of Sao Bernardo do Campo Municipality decided to develop the streets using the first permeable pavement in Brazil for the re-urbanization of the irregular residential areas of Detroit and Carminha located in the north region of Billings Lake basin in order to reduce the surface pollution load and recharge the groundwater in the lake basin. The development was one of the development projects based on the agreement between the relevant authorities and residents (named as TACs: Termo de Ajustamento de Conduta) which was implemented since 1999.

The outline of above project is shown as follows.

1) Type of Structure of Permeable Pavement

The structure type of the permeable pavement is composed of a) seepage type at roadbed (the type which rainwater is directly saturated from roadbed into ground) and b) temporary trap type at pavement body (the type which aims at prevention of storm runoff by the temporary trap of rainwater inside the pavement body).

For the this implementation, the latter type was adopted because of the reasons that the allowable capacity on the infiltration and its uniformity at roadbed or existing ground cannot be prospected due to the geological variations of the target project sites.

2) Temporary Trap System at Pavement Body

The system takes the surface rainwater and drains it into the permeable trench (W=50cm, H=60cm) covered by permeable sheet (named as Manta Geotextil) and filled with singled sized gravels (named as gravel No. 3). The permeable trench is constructed at the lower part of the pavement (carriageway) in parallel of concrete type edge stone (named as Guia e Sargeta) which is installed at the boundary between pavement part and sidewalk. The drainage water from above permeable trench is a) temporarily trapped at the drainage well (Diameter=70cm, Depth=about 5m: the well which is covered by permeable sheet and filled with large sized gravels) installed at the interval of about 30 m, and followed by the infiltration into the existing ground.

3) Cross Section of Pavement Body

The construction of the pavement works is carried out by the following procedures as the same way of the traditional method;

a) preparation work of roadbed to secure of flatness and compaction (below CBR12, accompanied with humidity control)
b) construction work of roadbed (t = 15cm to 20cm) by the gravels after size control (named as Brita graduada)
c) spraying of asphalt waterproofing admixture (named as CM-30)
d) construction of base layer (t = 7cm) by the normal asphalt waterproofing mixture (named as PMQ-Pre mixtrada quente)
e) spraying of antistripping additive (named as Ligante de Emulex), and
f) construction of surface permeable pavement (t = 5cm) by the porous asphalt mixture (named as *CPA:* Camada Porosa de Atrito)

4) Points of Concern for Design and Construction

The specification of the proposed permeable pavement should be basically applied for a) the pavement works directed for the small streets with the longitudinal slopes below 12 %, and b) the

roadbed construction works by the large-sized gravels (t = 30cm to 50cm) before the roadbed construction works as mentioned in above 3), b) should be carried out for regional arterial roads which has large a traffic volume of heavy vehicles, and c) the drain ditch / drain box (named as Boca de Lôbo), concrete type drain pipe for rainwater should be installed in the same way as the normal rainwater drainage design and followed by the construction of concrete type pavement for the places such as traffic intersection gathering of excess rainwater.

When there are the residential lots or residential areas in the cross-sectional direction which are greatly located below the road surface, the permeable trench should be installed with its one-side inclination of the road slope at the opposition parts of the target residential lots or areas in order to prevent the water inundation into the residential areas from the drainage well as mentioned in above 2), b).

5) Sidewalk

The permeable pavement at the sidewalk is also important and the half part of the sidewalk should be covered by turf since its proportion ration to the street correspond is approximately to 50 % of the carriageway.

(3) Estimated Problems based on Implementation of Permeable Pavement in Street Area

In case of new housing area development, the permeable pavement can be implemented including its sidewalk areas, in the coordination with the relevant state agencies by regulating the road standards based on housing area development and detailed bylaws related to the specification of permeable pavement which is appropriate and operable. However, as for the installation works such as the water pipe network and sewage pipe network included the its connection pipes for each domicile which were conducted under the different jurisdiction, it is necessary to pay attention to the adjustment of construction schedule of the pavement works or the repair works.

In addition, the streets with enough road width would be hard to develop in the irregular residential areas existents. In such case, the verification will be necessary for the location of the permeable trench, since the damage at the weak parts of the pavement strength is anticipated by the passage of the heavy vehicles such as the garbage collection vehicles of domestic waste and the gas container distributing vehicles.