Sao Paulo Metropolitan Region

Guarapiranga Project
Water Sources São Paulo Metropolitan Region

South America, Brazil and the State of São Paulo
The State and the São Paulo Metropolitan Area

São Paulo Metropolitan Area
21.2 million inhabitants
39 municipalities
# Water Sources São Paulo Metropolitan Region

## Sao Paulo Metropolitan Region and City of Sao Paulo

### Demographic Evolution Since 1900

<table>
<thead>
<tr>
<th>Período</th>
<th>City of São Paulo</th>
<th>São Paulo Metropolitan Region</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population (hab)</td>
<td>Annual Rate of Growth (%)</td>
</tr>
<tr>
<td>1.900</td>
<td>239.820</td>
<td>-</td>
</tr>
<tr>
<td>1.920</td>
<td>579.033</td>
<td>4,5</td>
</tr>
<tr>
<td>1.940</td>
<td>1.326.261</td>
<td>4,2</td>
</tr>
<tr>
<td>1.950</td>
<td>2.198.096</td>
<td>5,2</td>
</tr>
<tr>
<td>1.960</td>
<td>3.781.446</td>
<td>5,6</td>
</tr>
<tr>
<td>1.970</td>
<td>5.885.475</td>
<td>4,5</td>
</tr>
<tr>
<td>1.980</td>
<td>8.475.380</td>
<td>3,7</td>
</tr>
<tr>
<td>1.991</td>
<td>9.512.545</td>
<td>1,2</td>
</tr>
<tr>
<td>2.000</td>
<td>10.398.576</td>
<td>0,9</td>
</tr>
<tr>
<td>2.010</td>
<td>11.253.503</td>
<td>0,8</td>
</tr>
</tbody>
</table>
Water Sources São Paulo Metropolitan Region

Water Supply System
Water Sources São Paulo Metropolitan Region

Cachoeira Reservoir – Cantareira System
Water Sources São Paulo Metropolitan Region

Paiva Castro Reservoir – Cantareira System
Reservoirs of Alto Cotia System

Barragem da Graça

Pedro Beicht
Water Sources São Paulo Metropolitan Region

Guarapiranga e Billings Reservoirs
Compatible Uses in the Territory of Guarapiranga
Water Sources São Paulo Metropolitan Region

The Wetland of Embu Guaçu Creek
Guarapiranga Reservoir
Billings Reservoir – Cantinho do Céu e Gaivota Settlemens
Slums and Illegal Settlements

Map of São Paulo Metropolitan Region showing water sources and slums.
The Most Polluted Sub-basins

- 50% of the phosphorus inflow to the reservoir
- 3.5% of total area
- 7% of total flow.
### Water Sources São Paulo Metropolitan Region

## Financial Details

- **Signing of Contract with the World Bank**: December/1992
- **Original Total Program Budget**: US$ 262 million
- **Revised Budget**: US$ 336 million
- **World Bank Financing**: US$ 119 million

<table>
<thead>
<tr>
<th>Executing Agency</th>
<th>World Bank Value (US$ 1000)</th>
<th>(% of Total)</th>
<th>Local Fund Value (US$ 1000)</th>
<th>(% of Total)</th>
<th>Total Value (US$ 1000)</th>
<th>(% of Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UGP</td>
<td>20.621</td>
<td>17</td>
<td>6.523</td>
<td>3</td>
<td>27.144</td>
<td>8</td>
</tr>
<tr>
<td>SABESP</td>
<td>42.465</td>
<td>36</td>
<td>51.885</td>
<td>23</td>
<td>94.350</td>
<td>28</td>
</tr>
<tr>
<td>CDHU</td>
<td>9.474</td>
<td>8</td>
<td>60.442</td>
<td>28</td>
<td>69.916</td>
<td>20</td>
</tr>
<tr>
<td>SMA</td>
<td>13.306</td>
<td>11</td>
<td>14.411</td>
<td>6</td>
<td>27.717</td>
<td>8</td>
</tr>
<tr>
<td>PMSP</td>
<td>33.133</td>
<td>28</td>
<td>83.754**</td>
<td>40</td>
<td>116.887**</td>
<td>36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>119.000</strong></td>
<td><strong>100</strong></td>
<td><strong>217.015</strong></td>
<td><strong>100</strong></td>
<td><strong>336.015</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**NB**: Revised figures (including Housing)
### Investment Allocation

<table>
<thead>
<tr>
<th>Service</th>
<th>Allocation (US$ million)</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water and Sewage Services</td>
<td>94.3</td>
<td>Expansion of the sewage collecting system; Increased number of domestic sewage connections; Implantation of interceptors and main collectors; Construction of pumping stations; Construction of sewage treatment plants.</td>
</tr>
<tr>
<td>Refuse Collection</td>
<td>5.7</td>
<td>Expansion of refuse collection in the municipalities of Embu, Itapecerica da Serra and Embu-Guaçu; Recovery and improvements to refuse-disposal areas in the municipalities of Embu and Itapecerica da Serra.</td>
</tr>
<tr>
<td>Urban Rehabilitation</td>
<td>187.1</td>
<td>Installation of urban infrastructure in slums; Improvements to urban infrastructure; Construction of housing units for removed families</td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>27.7</td>
<td>Installation of parks, basin resettlement, support for inspection procedures and environmental studies.</td>
</tr>
<tr>
<td>Basin Management</td>
<td>21.3</td>
<td>Installation of the Basin Management Committee; Studies on equipping basin management with the most effective instruments.</td>
</tr>
</tbody>
</table>
Guarapiranga Project Water and Sewage Civil Works
Guarapiranga Project
Embu: dump before the intervention
Guarapiranga Project
Embu: landfill during the intervention
Guarapiranga Project: dump in Itapecerica da Serra
Guarapiranga Project: 
Itapecerica da Serra – implementation of the landfill
Guarapiranga Project
Reurbanization of a Slum - Jordanópolis
Guarapiranga Project
Jardim Esmeralda Slum
Water Sources São Paulo Metropolitan Region

Guarapiranga Project
Jardim Iporanga Slum Before the Civil Works
Guarapiranga Project
Jardim Iporanga Slum After the Civil Works
Water Sources São Paulo Metropolitan Region

Housing Complexes

Pascoal Melantonio housing complex
Guarapiranga Ecological Park
## Guarapiranga Projects
### Main Urban Interventions

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urbanized Slums</td>
<td>105</td>
</tr>
<tr>
<td>Families Benefited by the Urbanization of Slums</td>
<td>17,350</td>
</tr>
<tr>
<td>Housing Units</td>
<td>1,560</td>
</tr>
<tr>
<td>New Housing Units (within the slums)</td>
<td>836</td>
</tr>
<tr>
<td>Families Benefited by the Infrastructure in Low Income Settlements</td>
<td>38,200</td>
</tr>
<tr>
<td>New Parks</td>
<td>6 (459ha)</td>
</tr>
</tbody>
</table>
Designing an Intervention in Urban River Basins
In the Other Hand, What are the Problems to be Faced by the Management of Guarapiranga and Billings Basins?

- Population growth is fueled by job offers in the area outside, but adjacent to the basin
- Low and extremely low-income population groups concentrated on the reservoir’s right and left banks. Urban expansion is almost exclusively limited to such groups. There are still large unpopulated areas subject to illegal settlements
- Legislation from 70th’s produced ambiguous effects – controlled the “formal” economy, but not the “informal” one
- There is a poor public-service attendance (because the old legislation)
- There are high unemployment and underemployment, social deterioration and high crime rates (but falling)
- It is tipically a regional problem, difficult to deal with anywhere, but specially because the Brazilian federalism.
Key Issues for Assessment and Sustainability (or some questions to be answered)

In areas with an occupation with certain characteristics - high density, predominancy of low income families, large presence of slums and precarious villages -, is it possible to control and to upgrade the water quality?
Key Issues for Assessment and Sustainability

Is slum upgrading a feasible and justifiable housing-policy alternative?
Key Issues for Assessment and Sustainability

Is a separate system an adequate sewage solution?
What is necessary to change the pattern of land use in the watershed?
Key Issues for Assessment and Sustainability

Can such an ambitious program, focused on a relatively small area and whose results depend on much more far-reaching issues such as employment rates, earnings levels and housing policies, be successful?
Main Conclusions

Water Quality and Sewerage

- Emphasis on continued operational improvements to the sewage system and control over other sources of pollution loads

- Expand the use of complementary treatment for natural water bodies

- Adopt advanced treatment techniques for drinking water

- Expand knowledge of water quality in the São Paulo water-source rivers and reservoirs and improve monitoring procedures
Main Conclusions

- Improvement of urban standards and encouragement of adequate land use

- Continue with the slums upgrading and the recuperation of degraded areas; regularize title to the properties in the area and improve social follow-up

- Encourage alternative types of occupation compatible with protecting the water sources; strengthen inspection procedures
Main Conclusions

- Occupation of water-source territories in large, concentrated urban areas in the developing (or third) world is not a sectorial problem

- Slum upgrading is an adequate solution for situations like this

- Operating separate sewer systems in urban areas characterized by uncontrolled land occupation is a major problem
Main Conclusions

- Water quality in tropical lakes and pollution-control and treatment techniques in water-supply reservoirs are an important field of study in the decades ahead.

- Although it is possible to control such problems as those of the São Paulo water sources, this will always be a lengthy process involving gradual gains.

- The methodology adopted in the Guarapiranga and Mananciais Projects can be useful for elaborating, controlling, carrying out and assessing programs for areas with serious problems of water pollution and availability in large, densely-populated urban regions.
Water Sources São Paulo Metropolitan Region

Basic Aspects of the Changing Water Source Legislation

The Legislation to be substituted

- State legislation
- Land-use and occupation legislation
- Population density norms and restrictive control parameters

Category 1 Areas
Category 2 Areas
- Type A: maximum density = 50 inhab./ha
- Type B: 34 inhab./ha
- Type C: average density similar to rural areas

The New Legislation

- Water Quality Control
- Target for Affluent Loads (Phosphorous)
- Referential Loads for each Sub-Basin and Municipality
- Environmental and Development Plans
- Municipal Laws Detailing Land Use
Methodology – Land Use v. Water Quality Correlation Model
Cargas de Fósforo Afluentes ao Reservatório Guarapiranga (kg/dia)

<table>
<thead>
<tr>
<th>Ano</th>
<th>Mqual 1.0</th>
<th>Mqual 2.0</th>
<th>Valores Medidos Cargas Afluentes</th>
<th>Cargas Potenciais</th>
<th>População na APRM</th>
</tr>
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<tbody>
<tr>
<td>1991</td>
<td>828</td>
<td>329</td>
<td>828</td>
<td>940</td>
<td>548.37</td>
</tr>
<tr>
<td>1992</td>
<td>245</td>
<td>245</td>
<td>241</td>
<td>939.6</td>
<td>622.283</td>
</tr>
<tr>
<td>1993</td>
<td>245</td>
<td>245</td>
<td>241</td>
<td>1139.21</td>
<td>757.24</td>
</tr>
<tr>
<td>1994</td>
<td>245</td>
<td>245</td>
<td>241</td>
<td>244</td>
<td>925.76</td>
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<tr>
<td>1995</td>
<td>245</td>
<td>245</td>
<td>241</td>
<td>1397.9</td>
<td>883.30</td>
</tr>
<tr>
<td>1996</td>
<td>245</td>
<td>245</td>
<td>241</td>
<td>1350</td>
<td>894.00</td>
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<tr>
<td>1997</td>
<td>245</td>
<td>245</td>
<td>241</td>
<td></td>
<td>930.96</td>
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Carga Meta = 147 - Lei Específica 2008
## Guarapiranga – Billings Project Budget (including fund of PAC)

<table>
<thead>
<tr>
<th>Agency</th>
<th>Federal Budget</th>
<th>State Budget</th>
<th>Municipality Budget</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>São Paulo Municipality</td>
<td>130,00</td>
<td>-</td>
<td>446,58</td>
<td>576,58</td>
</tr>
<tr>
<td>SABESP ¹</td>
<td>120,00</td>
<td>-</td>
<td>42,13</td>
<td>162,13</td>
</tr>
<tr>
<td>State</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Housing Company</td>
<td>-</td>
<td>130,60</td>
<td>-</td>
<td>130,60</td>
</tr>
<tr>
<td>TOTAL</td>
<td>250,00</td>
<td>130,60</td>
<td>488,71</td>
<td>869,31</td>
</tr>
</tbody>
</table>

Amount in R$ milhões

(¹) To apply in the execution of water and sewerage systems of the 45 areas to be urbanized by São Paulo Municipality