

|                               |  |
|-------------------------------|--|
| Country Name                  | <b>Project for Improvement of Operation and Maintenance of Water Supply and Sewerage Systems in Parana State</b> |
| Federative Republic of Brazil |  |

**I. Project Outline**

|   |   |              |   |               |                |                       |                                |                                  |   |   |  |
|---|---|--------------|---|---------------|----------------|-----------------------|--------------------------------|----------------------------------|---|---|--|
| Background  | <p>In the Curitiba Metropolitan Area (CMA) along the Atlantic Coast in southern Brazil, rapid urbanization resulted in a shortage of water supply and sewerage services, and it had serious adverse effects on the sanitary environment of the inhabitants in the area. In order to improve water supply and sewerage services in the area, JICA implemented “Parana State Environmental Improvement Project” (1998), an ODA Loan project, targeting Parana State Sanitation Company (SANEPAR). However, SANEPAR did not have a sufficient capacity to operate and maintain (O&amp;M) its water supply and sewerage facilities, and the maintenance works were not carried out properly. As a result, many obsolete water supply and sewerage facilities were left without necessary timely replacement. For the reasons, several problems, such as leakage of water and sewage caused by corrosion, damages and blocking of water supply and sewerage pipes as well as sewage overflow from utility holes and drainages on occasions when the water flows increased.</p>   |              |   |               |                |                       |                                |                                  |   |   |  |
| Objectives of the Project   | <p>Through delivery of trainings on O&amp;M of sewerage pipe network, sewerage treatment plants, and water treatment plants to the SANEPAR staff, preparations of rehabilitation/replacement plans and improvement plans on sewerage pipe network, development of O&amp;M manuals and replacement plans on sewerage treatment plants and water treatment plants, and organizing workshops/seminars to disseminate the manual and the plans prepared by the project, the project aimed at improving the O&amp;M of water supply and sewerage systems by SANEPAR in the target area of the project, thereby contributing to improvement of water supply and sewerage services of SANEPAR in the target area.</p> <ol style="list-style-type: none"> <li>Overall Goal: Water supply and sewerage service of SANEPAR is improved in the target area of the project.</li> <li>Project Purpose: Operation and maintenance of water supply and sewerage systems in SANEPAR is improved in the target area of the project.</li> </ol>   |              |   |               |                |                       |                                |                                  |   |   |  |
| Activities of the Project   | <ol style="list-style-type: none"> <li>Project Site: the Curitiba Metropolitan Area and coastal areas in Parana State</li> <li>Main Activities: 1) Delivery of trainings on O&amp;M of sewerage pipe network, sewerage treatment plants, and water treatment plants to the SANEPAR staff, 2) Preparation of rehabilitation/replacement plans and improvement plans on sewerage pipe network, 3) Preparation of O&amp;M manuals and replacement plans on sewerage treatment plants and water treatment plants, 4) Organizing workshops/seminars to disseminate the manual and plans prepared by the project, and so on.</li> <li>Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Japanese Side</td> <td style="width: 50%;">Brazilian Side</td> </tr> <tr> <td>1) Experts: 7 persons</td> <td>1. Staff Allocated: 67 persons</td> </tr> <tr> <td>2) Trainees Received: 17 persons</td> <td>2. Land and facility: office space in SANEPAR</td> </tr> <tr> <td>3) Equipment: TV camera for main sewerage pipe diagnosis, ultra-sonic flow meter, diffusion type hydrogen sulfide meter, etc.</td> <td>3. Local expense: utility cost, cost for installation of equipment for investigation and experiments</td> </tr> </table> </li> </ol> |              |   | Japanese Side | Brazilian Side | 1) Experts: 7 persons | 1. Staff Allocated: 67 persons | 2) Trainees Received: 17 persons | 2. Land and facility: office space in SANEPAR | 3) Equipment: TV camera for main sewerage pipe diagnosis, ultra-sonic flow meter, diffusion type hydrogen sulfide meter, etc. | 3. Local expense: utility cost, cost for installation of equipment for investigation and experiments |
| Japanese Side   | Brazilian Side  |              |   |               |                |                       |                                |                                  |   |   |  |
| 1) Experts: 7 persons   | 1. Staff Allocated: 67 persons  |              |   |               |                |                       |                                |                                  |   |   |  |
| 2) Trainees Received: 17 persons  | 2. Land and facility: office space in SANEPAR   |              |   |               |                |                       |                                |                                  |   |   |  |
| 3) Equipment: TV camera for main sewerage pipe diagnosis, ultra-sonic flow meter, diffusion type hydrogen sulfide meter, etc. | 3. Local expense: utility cost, cost for installation of equipment for investigation and experiments  |              |   |               |                |                       |                                |                                  |   |   |  |
| Project Period  | September 2012 – September 2015   | Project Cost | (ex-ante) 340 million yen, (actual) 416 million yen |               |                |                       |                                |                                  |   |   |  |
| Implementing Agency   | Parana State Sanitation Company (SANEPAR: Companhia de Saneamento do Paraná)  |              |   |               |                |                       |                                |                                  |   |   |  |
| Cooperation Agency in Japan   | Nihon Suido Consultants Co., Ltd.   |              |   |               |                |                       |                                |                                  |   |   |  |

**II. Result of the Evaluation**

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|--|
| 1 Relevance  |
| <p>&lt;Consistency with the Development Policy of Brazil at the Time of Ex-Ante Evaluation and Project Completion&gt;</p> <p>The project was consistent with Brazil’s development policies of the “the Federal Law No. 11,445 on Basic Sanitation” (revised in 2007) stipulating directions of organizational system and infrastructure development in order to equally provide the people of Brazil services in the three areas, including water supply and sanitation, solid waste management, and rainwater drainage management in urban areas, and the “National Plan of Basic Sanitation” (2011) focusing on acceleration/improvement of water supply and sewerage system as well as the services in integrated manner at the time of ex-ante evaluation and at the time of project completion.</p> <p>&lt;Consistency with the Development Needs of Brazil at the Time of Ex-Ante Evaluation and Project Completion &gt;</p> <p>The project was consistent with Brazil’s development needs of improvement of an O&amp;M capacity on water supply and sewerage facilities under SANEPAR in order to cope with causes of leakages and overflows from water supply and sewerage systems in CMA and coastal areas in Parana State.</p> <p>&lt;Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation&gt;</p> <p>The project was consistent with Japan’s ODA policy<sup>1</sup> for Brazil, focusing on the five priority areas including environment, based on the top-level agreement between the President of Brazil and the Prime Minister of Japan when the President Lula visited Japan in May, 2005.</p> <p>&lt;Evaluation Result&gt;</p> |

<sup>1</sup> Ministry of Foreign Affairs “ODA Databook 2011”

In light of the above, the relevance of the project is high.

## 2 Effectiveness/Impact

### <Status of Achievement of the Project Purpose at the time of Project Completion>

The Project Purpose was achieved by the time of project completion. Through the project, the O&M capacity of SANEPAR for water supply and sewerage systems was enhanced. As a result, the performance indicator on O&M of sewerage treatment plant (i.e. of the total treated sewerage volume against the total inflow volume) (Indicator 1) had continuously improved since the project started and exceeded the target value in 2015. As for the compliance ratio of the treated water quality standard (Indicator 2), the indicator in CMA worsened in 2014 from the level at the beginning of the project, but ended up exceeding the target value in 2015. In the coastal areas, the ones slightly dropped in 2014 but reached 100% in 2015, which was over the target. Also, the indicator had sustained at 100% at the exits of water treatment plants in of Irai, Praia de Leste, Morretes, Saiguaçu and Guaraqueçaba targeted by the project.

### <Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects have been continued since the project completion. The performance indicator on O&M of sewerage treatment plant improved through the O&M capacity of SANEPAR for water supply and sewerage system enhanced by the project achieved 100% in 2017 across CMA, and then, has sustained at 100% by the time of ex-post evaluation. In the coastal areas, although not improving in one of the five target areas, the indicator improved in the two target sites to more than 90%, and remained about 80% in the remaining one site. For the sewerage treatment plants without improvement of the indicator, improvement plans have been planned to implement. Also, in terms of the compliance ratio of water quality standard, three out of the six target sewerage treatment plants in CMA achieved 100%, the two target plants reached almost 95%, and the remaining one plant improved up to 82%. In the coastal areas, out of the five target plants, the two plants attained approximately 90%, the one plant reached 92%, another plant had around 70%, and the remaining one plants reached around 60%. Furthermore, at the exit of water treatment plants in Irai, Praia de Leste, Morretes, Saiguaçu, and Guaraqueçaba targeted by the project, the performance indicator on O&M of water treatment plant have sustained at 100%.

Furthermore, as a result that SANEPAR has been able to properly operate and maintain the sewerage pipe networks, the number of complaints on the network in pilot areas has decreased year by year. Also, it was confirmed that the dissolved oxygen level of river waters (at the 500 m upper points from the most downstream) in the target areas have been improved.

### <Status of Achievement for Overall Goal at the time of Ex-post Evaluation>

The Overall Goal has been achieved at the time of ex-post evaluation. As of 2018, the coverage of sewerage system became 80.65% in CMA and 72.12% in the coastal areas, achieving the target value (Indicator 1). Also, the rehabilitation/replacement plans prepared by the project (sewerage pipe network, sewerage treatment plants and pumping stations, water treatment plants) are being implemented (Indicator 2).

### <Other Impacts at the time of Ex-post Evaluation>

No other positive or negative impact was observed at the time of ex-post evaluation.

### <Evaluation Result>

Therefore, the effectiveness/impact of the project is high.

### Achievement of Project Purpose and Overall Goal

| Aim   | Indicators   | Results  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
|---|--|--|---------------------|---------------------|-------|-------|------|-----|----------|-------|-------|-------|---------------|-------|-------|-------|------------------|-------|-------|-------|----------|-------|-------|-------|-----------|-------|-------|-------|
| (Project Purpose)<br>Operation and maintenance of water supply and sewerage systems in SANEPAR is improved in the target area of the project.   | (Indicator 1)<br>Performance indicators on O&M of sewerage treatment plant (i.e. volume of treated sewage divided by total inflow volume) is improved to 99.18% in CMA. In addition, % of water quality conformity to the treated water quality standard is improved to 37.3% in CMA and 97.6% in the Coastal Area respectively. | Status of the Achievement: achieved (continued)<br>(Project Completion)  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
|   |  | <ul style="list-style-type: none"> <li>Performance indicator on O&amp;M of sewerage treatment plant: it became 99.79% in 2015, exceeding the target value.</li> </ul>  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
|   |  | [Performance indicator on O&M of sewerage treatment plant (Unit: %)]   |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
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|   |  |  | 2012                | 2013                | 2014  | 2015  |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
|   |  |  | 98.61               | 98.23               | 98.73 | 99.79 |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
|   |  | <ul style="list-style-type: none"> <li>The compliance ratio of the treated water quality standard: in 2015, it became 38.89% in CMA and 100% in the coastal areas, respectively, achieving the target values.</li> </ul>   |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
|   |  | [The compliance ratio of the treated water quality standard (Unit: %)]   |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
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|   |  | Area / Year  | 2012                | 2013                | 2014  | 2015  |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| CMA   | 41.65  | 32.19  | 30.00               | 38.89               |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| Coastal areas   | 99.39  | 98.15  | 98.89               | 100.00              |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| (Ex-post Evaluation)  |  |  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| <ul style="list-style-type: none"> <li>Performance indicator on O&amp;M of sewerage treatment plant:</li> </ul>   |  |  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| [Performance indicator on O&M of sewerage treatment plant (Unit: %)]  |  |  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
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| Name of Plants /Year  | 2015   | 2018   | 2019<br>(as of May) |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| CMA   | 99.52  | 100  | 100                 |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| Morretes  | 59.33  | 58.87  | 58.48               |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| Guaranqueçaba   | 91.52  | 90.22  | 90.10               |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| Pontal do Paraná  | 26.07  | 56.27  | 72.56               |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| Matinhos  | 51.57  | 78.92  | 90.32               |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| Guaratuba   | 76.38  | 81.99  | 81.96               |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| <ul style="list-style-type: none"> <li>The compliance ratio of the treated water quality standard:</li> </ul>   |  |  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |
| [The compliance ratio of the treated water quality standard (Unit: %)]  |  |  |                     |                     |       |       |      |     |          |       |       |       |               |       |       |       |                  |       |       |       |          |       |       |       |           |       |       |       |

|   |   | Name of Plants / Year   | 2015  | 2018  | 2019<br>(as of May) |       |       |
|---|---|---|-------|-------|---------------------|-------|-------|
|   |   | CMA   |       |       |                     |       |       |
|   |   | São Jorge   | 92    | 89.3  | 96.7                |       |       |
|   |   | Santa Quitéria  | 43.1  | 69.1  | 100                 |       |       |
|   |   | CIC Xisto   | 29.8  | 40.4  | 100                 |       |       |
|   |   | Fazenda Rio Grande  | 88.9  | 94.6  | 100                 |       |       |
|   |   | Atuba Sul   | 26.2  | 41.9  | 82                  |       |       |
|   |   | Padilha Sul   | 47.5  | 69.4  | 93.3                |       |       |
|   |   | Coastal areas   |       |       |                     |       |       |
|   |   | Morretes  | 59.33 | 58.87 | 58.48               |       |       |
|   |   | Guaraqueçaba  | 91.52 | 90.22 | 90.10               |       |       |
|   |   | Pontal do Parana  | 26.07 | 56.27 | 72.56               |       |       |
|   |   | Matinhos  | 51.57 | 78.92 | 90.32               |       |       |
|   |   | Guaratuba   | 76.38 | 81.99 | 81.96               |       |       |
|   | (Indicator 2)<br>Performance indicator on O&M of water treatment plant (i.e. % of conformity to the drinking water quality standard of treated water (ISP-Produção: Índice de Conformidade ao Padrão de potabilidade na Produção)) is improved to 100%. | Status of the Achievement: achieved (continued)<br>(Project Completion)<br>• % of conformity to the drinking water quality standard of treated water remained at 100% at the exit of water treatment plants (Irai, Praia de Leste, Morretes, Saiguaçu, Guaraqueçaba).<br>(Ex-post Evaluation)<br>• to the compliance ratio of the drinking water quality standard of treated water remained at 100% at the exit of water treatment plants (Irai, Praia de Leste, Morretes, Saiguaçu, Guaraqueçaba). |       |       |                     |       |       |
| (Overall Goal)<br>Water supply and sewerage service of SANEPAR is improved in the target area of the project. | (Indicator 1)<br>The coverage of sewerage system becomes 79% in CMA and 60% in coastal area by the end of 2018 (baseline: 72% in CMA, 49.4% in coastal area, 2011).   | (Ex-post Evaluation) achieved<br>• The target value was achieved in CMA and the coastal areas by 2018.<br>[Coverage of sewerage system in the target area of the project (Unit: %)]   |       |       |                     |       |       |
|   |   | Area / Year   | 2015  | 2016  | 2017                | 2018  | 2019  |
|   |   | CMA   | 77.25 | 78.85 | 79.77               | 80.65 | 81.80 |
|   |   | Coastal areas   | 51.73 | 52.73 | 60.00               | 72.12 | 81.08 |
|   | (Indicator 2)<br>Rehabilitation/replacement plan developed by the project is implemented by year 2020.  | (Ex-post Evaluation) achieved<br>• Rehabilitation/replacement plan on sewerage pipe network: 45% of the plan has been completed by July 2019.<br>• Rehabilitation/replacement plan on sewerage treatment plants and pumping stations: the situation varies among sewerage treatment plants, but the plan is being implemented.<br>• Rehabilitation/replacement plan on water treatment plants: the plan is being completed by July 2019.  |       |       |                     |       |       |

Source : Terminal Evaluation Report, Questionnaire and Interview with SANEPAR

### 3 Efficiency

Although the project period was within the plan (ratio against the plan: 100%), the project cost exceeded the plan (ratio against the plan: 122%). The outputs were produced as planned. Therefore, the efficiency of the project is fair.

### 4 Sustainability

#### <Policy Aspect>

The “National Plan of Public Sanitation” (2014-2033) promotes the dissemination of water supply and sewerage service across the country. Under the plan, SANEPAR has aimed at the coverage of sewerage system of 100% and actively promoted their mid-term plan (2018-2023) in cooperation with the Ministry of Environment in Paraná State. Therefore, the project has been backed up by the policy and efforts.

#### <Institutional Aspect>

##### [O&M of water supply and sewerage systems]

There have not been any major changes in the organizational setting for O&M of water supply and sewerage systems targeted by the project. The Operation Department of SANEPAR has been responsible for O&M of water supply and sewerage systems. According to SANEPAR, 1,041 staff members have been assigned to the department (sewerage pipes network: 627, sewerage system: 149, water supply system: 265), and on occasions for a lack of staff, some tasks have been entrusted to external companies; as a result, the department has performed their responsibilities without any major problems, and it is considered that the implementation system does not have any problems.

##### [Database of sewerage pipes]

The database of sewerage pipes developed by the project is utilized by SANEPAR every day. In this background, SANEPAR has stipulated the database to standardize remote diagnosis of the sewerage pipe network carried out by SANEPAR.

##### [measurement system for monitoring sewage quantity]

The measurement system for monitoring sewage volume established by the project has continuously been utilized for sewage management in the rivers in CMA.

#### <Technical Aspect>

##### [O&M of water supply and sewerage systems]

The staff of the Operation Department of SANEPAR has sustained the necessary knowledge and skills for the O&M of water supply and sewerage system targeted by the project. That has been because SANEPAR has an internal training system by using manuals prepared by the project.

The manuals prepared by the project (sewerage treatment plant, water treatment plant) have continuously been utilized by operators in each plant. In the background, these manuals were incorporated into the operational regulations of SANEPAR and have been utilized for

the trainings as training materials. Also, the manuals have been converted into electronic formats and have been regularly updated.

<Financial Aspect>

The budget for O&M of water supply and sewerage systems has been allocated to SANEPAR since the project completion. Also, according to SANEPAR, the budget has been sufficient as they have performed their responsibilities without any major problems. SANEPAR has adopted a multiple year budgeting and secured and reviewed its budget every five years. The budgets for the period from 2019 to 2023 has already been reviewed, and the allocation of the sufficient budget has been decided. Also, the budget for rehabilitation/replacement plans on water supply and sewerage systems prepared by the project has also included into the just above-mentioned budget and thus it is considered that SANEPAR will be able to secure sufficient budgets in the future.

Budget of SANEPAR

(Unit: Million Real)

| 2015 | 2016 | 2017 | 2018 | 2019 |
|------|------|------|------|------|
| 48   | 39   | 62   | 101  | 48   |

<Evaluation Result>

Therefore, the sustainability of the effects through the project is high.

### 5 Summary of the Evaluation

The project achieved the Project Purpose aiming at the improvement of O&M of water supply and sewerage systems in SANEPAR in the target area of the project and the Overall Goal aiming at the improvement of water supply and sewerage service of SANEPAR in the target area of the project. As for the efficiency, the project cost exceeded the plan.

Considering all of the above points, this project is evaluated to be highly satisfactory.

### III. Recommendations & Lessons Learned

Lessons Learned for JICA:

- By not only undertaking technical transfer against problems in each area but also providing visiting lectures (seminars and workshops), which were implemented as activities of the project, to staff members in CMA as well as the coastal areas, the institution for existing internal trainings in SANEPAR was strengthened, and furthermore, the importance of recording of each process, preventive maintenance, and improvement have been increasingly recognized. Thus, even at the time of ex-post evaluation, the staff has paid attention to how to improve the efficiency of daily tasks as well as 3S (Seiri, Seiton, and Seiso)<sup>2</sup>. Therefore, it is important to enhance the internal training system during the project period for sustainable capacity improvement.
- Even after the project completion, each of the activities has been sustained or improved, and as an organization, SANEPAR have made short-, mid-, and long-term plans considering maintenance and put efforts on securing the necessary budget. This was due to the involvement in the project by the upper part of the organization whose interest was of the high-level management from the onset of the project. This commitment is considered to be an important factor. Thus, it is essential to make the high-level management involve in the project from the planning stage in order to ensure sustainability.



Sewerage Treatment Plant in Atuba Sul



Diagnosis of Sewerage Pipe Network

<sup>2</sup> 3S, Seiri (sort), Seiton (Set) and Seisou (Shine), is a methodology developed in Japanese manufacturing industries to improve work environment and quality control.