

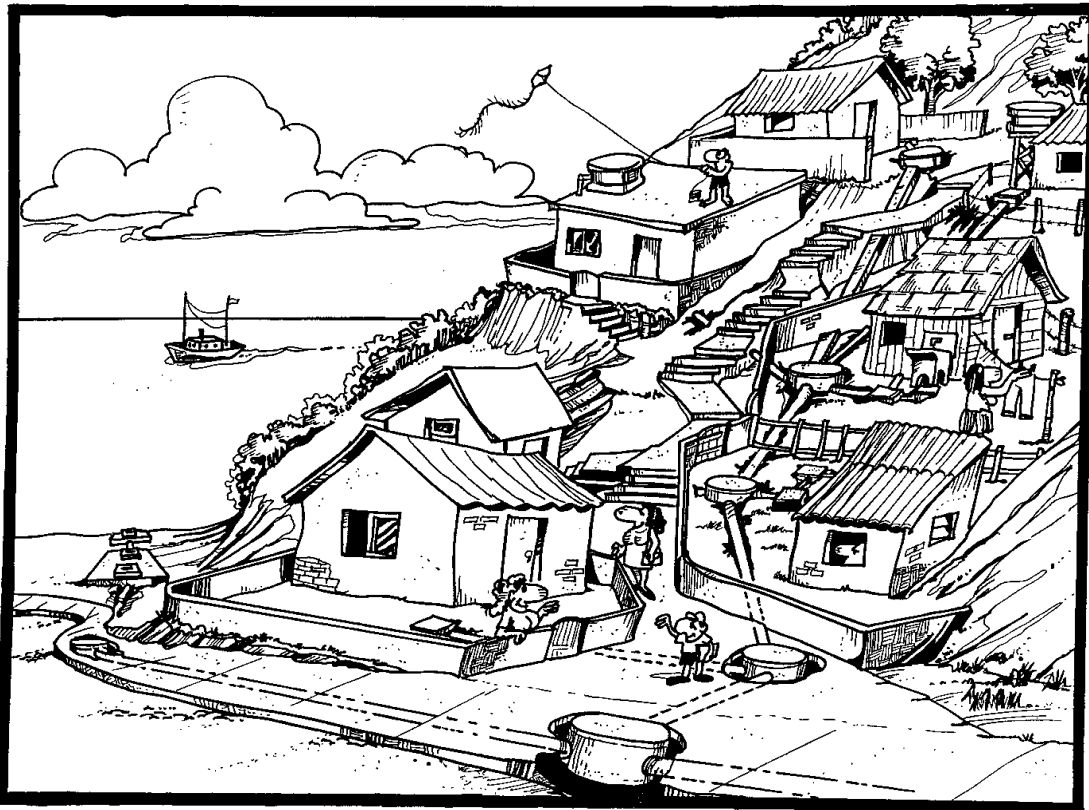


## 'Choosing and Implementing Small-Bore Sewers'

Case Study

# BRAZIL

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*Source: Luis Lobo, WSP*

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## ***I. Summary***

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The condominium approach, which has been progressively adopted in most Brazilian states over the last thirty years, has met with varying degrees of success. Furthermore, the operators and professionals' levels of expertise and ownership have also varied.

From the engineering point of view, condominium sewerage is based on:

- using smaller diameter pipes and manholes;
- 'streamlining the routes' by reducing the sewer length, sizing the systems more accurately and moving away from the traditional grid-based layouts that require additional costly and unnecessary pipework;
- routing the system over private land wherever possible with a view to reducing the sewer length.

The aim of simplifying the sewer systems in this way was to reduce costs and thus "do more with the same budget". As a result, condominium sewerage has led to significant improvements in sanitation coverage, particularly for the inhabitants of informal settlements (*favelas*). The condominium approach has thus largely fulfilled its objective: to provide universal access to sanitation services in densely populated urban areas where on-site sanitation was not an option and where, due to their improved standards of living, the inhabitants' demand was for piped sewerage as there is, usually, no room for alternatives like septic tanks. A number of public and private practitioners in Brazil have developed original and innovative technical know-how in this area that deserves to be more widely used and understood.

In contrast, the 'community-based' management of condominium sewerage has been a widespread failure. The aim of this approach was to enable the poorest users to contribute to service operating costs 'in kind' (checking, maintaining and cleaning tertiary pipework and manholes, in addition to their own household facilities) rather than in cash, in exchange for a 40 to 50% discount on their sanitation fee.

However, as operational problems – obstructions, basically – came up, the users never fully honored their maintenance commitments and soon naturally turned to the traditional water and sanitation operators for help. In some instances, these operators attempted to ensure the users upheld their 'condominial pacts'. However, media and political advocacy campaigns by users, along with court rulings, have led to operators being forced into taking over management of the condominium sewer schemes (in return for which, wherever political power forces allow, they now charge similar sanitation fees as for conventional sewerage).

Although the limitations of community-based operation of condominium sewerage have long been recognized (WATSON, 1995, in a report for the World Bank), there still appear to be misconceptions surrounding the Brazilian 'condominial model' elsewhere in the world. Thus, many of the initiatives developed in Africa, for example, continue to assign responsibility for operating the service to the users on the basis of their goodwill and solidarity, whilst failing to provide adequate supervision or support, and whilst citing what appear to be poorly understood examples from Brazil.

However, under the condominium concept developed by its creator, engineer José Carlos Melo, user involvement is not merely restricted to sewer maintenance. Instead, the condominium approach involves concerted service planning at district level and includes promotion, awareness-raising, capacity-building and public debate in all phases of service development. As a result of this approach, a number of water and sanitation operators have developed particularly useful social engineering expertise, creating multi-disciplinary teams in which social workers and engineers share an equal footing.

*Contents*

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- I. Summary ..... 3
- II. Introduction..... 7
- III. Development of the political economy of sanitation in Brazil over the last 40 years 8
- IV. Condominial sewerage in Brazil ..... 9
  - 1. A response to high urban population density and stakeholder demand ..... 9
  - 1. A first step towards universal service in Brazil ..... 10
  - 2. José Carlos Melo’s 'condominial philosophy' ..... 10
  - 3. The failure of community-based management ..... 12
  - 4. Condominial sewerage today..... 13
  - 5. Condominial sewerage outside Brazil..... 14
- V. Recife, Salvador and Brasilia case studies..... 15
  - 1. Service development level..... 15
  - 2. Selection process..... 16
  - 3. Context ..... 17
  - 4. Condominial sewerage design..... 19
  - 6. Condominial sewerage implementation..... 24
  - 7. Condominial sewerage management ..... 26
  - 8. User involvement in the process ..... 34
  - 9. Condominial sewerage costs..... 37
- VI. Bibliography ..... 40

## List of Tables

Table 1. Service development level.....	15
Table 2. The selection process used.....	16
Table 3. The context in which condominal sewerage was implemented in Brasilia, Salvador and Recife .....	17
Table 4. Condominal sewerage designs used in Brasilia, Salvador and Recife.....	19
Table 5. Division of roles during the construction and implementation phase in Brasilia, Salvador and Recife.....	24
Table 6. Service operating responsibilities, roles and tasks in Brasilia, Salvador and Recife .....	26
Table 7. User involvement in the different stages of the service development process in Brasilia, Salvador and Recife .....	34
Table 8. Costs and sources of funding for condominal sewerage investment and operation in Brasilia, Salvador and Recife.....	37
Table 9. Comparison of the average cost of conventional and condominal sewerage in Salvador .....	38
Table 10. Operating costs of the different sewer system components in Brasilia.....	39

## List of Boxes

Box 1: The user involvement and awareness-raising method used in Brazil .....	11
Box 2: Is condominal sewerage an ‘ultra-liberal’ philosophy?.....	12
Box 3: The weak capacities of the users’ associations .....	12
Box 4. In Recife, sewer systems are jointly managed by the municipality and the operator.....	13

## List of Figures

Figure 1. Political movements and sanitation service management trends .....	8
Figure 2. Funding levels (subsidies) allocated by the state to the sanitation sector in Brazil between 2003 and 2009 .....	9
Figure 3. Plan of a conventional sewerage and condominal sewerage layout .....	10
Figure 4. Plan of a condominal sewer system in an informal settlement in Brasilia.....	20
Figure 5. Pipe diameters and depths used by sewer constructors/stakeholders in Brasilia .....	21
Figure 6. Plan of a condominal sewer scheme in Salvador .....	23
Figure 7. The customer relations, operations and repairs and maintenance system used in Brasilia .....	30
Figure 8. The interactive and integrated repairs and maintenance system used in the Federal District .....	31
Figure 9. Type of repairs and maintenance activities undertaken on the sewer system in the Mangueira district of Recife between June 1998 and June 1999 .....	32
Figure 10. The CAESB approach involves the users at each stage of the service development process. ....	35
Figure 11. Investment items for condominal sewerage infrastructure in Brasilia .....	38

## List of Photos

Photo 1. In Salvador, informal housing accounts for over 50% of all buildings within the city. The <i>favelas</i> are often constructed on the sides of the <i>moros</i> (hills) .....	18
Photo 2. A <i>favela</i> that has been redeveloped and provided with basic services in Recife.....	18
Photo 3. A rich residential area in the Federal District (in which the federal capital, Brasilia, is located) .....	18
Photo 4. Mass production of ‘simplified’ manholes in Brasilia .....	21
Photo 5. Manhole cover that has been incorporated into the sidewalk in Salvador.....	22
Photo 6. A condominal sewer scheme in a hillside <i>favela</i> on the coast in Salvador de Bahia .....	22
Photo 7. CAESB employees laying a connection manhole in a residential district of Brasilia .....	25
Photo 8. CAESB employees digging trenches for sewer lines in a residential district of Brasilia .....	25
Photo 9. A condominal sewer line on public land in Salvador: a team from EMBASA carrying out maintenance using hand tools .....	27
Photo 10. EMBASA’s high-pressure sewer cleaning truck used to remove major blockages on the sewer .....	28
Photo 11. Left: a portable high-pressure sewer cleaner used by CAESB in Brasilia. Right: robots with sewer inspection cameras suitable for sewer pipes of different diameters .....	29
Photo 12. Leak detection equipment used to identify invisible leaks on sewer schemes in Brasilia.....	30

Photo 13. Note displayed in the user information office in an area of Recife reminding users of the respective sewer maintenance responsibilities of the provincial operator, COMPESA, and the Recife city sanitation department .....32

Photo 14. Condominial sewer line maintenance request form and the Recife city sanitation department’s maintenance log book ..... 33

Photo 15. Scale models of housing districts used during training and awareness-raising activities undertaken by the operator EMBASA in Salvador.....36

## **II. Introduction**

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### *Objectives and methodology of the study being conducted by pS-Eau*

The small-bore sewer (also known as: a reduced diameter sewer, condominial sewerage, etc.) is a solution that has been implemented across the world over the last few decades, using diverse technological options and management methods and in a wide range of contexts and on different scales.

However, in Africa, these small-bore sewers often struggle to remain sustainable and the implementing conditions required to ensure they are effective are still open to debate, as are their real comparative advantages over other sanitation solutions.

The aim of the study being undertaken by pS-Eau is thus to provide responses to the following three questions:

- What exactly are the **strengths and weaknesses** of small-bore sewer systems from a technical, financial and management perspective? What have been the **factors of success – or failure – of the different small-bore sewer systems** implemented across the globe? **In which contexts** is this solution appropriate?
- What recommendations for **designing, implementing and operating** these systems in African countries can be made?
- Is it appropriate to advocate this solution to national and local decision-makers in Africa and their development partners, and what obstacles need to be overcome to do this?

The study is based on a comprehensive review of available literature (articles, manuals, evaluation reports, etc.), interviews with a number of sector experts and **five in-depth case studies undertaken through fieldwork and with the assistance of specialist consultants in India, Senegal, Ghana, Brazil and Mali.**

### *Objectives*

This case study report on condominial sewerage in Brazil is based on information gathered during a field visit to Brazil undertaken in March 2013 by Antonio da Costa Miranda Neto, international consultant (who previously worked as a manager for municipal water and sanitation departments and water and sanitation public operators in Brazil) and Jean-Marie Ily, coordinator of the Programme Solidarité Eau (pS-Eau) 'Choosing and implementing small-bore sewers' study.

The study was conducted in three cities:

- Brasilia
- Recife
- Salvador

Natal, which was initially included, was later dropped from the study as the operator and local authorities are no longer using the condominial sewerage approach. Although both Rio and Sao Paulo also appear to have implemented relevant condominial sewerage initiatives, it was unfortunately not possible to visit either of these cities due to time constraints.

A literature review was also undertaken to supplement the field studies (please see the list of references in the Annex).

Finally, interviews were conducted with a number of Brazilian and Colombian condominial sewerage experts, including José Carlos Melo, the 'father' of condominial sewerage, during the Rede Waterlat-organized 'Desafio: Inovações e Desafios para a Democratização dos Serviços de Saneamento' forum held in Recife.

### **III. Development of the political economy of sanitation in Brazil over the last 40 years**

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Brazil's state (provincial) water and sanitation operators were established under the military regime (1970s), a period during which major investment was also made mostly in water, also in sanitation (PLANASA). The 1980-90s – or the 'lost decade' – saw, under different governments, the increasing of inflation and the deepening of social-economical gaps. This led to a decline in economic growth and fiscal resources and a sharp drop in investment in the sanitation sector.

It was in this context that Condominial Sewerage was created, summing up two appealing aspects from a democratic perspective – social mobilization under a dictatorship, and due to its low costs, the coverage of more population with the same investment amount.

After Lula's Workers' Party came to power in 2002, the federal state developed the growth acceleration program (PAC), which included water and sanitation as one of its priorities with a budget allocation of 5 billion dollars a year (although this has only been partially disbursed due to low provincial- and state-level actions: 35% in the first year). The use of condominial sewerage was advocated by this program.

There have also been regular shifts in the balance of power within the states with various forms of power play between the supporters of public ownership (either state or municipal, that's another Constitutional controversy), and those who support privatization (liberals). However, it is usually a hybrid model that is put in place as most municipalities have retained a contract with the state operators, but now have greater contracting authority powers. They can also delegate operation to the private sector and this is becoming an increasingly business option. (From SHANKLAND et al., 2010).

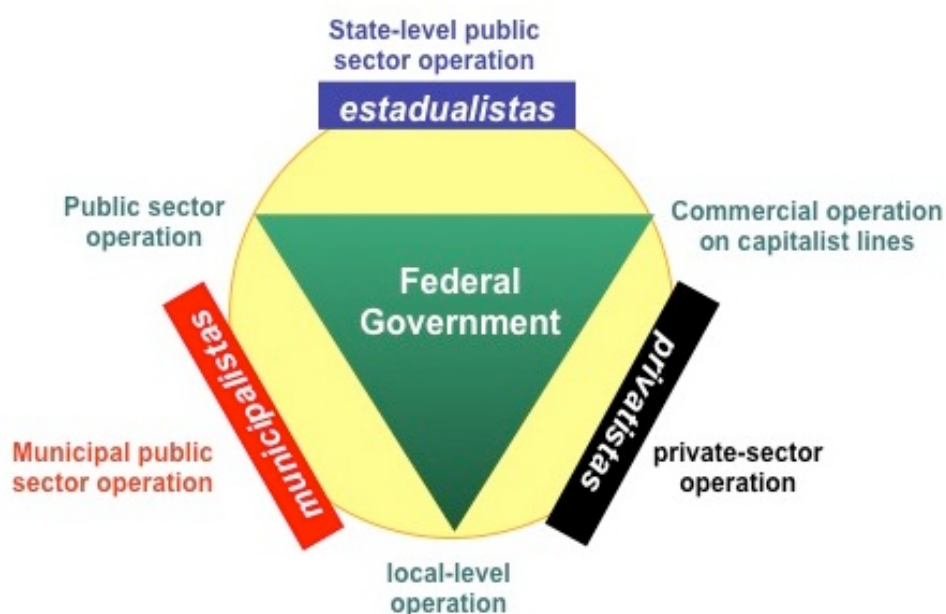


Figure 1. Political movements and sanitation service management trends (source: SHANKLAND et al., 2010)



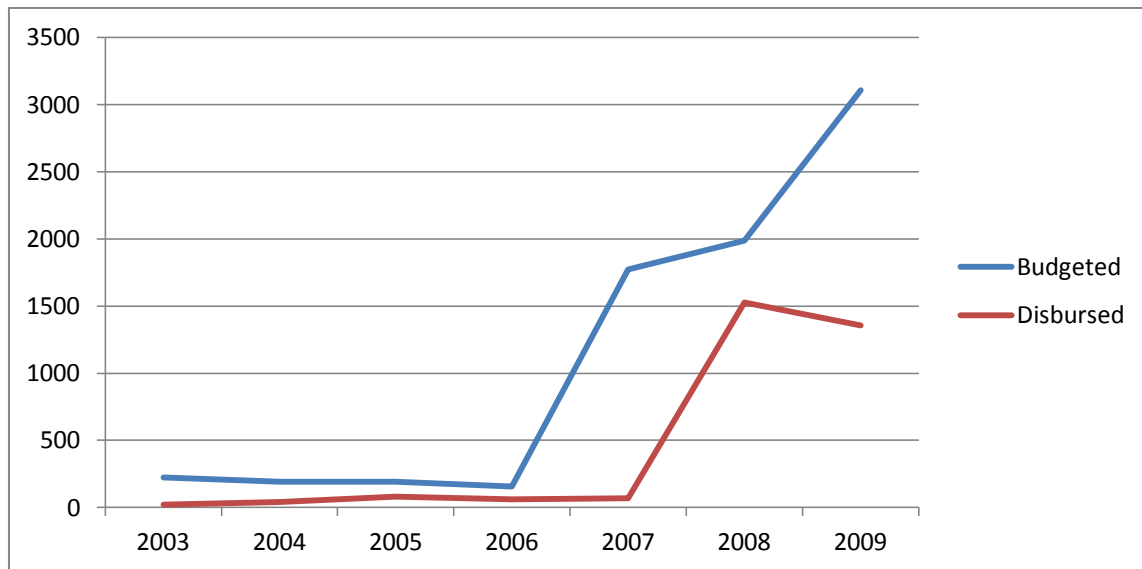


Figure 2. Funding levels (subsidies) allocated by the state to the sanitation sector in Brazil between 2003 and 2009 (source: SHANKLAND et al.)

## IV. Condominial sewerage in Brazil

### 1. A response to high urban population density and stakeholder demand

Although more expensive and requiring higher levels of water consumption than on-site sanitation, piped sewer systems have been the public authorities' 'natural' response to the sanitation challenges facing urban areas in Brazil for over 40 years.

In the majority of urban areas (and particularly in the unplanned settlements, or *favelas*, that are located on often hilly terrain), on-site sanitation is not an option as commonly there is no land space for latrines, and where it has the alleys are too winding and narrow for vacuum trucks to access and there is not enough space to move the latrines once the pits are full. Thus, as conventional sewerage is extremely expensive, condominial sewerage had been developed, in its beginning, as a compromise solution that is best suited to local contexts.

The first condominial sewer was installed in the district of Rocas, in the city of Natal, an area with high population density and rocky soil (that renders both pit-digging and soil infiltration of effluent difficult).

Piped sewer systems also satisfy the demand of the various stakeholders, as (from SHANKLAND et al, 2010, in particular):

- they reflect the public authorities' vision of a 'modern' country;
- for households, they remove both "wastewater and responsibilities";
- for the operators, piped sewerage is their business as usual, as opposed to low-scale solutions;
- for some politicians: piped sewer systems require major, high visibility investment programs that provide good economic returns;
- public works companies (that are often close to politicians) benefit from all the investment.

In contrast, rural areas have reverted to on-site sanitation as it is "simpler to manage". Thus, due to lack of maintenance, only one of the six sewer systems installed in small rural towns in the state of Ceará remains operational (albeit with difficulty) (source: discussion with a manager from Sistema Integrado de Saneamento Rural- SISAR, the water and sanitation operator for rural areas in the state of Ceará).

## 2. A first step towards universal service in Brazil

Condominial sewerage was initially developed for the *favelas*, unplanned settlements with narrow, winding lanes in which neither conventional sewers nor on-site sanitation were an option and whose inhabitants had long been excluded from sanitation services.

The aim of simplifying the sewer systems was to reduce their investment cost (by 25 to 50%) and thus "do more with the same resources", namely progressively install condominial sewers in all towns rather than only directing investment towards building conventional sewers with high capital costs in well-off areas.

Thus, in Parapuebas, rather than constructing a conventional system for the town center only, condominial sewerage was put in place for the whole town for the same budget (interview with J.C. Melo).

## 3. José Carlos Melo's 'condominial philosophy'

Although not the first Brazilian engineer to have studied the use of 'simplified' technologies as a means of expanding sanitation services, José Carlos Melo was the first to develop a complete 'doctrine' on the subject that included the technical, financial, institutional and management aspects required to provide universal access to sanitation services for the population of Brazil. He is thus rightly considered the 'father' of condominial sewerage.

The condominial sewerage 'philosophy' developed by Melo is based on the following principles:

### Technical

- using smaller diameter pipes and manholes;
- 'streamlining the routes' by reducing the sewer length, sizing the systems more accurately and moving away from the traditional grid-based layouts that require additional costly and unnecessary pipework;
- routing the system over private land wherever possible with a view to reducing the sewer length.

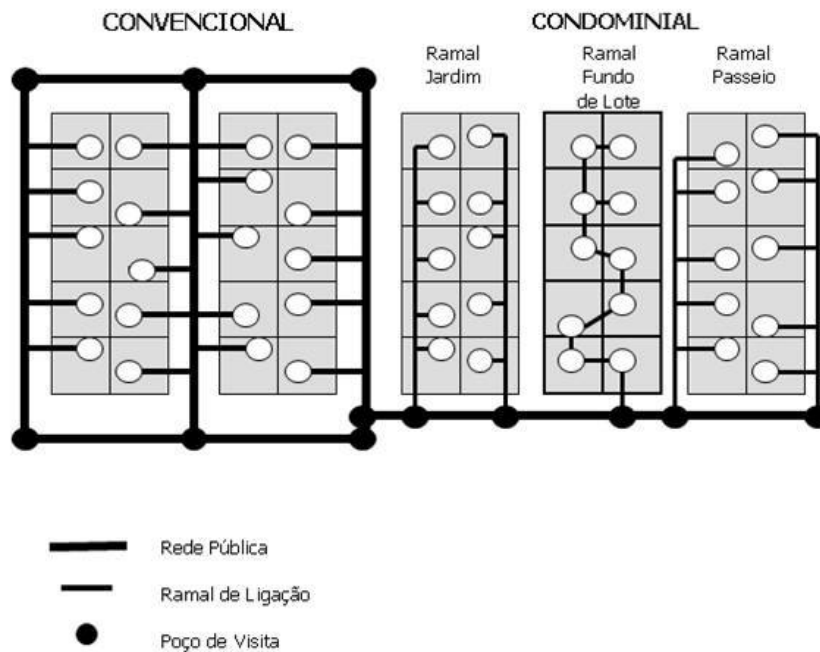


Figure 3. Plan of a conventional sewerage and condominial sewerage layout (source: adapted from NAZARETH P., 1998)

### *User participation in the decision-making process*

Along with the simplified sewer route, user participation in the decision-making process is the best known and most widely adopted element of the condominium sewerage philosophy outside Brazil.

Under the condominium system, the users, as members of local community associations, are involved in all technical, financial and management decisions pertaining to their sanitation service.

There are ongoing discussions between the users, the operator and his service providers throughout both the implementation and operational phases.

A number of 'social workers' or 'community workers' are employed to develop and support this dialogue and these form part of multi-disciplinary teams working alongside the engineers and technicians.

### *A condition of equity: condominium sewerage as the unique standard*

Users' acceptance of this 'simplified' condominium system (less expensive but more constraining for the user) was conditional upon condominium sewers becoming the unique standard for the entire town.

However, Brasilia is currently the only city in which this principle has been applied. Moreover, as Melo himself says, the condominium system, which was "invented to universalize access, has too often been used to discriminate" (*interview with JC Melo*), as it is considered to be a low-cost standard suitable only for use in poor districts.

### *Management: the condominium 'pact'*

**It is often incorrectly assumed that the condominium sewerage philosophy involves passing full responsibility for the sewer system onto the users only.** However, Melo stresses the need for cooperation between the users, local authority and the operator. The condominium 'pact' negotiated and signed by all parties is intended to ensure the rules of this cooperation and the technical and financial obligations of each party are established in a democratic manner.

Thus, in many cities, the users were initially asked to decide whether they wanted to undertake routine sewer maintenance themselves and thus receive a 50% discount on their sanitation fee (which is a substantial reduction for low-income families as the sanitation fee in Brazil generally equates to 100% of the water bill). They received both training and hand tools for sewer cleaning. The term 'condominal' sewerage is thus derived from this '*condominium*' based management.

Although Melo considers that the operators and public authorities have often been too "cowardly" in ensuring this pact is upheld, he also believes that public operators taking over control of the systems is a natural development given advances in technical understanding and economic growth (*interview with JC Melo*).

### **Box 1: The user involvement and awareness-raising method used in Brazil**

"A meeting with the households of the 'block' (around twenty households) aiming to:

- explain the general sanitation conditions necessitating interventions;
- appeal for cooperation;
- describe the proposed solution;
- make the potential users conscious of their responsibilities;
- exchange ideas and opinions;
- get permission to undertake a door-to-door survey.

And get agreements on:

- undertaking another meeting;
- the responsibilities of each person;
- the costs of the system and tariff policy;
- the allowance of the members of the community to observe the system."

Source: SARMENTO, 2001

## 4. The failure of community-based management

### Misunderstandings over responsibilities

Condominial sewerage soon generated considerable interest, particularly from municipalities, many of whom invested their own funds or sought state funding to construct condominial sewer schemes. However, development was often hampered by initial misunderstandings over the respective roles of the users and public operators.

Despite having signed condominial ‘pacts’, users that had undertaken to carry out routine sewer maintenance never actually did so. In Recife, for example, the municipality financed the construction of several condominial sewers; however, for a long time, neither the users nor the provincial public operators were willing to accept responsibility for managing these systems. In some instances, these issues even led to sewers being abandoned (particularly in Recife).

As a result, the operators were frequently called upon to help out and take over control of the systems, often under pressure from the municipalities and the state. The users also campaigned for fair treatment and access to services, with television reports showing the poor state of ‘condominial’ sewerage schemes and users from low-income districts who had been abandoned by the operators.

Furthermore, court rulings forced the operators to take over management of the condominial sewer systems (in Salvador, in particular).

In return, the operators sought to charge the same sanitation fees as for conventional sewerage (as, according to Companhia de Saneamento Ambiental do Distrito Federal – CAESB, condominial sewers are no cheaper to maintain). However, for political reasons, the initial reduced fee has been retained in most instances.

### The reasons for low user involvement in condominial sewerage maintenance

There are number of reasons for the low levels of user involvement in managing the sewers:

- the users’ organizations lack both structure and capacities (*see Box 3*);
- the resources and know-how required to carry out some of the maintenance tasks often exceed the capabilities of the ‘amateur sewer worker’ (identifying blockages and leaks, excavation works, sewer cleaning trucks);
- ‘condominial’ management has often given rise to neighborhood disputes: when a user fails to follow good practice and blocks the sewer, it inconveniences the entire block. In areas with social issues and where violence is rife, there are numerous of anecdotes of disputes gone bad ...;
- poor maintenance has led to leaks and seepage of wastewater into the subsoil, which in turn has resulted in subsidence, causing houses to collapse: the courts have ordered the operators to compensate the affected households (interviews with engineers from Empresa Baiana de Águas e Saneamento S.A - EMBASA in Salvador). This has cost the operators a lot of money and spurred them into taking over management of the sewers themselves;
- low-income users are poorly educated and have low levels of awareness (in Salvador, it has been noted that the sewers in middle-class areas are better maintained);

#### Box 2: Is condominial sewerage an ‘ultra-liberal’ philosophy?

**Yes**, according to certain Latin-American researchers and practitioners, it is a philosophy that leads to an inequality in service between rich and poor.

**No**, according to the philosophy of JC Melo; he advocates an average level of service for all rather than a high level of service for the rich alone, as well as the participation of the poorest and community participation.

The introduction of condominial sewerage also has to be seen in the context of post-dictatorship democratization; the aim being to empower the users by enabling them to assert their rights to water and sanitation and “take over from state-owned companies’ hands” as part of an anti-bureaucratic approach. This was also a time of low investment capacity, which meant that, over the long term, it was impossible to provide universal access to the service through conventional methods.

Melo, a man of the left, also had a brief career as a politician, serving as deputy mayor of Recife, then as secretary for infrastructure of the state of Pernambuco, in charge of water and sanitation services. He notably advocated for transparency and accountability in water supply, requiring regular meetings with users, a situation with which the conventional approach was extremely uncomfortable.

#### Box 3: The weak capacities of the users’ associations

The difficulties experienced when assigning responsibilities for the ‘original’ condominial sewers were due not only to disagreements between the states’ public operators and municipalities, but also to the fact that ‘participatory’ democracy was often very new, ad hoc and highly localized (virtually non-existent in Salvador, poor in Recife, etc.).

In those places where a users’ association has been set up (which is not always the case), this bears more resemblance to a general community discussion forum than to a body with set resources, rules and procedures.

- neighborhoods experience high residential turnover. This is due to upward social mobility (people moving out of their home district) or rent increases (gentrification) and the increased construction of new buildings, particularly in regularized informal settlements where turnover is traditionally high. Tenants or homeowners move out and the new arrivals are not trained on maintaining and managing the condominial sewers. Thus, 10 years after the sewers were installed in Natal, only 4% of inhabitants are able to name the 'condominial' representative for their area (WATSON, 1995);
- ongoing awareness-raising and support mechanisms are often lacking;
- whenever there is an operator working in the area, users automatically turn to this operator each time there is a problem, even if they signed the initial 'pact';
- as both the standard of living and demand for comfort increase, so the willingness to carry out maintenance tasks decreases.

**Box 4. In Recife, sewer systems are jointly managed by the municipality and the operator**

In Recife, following several years of conflict between the operator, users and municipality, none of whom were willing to accept responsibility for managing the condominial sewer systems, the solution put forward by the municipality (and imposed on the operator by the Pernambuco state government, which was led by a former mayor of Recife) was to share the responsibility for and operation of the sewer schemes:

- the municipality is responsible for the condominial sewer lines (which it often financed) and for maintaining these, as well as for carrying out ongoing IEC campaigns with the users;
- the public operator remains responsible for operating the main sewer lines.

Offices for the operator and municipal client relations departments have been set up in the low-income districts connected to condominial sewerage.

However, both parties appear to be neglecting their condominial sewerage responsibilities: the offices set aside for the operator are often empty and the local authority also seems to be steadily losing interest in the solution, most notably reducing the resources allocated to user awareness-raising and promotional activities.

## **5. Condominial sewerage today**

Condominial sewerage is still the focus of passionate debate in Brazil (see Box 2: *Is condominial sewerage an 'ultra-liberal' philosophy?*).

However, there is no question that condominial sewerage has provided universal access to sanitation services in urban areas and had a recognized impact on public health. In addition, it has helped to raise the self-esteem of the poor, who are now being increasingly recognized in public policies.

Although still met with resistance by some operators in Brazil, most Brazilian and international practitioners and scientists consider condominial sewerage to be an 'appropriate technology'. As noted by a number of the experts interviewed, it is thus significant that none of the universities in Brazil include condominial sewerage in their curricula and people have to travel to Leeds (Great Britain) for the relevant training.

There have been a few technological improvements made to condominal sewerage over the years: in many cases, the original diameter of the pipes used on condominal sewer lines has been increased from 100mm to 150mm due to a greater number of connections and increases (or potential increases) in consumption and to prevent blockages caused by solid waste. However, according to the experts (interview with Ivan Paiva, in particular), the basic design has remained the same.

The 'condominal' approach has progressively developed into one of '*saneamento integrado*', namely an integrated approach that involves working across sectors such as stormwater management, solid waste management, water and electricity services and road surfacing and in close alignment with land use and housing improvement or social development and security policies.

Lastly, although not the only approach in use, the condominal doctrine has also played an important role in helping develop a **concerted planning and social mediation culture and in bringing together operators, public authorities and users.**

## **6. Condominal sewerage outside Brazil**

It is included in national standards in Colombia, Paraguay, Peru, El Salvador and Bolivia and has also been piloted in the Dominican Republic. Furthermore, the Brazilian operator, CAESB, is providing technical assistance to the cities of Saint-Marc and Port-au-Prince in Haiti.

Brazilian technical experts had also been working on adapting the solution (the technical aspects only) for use in Benghazi in Libya prior to the fall of the Gaddafi regime.

There have also been numerous attempts to replicate the Latin American condominal sewerage model in Africa, for example:

- visits were undertaken by ONEP Morocco to Brazil, organized by the World Bank (which, however, did not lead to adoption of the standard);
- visits were also made by Luis Lobo for WSP to West Africa (Ghana, Senegal, Côte d'Ivoire) at the beginning of the years 2000;
- in addition, support was provided to the PAQPUD program in Dakar by the expert Fernando Inchauste (Peru).

Although the limitations of community-based operation of condominal sewerage in Brazil have long been recognized (WATSON, 1995, in particular), a number of countries have nonetheless continued to implement this management method. However, despite the fact that the Brazilian model quickly began to evolve, these countries often continue to pay insufficient attention to developing the capacities required to successfully manage piped sewerage systems (for more information on this, please refer to the final study analysis report, available on the pS-Eau website: [www.pseau.org](http://www.pseau.org)).

## V. Recife, Salvador and Brasilia case studies

Note:

As we were unable to obtain all the figures and data required during our short field visit, most of the information in this section is taken from the excellent study undertaken by SHANKLAND et al. for WSP in 2010 (covering the cities of Brasilia and Salvador).

### 1. Service development level

	Brasilia	Salvador	Recife
<b>Standard</b>	The condominal approach has been a CAESB standard since 1991.	The condominal approach has been adopted for informal settlements and conventional sewerage remains the standard for regular districts.  At the same time, conventional sewerage systems (primary sewer lines) have been extended and wastewater treatment plants constructed.	The condominal approach has been adopted for informal settlements and conventional sewerage remains the standard for regular districts.  Although abandoned for a number of years, development of condominal sewerage has resumed with IDB funding and technical assistance from the operator in Brasilia, CAESB.
<b>Number of connections and coverage rate</b>	214,600 households connected in 2010, giving a coverage rate of over 90% for the metropolitan area.	252,416 households connected in 2008.  The coverage rate increased from 26% in 1994 to 70% across the metropolitan area ten years later and to 90% within the city itself.	Of the 65 sewer schemes initially constructed, only 39 have been 'taken over' by the municipal technical departments and 6 new schemes have been built.

Table 1. Service development level (from SHANKLAND et al., 2010 and pS-Eau survey)

## 2. Selection process

	Brasilia	Salvador	Recife
<b>Why was condominal sewerage selected?</b>	Aim: to provide a universal service using an approach tailored to the investment resources available. One of the other advantages of condominal sewerage is that it is not necessary to open up the entire system for O&M.	Effluent from the <i>favelas</i> was running down the hillsides and tourist infrastructure and downstream to predominantly wealthy residential areas and beaches. The middle/upper classes also began to express environmental concerns. <sup>1</sup>	It was recommended in the context of PREZEIS program (Plan for Regularization of Special Zones of Social Interest) at the beginning of the 1990s: land tenure regularization, sanitation, roads, drainage, etc.
<b>How was it selected and by whom?</b>	During the 1990s, CAESB invested heavily in sanitation and adopted condominal sewerage for the entire Federal District.	Included in the major, multi-donor Bahia Azul program (IDB, JICA, WB, state, etc.): water, solid waste, road paving, awareness-raising and sanitation. Conventional sewerage was initially the preferred option; however, condominal sewerage was later adopted following a meeting with the World Bank.	The Municipality of Recife, invested in sanitation programs through its urban planning office and selected the condominal approach, which was included in the 1999 City master plan. During participatory budgeting (the most widely used participatory process in Brazil) between 2001-2008, sanitation came third on the inhabitants' list of priorities, behind street paving and housing.

Table 2. The selection process used (from SHANKLAND et al., 2010, SARMIENTO, 2001 and pS-Eau survey)

<sup>1</sup> The need for sanitation was somewhat 'imposed' on the poorer inhabitants, which is why, for a while, they were charged only 45% of the sanitation fee even though they were not taking care of the sewers. Also surprising is the fact that these programs were implemented without the traditional clientelism (there were none of the usual arrangements between local politicians and district leaders, etc.) (source: SHANKLAND et al., 2010)



### 3. Context

	Brasilia	Salvador	Recife
<b>Physical context</b>	Slight variations in relief	Large variations in relief (hills)	Slight variations in relief
<b>Urban morphology and land tenure context</b>	Mostly planned districts containing medium to large-sized plots. Also, some informal areas, particularly in the outlying 'satellite towns'.	Mostly irregular settlements (which make up around 50% of all housing in Salvador) with small-sized plots. Despite being informal, most of these districts were already being provided with public services (water, schools, health).	Districts with condominial sewerage are mostly informal and comprised of small plots. Despite being informal, most of these districts were already being provided with public services (electricity, water, schools, health).
<b>Urban and demographic processes</b>	Population growth and urban development	Population growth and urban development	Population growth and urban development
<b>Socio-economic level</b>	Average level of income per user per year within the city: R\$ 16,920, or around 4,100 euros (2003). Segments of the population connected to condominial sewerage: poor to rich.	Average level of income per user per year within the city: R\$4,624, or around 1,110 euros (2003). Segments of the population connected to condominial sewerage: poor and very poor (informal settlements only).	Segments of the population connected to condominial sewerage: poor and very poor (informal settlements only). This despite the fact that the 1999 City master plan included the adoption of condominial sewerage as the city-wide standard.

Table 3. The context in which condominial sewerage was implemented in Brasilia, Salvador and Recife (from SHANKLAND et al., 2010 and pS-Eau survey)



Photo 1. In Salvador, informal housing accounts for over 50% of all buildings within the city. The *favelas* are often constructed on the sides of the *morros* (hills)



Photo 2. A *favela* that has been redeveloped and provided with basic services in Recife



Photo 3. A rich residential area in the Federal District (in which the federal capital, Brasilia, is located)

#### 4. Condominial sewerage design

	Brasilia	Salvador	Recife
<b>Minimum depth of condominial sewer lines</b>	On private land: 40cm Under sidewalks: from 60-70cm up to 1.25m	On private land: 40cm Under sidewalks: 65cm	On private land: -40cm Under sidewalks: 70cm
<b>Minimum diameter of condominial sewer pipes</b>	100mm (150mm for the collectors or areas where high population growth is anticipated).	Currently 150mm (100mm at the start of the program).	Currently 150mm (100mm at the start of the program).-
<b>Minimum diameter of inspection chambers</b>	40cm	40cm	- 40cm-
<b>Minimum gradient</b>	0.5%	0.5%	- - 0,5%
<b>Treatment method</b>	Conventional centralized WWTP	Conventional centralized WWTP	None specifically
<b>Choice of route</b>	CAESB prepares a 'basic' design for the secondary sewer line. (A tender process is launched for sewer construction based on a feasibility report that is further refined as the user consultation process advances.) The condominial sewer route is established by CAESB following consultation with the users. Designing the sewer schemes in-house ensures that there is continuity and the specialist, multi-disciplinary team has a thorough understanding of the whole cycle.	Basic design prepared by consultancy firms recruited by EMBASA. The details of both the design and implementation are finalized by the construction companies themselves.	Almost all of the 65 condominial sewerage systems built in 2004 were routed along backyards. However, houses have been extended over the sewer lines on more than 30% of these schemes making access almost impossible.
<b>Possible options for the laying of condominial sewer lines</b>	Three options: under the sidewalk, in gardens (between the road and the house) or through backyards. Decision made by the users following negotiation with CAESB. Mostly prefer the 'under the sidewalk' option.	The decision is not made by the users, instead the condominial sewer lines are laid 'wherever possible', preferably under sidewalks, due to the winding alleys' layout in the <i>favelas</i> .	The decision is not made by the users, instead the condominial sewer lines are laid 'wherever possible', preferably under sidewalks, due to the winding alleys' layout in the <i>favelas</i> .

Table 4. Condominial sewerage designs used in Brasilia, Salvador and Recife (from SHANKLAND et al., 2010)

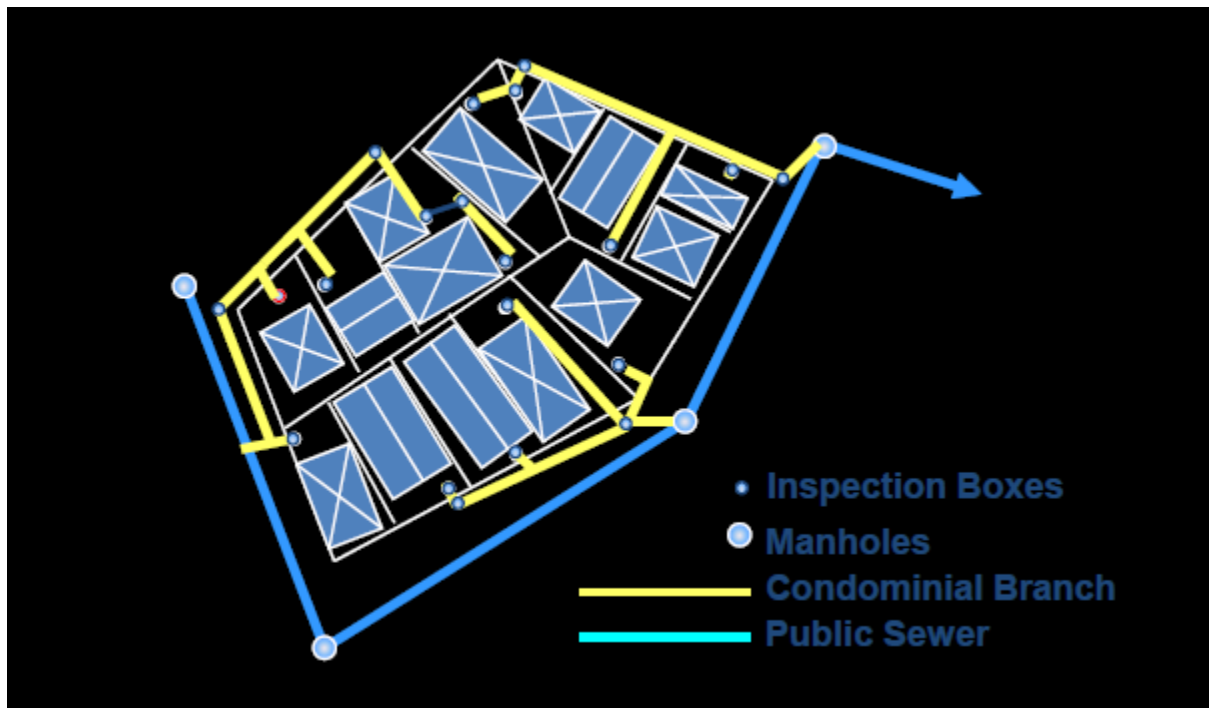


Figure 4. Plan of a condominial sewer system in an informal settlement in Brasilia (source: CAESB)

#### Comments and observations

##### *José Carlos Melo*

This approach should also be understood, not only as part of a wider process to empower and build the capacities of a user who is considered a "citizen" rather than merely a "client", but also as part of an approach to take services away from the provincial operators, deemed overly bureaucratic and not interested in providing services to the poor. It should also be set in context as having been developed in a post-dictatorship period during which relationships with the state were being questioned.

It is further necessary to stress the importance of ensuring the progressive development of the condominial approach to enable lessons to be learned/errors to be corrected and to stimulate demand.

##### *Brasilia*

The process involves 'breaking down' the sanitation plan and working on a more refined micro-watershed level, which makes it possible to reduce pipe diameters and streamline the route.

Rather than planning out the system first then identifying any connection issues (as is the case in Recife, where in some places the sewer system was laid above the level of some of the connections), the design process starts by determining the lowest point and the sewer pipes are then laid at the most suitable depth.

In places where the primary sewer line passes nearby, a direct connection is made, unlike in Salvador where the condominial sewer line was constructed in parallel to conventional sewerage.

A pipe diameter of 100mm is considered sufficient for 100 houses; however, a maximum of 25 houses are connected to a tertiary sewer line, meaning that 20%-25% of the maximum hydraulic capacity is used. Pipe diameters of 150mm are used in Salvador due to lack of education and awareness-raising (pipes are blocked by solid waste). In one of the satellite towns with 250,000 inhabitants, 100mm diameter pipes have been used for 80% of the system.

Users have a 40cm diameter inspection chamber on their plot and a CAESB department has recently begun carrying out checks to ensure that each household has a grease trap.

40cm to 60cm diameter molded concrete manholes with 'hollow' bases and a drain (lined channel) are mass produced and used in 95% of cases.

It is always the users who decide whether the condominium sewer lines are to be routed across public or private land (if over private land, the users are responsible for sewer line maintenance, in return for which they receive a 40% discount on their sanitation bill).

componente	Local	Tipo	Prof	Ø rede
Rede	Passeio	CP 60	Até 1,2m	Até 200mm
	Rua	PV Ø1m	>1,20m	Até 300mm
		PV Ø1,2m	>1,20m	300 a 600
		PV CA	>1,20m	>600mm
Ramal	Interno	CI 40	Até 90cm	100mm
	Externo	CI 60	Até 1,20m	

Figure 5. Pipe diameters and depths used by sewer constructors/stakeholders in Brasilia (source: CAESB)



Photo 4. Mass production of 'simplified' manholes in Brasilia (source: CAESB)

### Recife

At only 40%, the current connection rate is very low due to a lack of any real user involvement and participation.

According to specialists, an absurd rule is applied in Recife that results in sizeable additional costs: conventional sewerage system length  $\geq$  length of the roads minus 10%, and condominium sewerage system length  $\geq$  2 times the length of the roads.

### Salvador

The city has been divided into watersheds and micro-watersheds.

The initial pipe diameter of 100mm has been increased to 150mm on all condominium sewer schemes, which has significantly reduced clogging.

The decentralized treatment plants initially constructed in the districts have been progressively abandoned and filled in and all sewer schemes connected to more sophisticated wastewater treatment plants and a sea outfall. (Due to the city's topography, a large number of lift pumps have been required).

At the same time, as part of the Bahia Azul program, considerable efforts have also been made to improve the operator's performance and financial management and install meters for all.



Photo 5. Manhole cover that has been incorporated into the sidewalk in Salvador



Photo 6. A condominal sewer scheme in a hillside *favela* on the coast in Salvador de Bahia

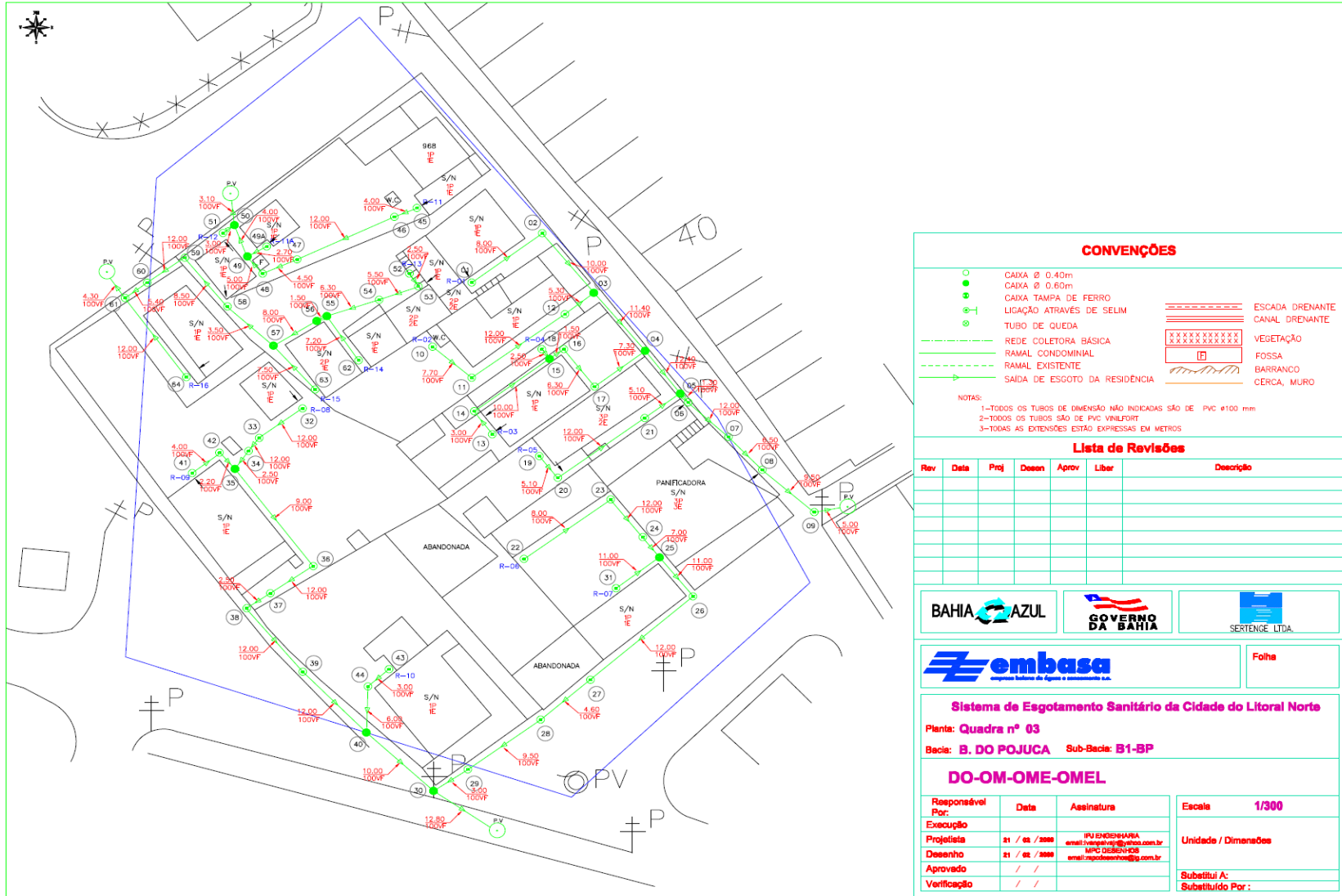


Figure 6. Plan of a condominal sewer scheme in Salvador de Bahia (source: Ivan PAIVA, consultant, and EMBASA)

## 7. Condominial sewerage implementation

	Brasilia	Salvador	Recife
<b>Technical supervision</b>	CAESB with the support of service providers.	Specialist companies.	Municipality technical team
<b>Sewer construction</b>	Contractors. Users can also help with construction, in return for which they do not have to pay connection costs. However, users rarely opt to help and prefer to pay for connection.	Contractors. No option for users to help with construction.	Contractors. No option for users to help with construction.

Table 5. Division of roles during the construction and implementation phase in Brasilia, Salvador and Recife (source: SHANKLAND et al. and pS-Eau survey)





Photo 7. CAESB contractors laying a connection manhole in a residential district of Brasilia



Photo 8. CAESB contractors digging trenches for sewer lines in a residential district of Brasilia

## 8. Condominial sewerage management

	Brasilia	Salvador	Recife
<b>Body responsible for the service during the operational phase</b>	Provincial operator, CAESB	Provincial operator, EMBASA	Municipal sanitation department, for condominial sewer lines  Provincial operator, COMPESA, for main sewer lines
<b>Service operator</b>	Provincial operator, CAESB	Provincial operator, EMBASA + sub-contractors	Municipal sanitation department, for condominial sewer lines  Provincial operator, COMPESA, for main sewer lines
<b>Technical operation</b>	Provincial operator, CAESB (with hand tools, high-pressure sewer cleansing equipment, cameras) and users for some condominial sewer lines	Provincial operator, EMBASA (with hand tools, high-pressure sewer cleansing equipment, cameras)	Municipal sanitation department, for condominial sewer lines  Provincial operator, COMPESA, for main sewer lines
<b>Financial operation</b>	Provincial operator, CAESB	Provincial operator, EMBASA	Municipal sanitation department, for condominial sewer lines  Provincial operator, COMPESA, for main sewer lines
<b>User-focused activities</b>	Provincial operator, CAESB: hotline, ongoing IEC	Provincial operator, EMBASA: hotline, ongoing IEC	Municipal sanitation department, for condominial sewer lines  Provincial operator, COMPESA, for main sewer lines
<b>Service regulation</b>	State regulator	State regulator + multi-stakeholder municipal committee	State regulator + multi-stakeholder municipal committee

Table 6. Service operating responsibilities, roles and tasks in Brasilia, Salvador and Recife (source: pS-Eau survey)

### Comments and observations

#### *Salvador*

The users had the choice of carrying out sewer maintenance themselves (with 45% of the sanitation fee still levied on the water bill...) or signing a contract with the state operator (with 80% of the fee levied on the water bill). They opted to maintain the systems themselves but frequently called upon the operator for assistance. As the distinction between public and private land within the districts is extremely unclear, users had difficulties determining whether the section of the sewer line requiring maintenance came under the responsibility of the community or the operator.

It was always the same users that experienced the most problems: those connected to the downstream sections of the sewer. They thus had to cover the majority of O&M costs and deal with the sewers backing up into their homes.

The user committees received very little post-project monitoring from the operator and found themselves ill-equipped to meet users' expectations.

As the users' sense of ownership of the sewer schemes declined, so poor practices multiplied: *"Examples of misuse cited by interviewees and focus group participants included diversion of stormwater into the sewerage system and the tendency for members of drug-trafficking gangs to break open inspection chamber covers in order to be able to hide inside when there was a police raid."* (SHANKLAND et al., 2010).

Inhabitants connected to condominial sewer schemes conducted campaigns, some of which received media coverage (television reports), demanding the same level of service as the users of conventional sewerage, namely direct management by the operator. The courts ruled in their favor citing the right of all to public services.

As a result, the operator decided to do away with the option of enabling users to choose between community-based and direct management... and increased its tariffs (wherever local political will allowed).

A concerted service regulation system, the only one of its kind in Brazil, was put in place in Salvador: *"To date, Bahia is the first and only state to attempt to bridge social oversight and technical regulation, through a multi-stakeholder committee made up of representatives from public and private sector organizations, labour unions, NGOs and housing rights groups. Since 2007, the committee, known as CORESAB, has held 16 public hearings with over 3000 participants to discuss sanitation issues in order to come up with more viable and "owned" solutions. A key issue for CORESAB in the last year has been around tariff setting, particularly regarding the competition for use of water and greater transparency around cross subsidies."* (SHANKLAND et al., 2010).



Photo 9. A condominial sewer line on public land in Salvador: a team from EMBASA carrying out maintenance using hand tools



Photo 10. EMBASA's high-pressure sewer cleaning truck used to remove major blockages on the sewer

## Brasilia

According to CAESB, condominal sewers require fewer major interventions than conventional sewerage (as less sludge is deposited due to the self-cleansing properties of the smaller diameter pipes), but more small interventions (clogging caused mainly by solid waste and sediment). Whilst this does not make condominal sewerage any more or less maintenance-intensive than conventional sewerage, it does require the operator to adapt his intervention methods to include ongoing user awareness-raising.

CAESB charges 100 real (or 34 euros) per intervention on sewer lines located in backyards, which thus come under the responsibility of the users. (The new management team wants to increase this fee to 1,000 real). It is then up to the inhabitants of the '*condominio*' to split the bill between them. However, this can sometimes cause disputes between users, as they argue over who caused the blockage. When the blockage can be clearly attributed to a single inhabitant, CAESB can send the invoice directly to this one user.



Photo 11. Left: a portable high-pressure sewer cleaner used by CAESB in Brasilia. Right: robots with sewer inspection cameras suitable for sewer pipes of different diameters (source: CAESB)



Photo 12. Leak detection equipment used to identify invisible leaks on sewer schemes in Brasília (source: CAESB)

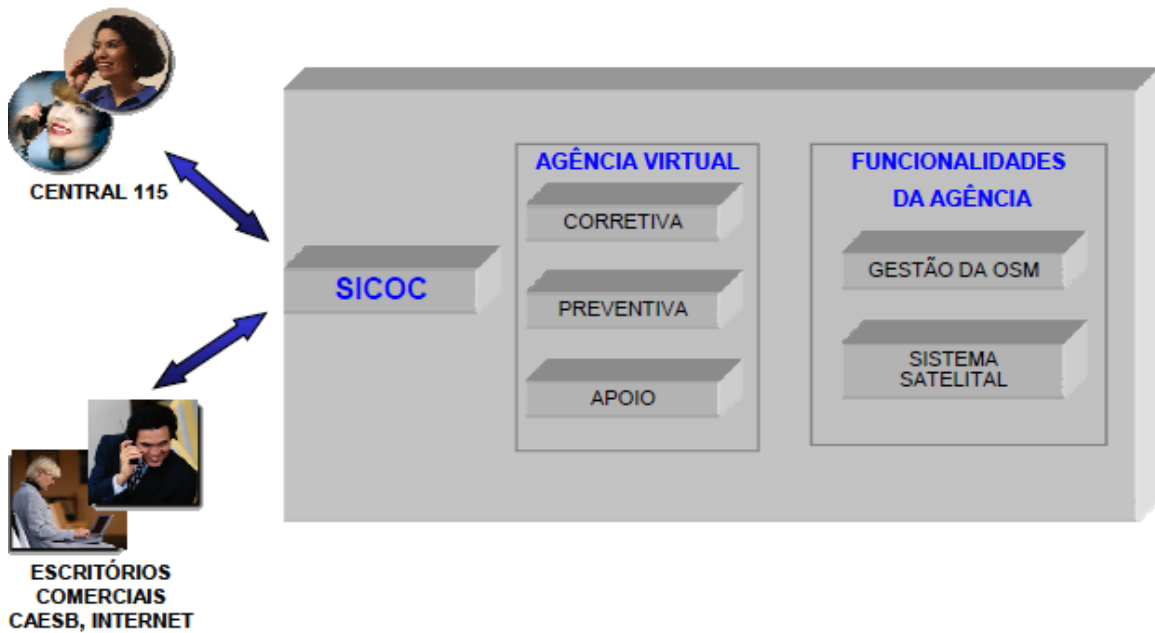
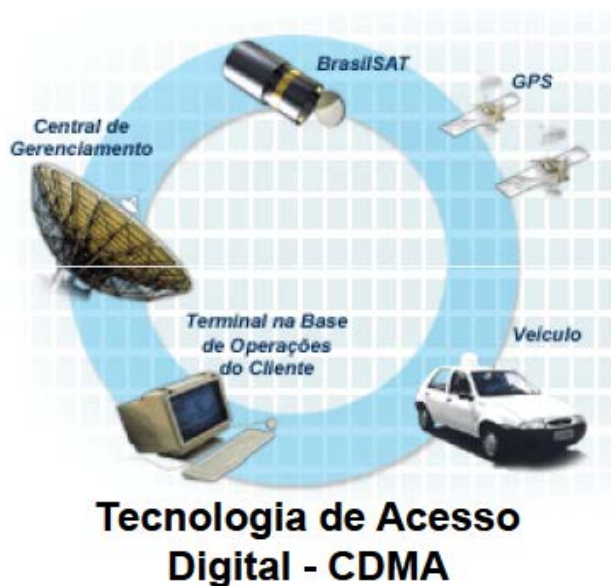


Figure 7. The customer relations, operations and repairs and maintenance system used in Brasília (source: CAESB)



**Terminal de Comunicação**



Figure 8. The interactive and integrated repairs and maintenance system used in the Federal District (source: CAESB)

### Recife

In Recife, following several years of conflict between the operator, users and municipality, none of whom were willing to accept responsibility for managing the condominial sewer systems, the solution put forward by the municipality (and imposed on the operator by the Pernambuco state government, which was led by a former mayor of Recife) was to share the responsibility for and operation of the sewer schemes:

- the municipality is responsible for the condominial sewer lines (which it often financed) and for maintaining these, as well as for carrying out ongoing IEC campaigns with the users;
- the public operator remains responsible for operating the main sewer lines.

Offices for the operator and municipal client relations departments have been set up in the low-income districts connected to condominial sewerage.

However, both parties appear to be neglecting their condominial sewerage responsibilities: the offices set aside for the operator are often empty and the local authority also seems to be steadily losing interest in the solution.

The municipal technical departments contend that it is difficult for non-professionals to undertake sewer maintenance themselves. After 12 years of maintaining the sewers, these technical departments still have to borrow heavy equipment from COMPESA (Recife's public operator in charge of 3<sup>rd</sup> and 4<sup>th</sup> level maintenance) on a regular basis to deal with certain problems.

The route initially chosen runs through backyards, which has led to numerous conflicts between neighbors.

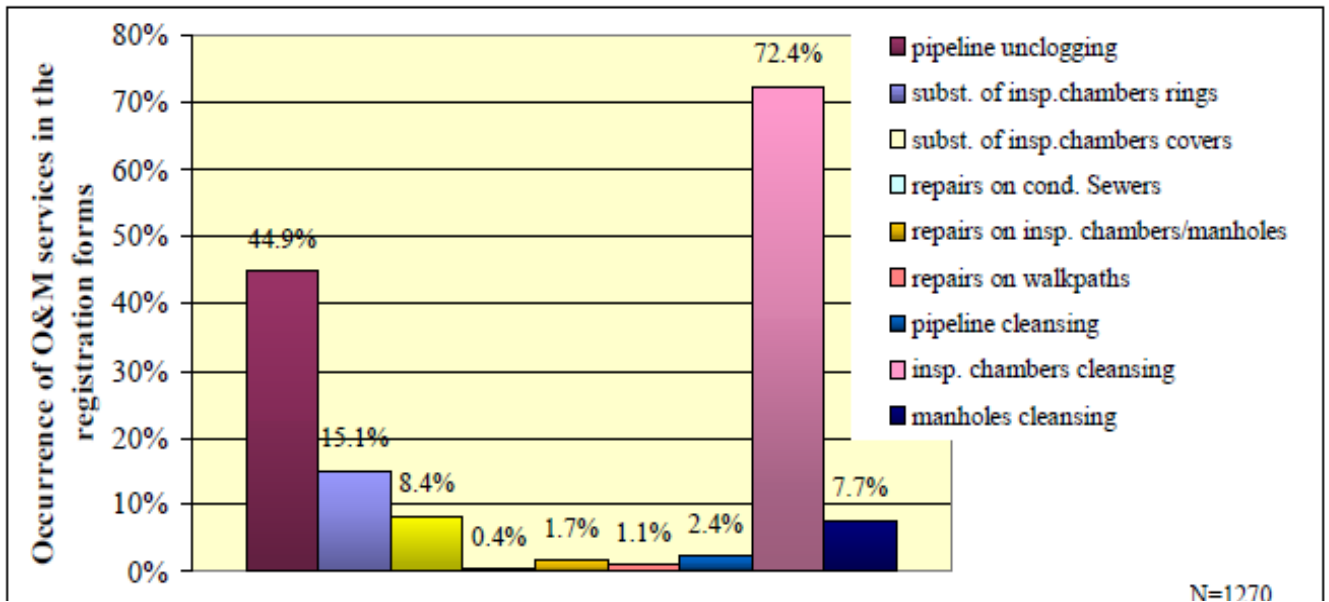


Figure 9. Type of repairs and maintenance activities undertaken on the sewer system in the Mangueira district of Recife between June 1998 and June 1999 (source: SARMENTO V., 2001)

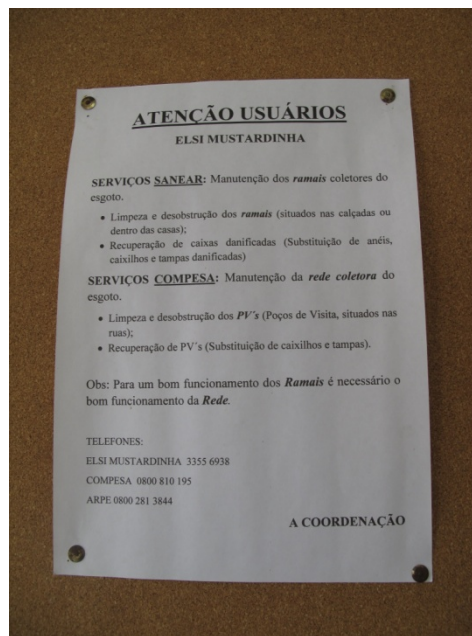


Photo 13. Note displayed in the user information office in an area of Recife reminding users of the respective sewer maintenance responsibilities of the provincial operator, COMPESA, and the Recife city sanitation department



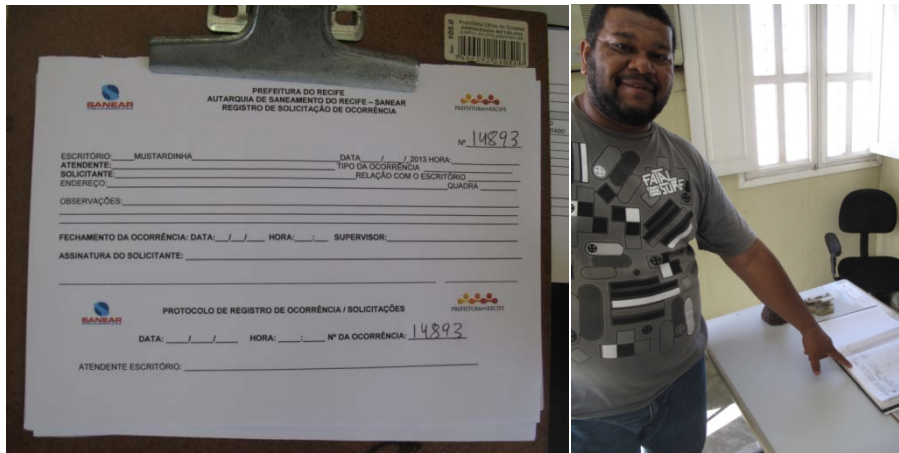


Photo 14. Condominial sewer line maintenance request form and the Recife city sanitation department's maintenance log book

## 9. User involvement in the process

	Brasilia	Salvador	Recife
<b>User mobilization (awareness-raising, promotion, consultation)</b>	CAESB community mobilization team	EMBASA community mobilization team	Municipal departments
<b>Service contract</b>	Contract signed prior to construction. Minimum objective set before work started was a connection rate of 80%.	Contract signed prior to construction. Minimum objective set before work started was a connection rate of 80%.	Contract signed prior to construction. Minimum objective set before work started was a connection rate of 80%.
<b>Was use of the condominial mandatory?</b>	Yes	Yes	Yes
<b>Is connection to the sewer mandatory?</b>	Yes, if the sewer route passes near the plot and the operator is authorized to invoice for the connection cost. However, the extent to which this is applied depends on the prevailing political will.	No (voluntary)	Yes Yes, if the sewer route passes near the plot and the operator is authorized to invoice for the connection cost. However, the extent to which this is applied depends on the prevailing political will.
<b>Are users involved in condominial sewer line construction?</b>	This is an available option	No	No
<b>Number of local community meetings held</b>	7,800	10,000	500
<b>Users' preferred option for the laying of condominial sewer lines</b>	Under sidewalks	No options available; technically-driven solution	No options available; technically-driven solution
<b>Users' preferred management method</b>	Management by CAESB	Management by the users themselves initially, due to the fee discount available. However, EMBASA has had to take over this management and there is no longer a choice.	Management by the users themselves initially, due to the fee discount available. However, the municipality has had to take over this management and there is no longer a choice.
<b>Level of user involvement in sewer maintenance</b>	Low	Low	Low

Table 7. User involvement in the different stages of the service development process in Brasilia, Salvador and Recife (source: SHANKLAND et al., 2010 and pS-Eau survey)

### Comments and observations

#### *Brasilia*

User involvement is stimulated and coordinated by teams that specialize in condominial sewerage and in which social workers work alongside engineers on the same footing, etc.

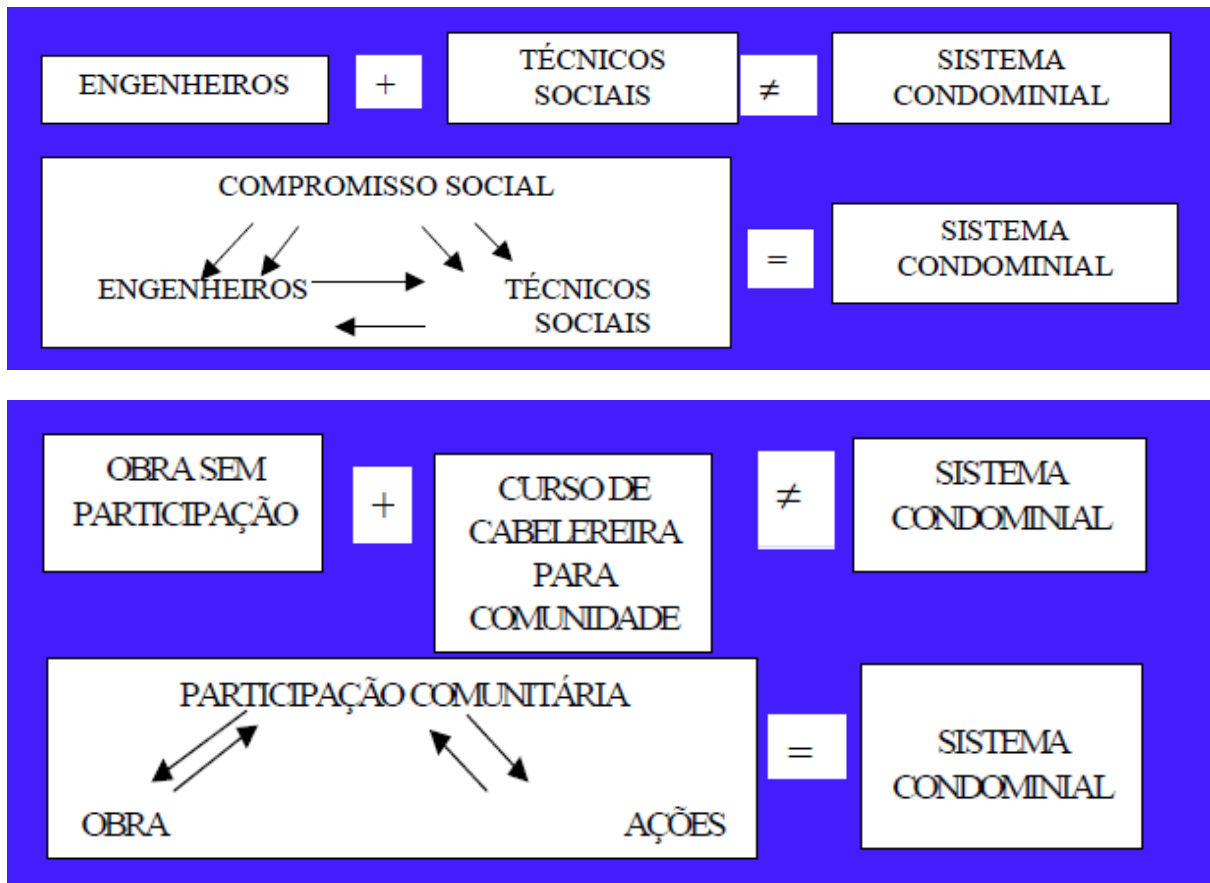


Figure 10. The CAESB approach involves the users at each stage of the service development process.

According to CAESB, the majority of users want to connect to the sewer system. 25% are more hesitant but agree to a connection once provided with additional information. Only 5% are really reluctant and, for these, CAESB enforces the law that requires a user to connect to the sewer scheme when the sewer line passes in the vicinity of their home (similar to the situation in France).

A community meeting is held to discuss user expectations and present the different options available. A *condominio* representative is selected to act as the operator's key contact, but is not allocated any other specific responsibilities. This is the only group meeting held during the service development process. All subsequent discussions between the users and the operator take place during the CAESB teams' home visits.

### Salvador

All users were initially reluctant to connect to the sewer scheme because the construction work caused disruption; they had little trust in public services and because of the cost, etc. However, as the program progressed, demand increased among poor and rich alike.

EMBASA and all program stakeholders/contractors recruited large numbers of social workers. Use of both the social approach and the dedicated team created within EMBASA was continued as part of the subsequent program (PAC) and studied/expanded elsewhere in Brazil.

According to SHANKLAND et al., 2010, EMBASA created a dedicated 'social mobilization' department that, as part of the Bahia Azul program, undertook major user mobilization efforts, which helped considerably develop user trust in the operator. For its part, the operator significantly developed its understanding of user expectations and improved its responsiveness to user demands. As the inhabitants gained confidence in their abilities to act as citizens and enter into discussions with the public authorities and service operators, so their relationship with these entities changed: from being inhabitants of the *favelas*, they became residents of a distinct 'district'.

Local residents were heavily involved in the implementation phase.

*Recife*



**Photo 15. Scale models of housing districts used during training and awareness-raising activities undertaken by the operator EMBASA in Salvador**

## 10. Condominial sewerage costs

	Brasilia	Salvador	Recife
<b>Investment costs and sources of funding</b>	Cost with treatment: between 500 and 3,500 real per inhabitant, or between 170 and 1,200 euros. Financed through state subsidies (in turn often financed through a development bank loan) and own funds.	See the figures per meter in the table below. Financed through state subsidies (in turn often financed through a development bank loan) and own funds.	2,000 to 12,400 real per connection, or between 677 and 4,200 euros.
<b>Operating costs and sources of funding</b>	Not available, but CAESB estimates these to be similar to those for conventional sewerage.	Not available as incorporated into the overall sanitation service budget along with the conventional sewerage schemes and WWTP.	Not available
<b>Specific condominial sewerage fee</b>	For a long time, the fees charged by operators differed depending on whether the condominial sewers were being operated by the public operator (fee equal to 80% of the water bill in Salvador and 100% in Brasilia) or by the users (60% of the water bill in Brasilia, 45% in Salvador). The operators are now directly managing all condominial sewers, however. Nevertheless, in Salvador, the operator is finding it difficult to increase the fee to 100% due to lack of political will.		From 40% to 100% of the water bill, depending on the sewer routing (from backyards to sidewalks)
<b>Specific condominial sewerage connection fee</b>	The connection fee is uniformly set at 580 real (around 200 euros), paid in 24 monthly installments through the water bill.		

**Table 8. Costs and sources of funding for condominial sewerage investment and operation in Brasilia, Salvador and Recife (Sources: from SHANKLAND et al., 2010 and pS-Eau survey)**

The variation in investment costs in Brasilia is due to the fact that the two operators have different levels of expertise. CAESB has been working in a consultancy capacity in Recife, where they have succeeded in reducing these costs by up to 50% by streamlining the routes and reducing the number of lift pumps.

According to CAESB, O&M costs for condominial sewerage are virtually the same as those for conventional sewer systems (see Table 10, below).

In Brasilia, the very poor (those that consume less than 10m<sup>3</sup> of water per month) are not charged a sanitation fee through their water bill. However, this applies to only 2% of users.

	Flat terrain	Hilly terrain
Condominial sewerage (in Brazilian real /meter)	85	100
Conventional sewerage (in Brazilian real /meter)	180	250

Table 9. Comparison of the average cost of conventional and condominial sewerage in Salvador de Bahia (source: Ivan Paiva)

### Investimento no Sistema Condominial

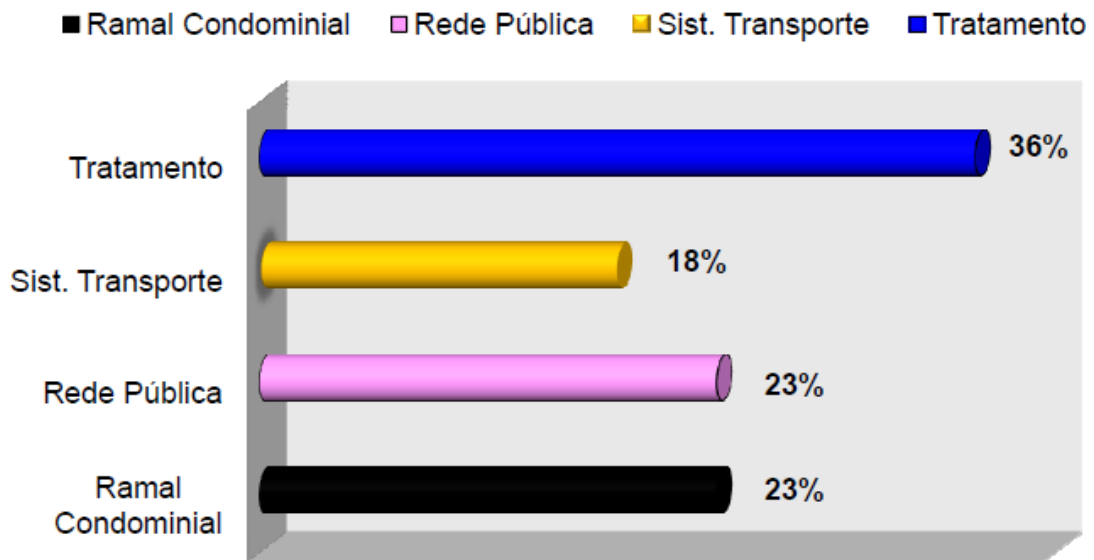


Figure 11. Investment items for condominial sewerage infrastructure in Brasilia (source: CAESB)

**INDICADORES PROJETO DE ESGOTO - ÁGUAS LINDAS**

Componente	Valores						
	Quantidade m	População Atend	Soma de Custo R\$	% Custo	Soma de Ligações	Custo/metro	Custo/ ligação
<b>Ramal</b>							
Condominial	251.253,16	88.850,00	14.233.545,68	23%	19.745,00	56,65	720,87
Rede Pública	102.545,97	-	13.165.289,95	22%		128,38	666,77
interceptor	8.671,50	-	4.444.674,82	7%		512,56	225,10
ETE	-		21.907.696,56	36%		-	1.109,53
canteiro		-	362.106,80	1%		-	-
Elevatória	-		4.234.889,46	7%		-	119,25
Recalque	7.255,00		2.723.300,31	4%		375,37	76,68
<b>Total geral</b>	<b>369.725,63</b>	<b>88.850,00</b>	<b>61.071.503,58</b>	<b>100%</b>	<b>19.745,00</b>	<b>165,18</b>	<b>3.093,01</b>

Valores em R\$ - base Tab 06/2008

Table 10. Operating costs of the different sewer system components in Brasilia (source: CAESB)

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