



**Semana temática:** Agua y ciudad

**Eje temático:** Pautas de los gobiernos locales para la sostenibilidad

**Título de la ponencia:** Integrated Urban Water Management in Belo Horizonte, Brazil

**Autores:** Nascimento, Nilo <sup>1</sup>; Costa, Heloisa <sup>2</sup>; Costa, Geraldo <sup>3</sup>; Dias, Janise<sup>4</sup>; Knauer, Sônia<sup>5</sup>

<sup>1</sup> Universidade Federal de Minas Gerais, Departamento de Engenharia Hidráulica e Recursos Hídricos, Av. do Contorno, 842, 30110-060 – Belo Horizonte, MG, Brazil, Correo electrónico: [niloon@ehr.ufmg.br](mailto:niloon@ehr.ufmg.br), Teléfono: +55.31.3409.1872

<sup>2</sup> Universidade Federal de Minas Gerais, Instituto de Geo-Ciências, Departamento de Geografia, Av. Antônio Carlos, 6627, 31270-901 – Belo Horizonte, MG, Brazil, Correo electrónico: [hsmcosta@terra.com.br](mailto:hsmcosta@terra.com.br), Teléfono: +55.31.3409.5461

<sup>3</sup> Universidade Federal de Minas Gerais, Instituto de Geo-Ciências, Departamento de Geografia, Av. Antônio Carlos, 6627, 31270-901 – Belo Horizonte, MG, Brazil, Correo electrónico: [gemcosta.bhz@terra.com.br](mailto:gemcosta.bhz@terra.com.br), Teléfono: +55.31.3409.5430

<sup>4</sup> Universidade Federal de Minas Gerais, Instituto de Geo-Ciências, Departamento de Geografia, Av. Antônio Carlos, 6627, 31270-901 – Belo Horizonte, MG, Brazil, Correo electrónico: [janisebruno@yahoo.com.br](mailto:janisebruno@yahoo.com.br), Teléfono: +55.31.3409.5430

<sup>5</sup> Prefeitura de Belo Horizonte, Secretaria Municipal de Meio Ambiente, Av. Afonso Pena, 4000, 31270-901 – Belo Horizonte, MG, Brazil, Correo electrónico: [knauer@pbh.gov.br](mailto:knauer@pbh.gov.br), Teléfono:

**Abstract:**

Integrated urban water management (IUWM) presents a wide range of different challenges to be effectively implemented. This may concern, at a first level, to promote integration of different water domains, such as water supply, sanitation, storm water management and receiving water protection at the urban environment. Due to the close relationship between water and land use, promoting IUWM requires also the development of integrated policies consistent with the territorial management. That is the case of urban development policies having major impacts on land use, such as housing and road system and transportation. Furthermore, local policies usually reflect on the water management at other territorial scales, beyond the municipal borders, usually involving the metropolitan and the river basin scales. Therefore, significant political and managerial efforts have to be developed by a wide range of institutions and stakeholders in pursuing sustainable and integrated urban water management within this complex political and institutional environment. The present paper centres on the assessment of the Belo Horizonte city experience in IUWM policy formulation and institutional development, focusing on the recent implementation of its Municipal Environmental Sanitation Policy. Since 2001, the Belo Horizonte municipality implemented a Municipal Environmental Sanitation Policy, aiming at providing universal access to urban infrastructure and services at the municipal scale, promoting participatory decision-making and social control on water policy formulation and implementation, recovering environmental degraded areas, particularly urban water bodies, and improving managerial instruments such as planning and funding for environmental sanitation actions. Belo Horizonte is a planned city built in 1898 to become the capital of the Minas Gerais state, in Brazil. It has 2,227,400 inhabitants with a population density of 6,900 inhabitants/km<sup>2</sup>.

**Key words:** integrated urban water management, participatory processes, urban policies, water management planning

## 1. Introduction

Belo Horizonte (BH) is located in southeast Brazil and has a population of 2.2 million inhabitants. The city lies at 20° South latitude and 44° West longitude and has an altitude of 750 to 1,300 meters. Planned to be the capital of the state of Minas Gerais, the construction of BH began at the end of the nineteenth century. The project was inspired by the positivist principles that were strong during that time. In opposition to the “anachronism” of the former capital, Ouro Preto, a XVII Century town of baroque inspired urbanism, BH was conceived to be a reference of rationality due the use by the city designers of the then most updated scientific and technical knowledge on urbanism. A general geometric design oriented the urban plan, resulting in rigidly regular streets and broad avenues meeting at right angles to form square blocks. This urban model intentionally ignored natural, existent local characteristics such as the region's topography and hydrography. The purpose of rationally controlling natural processes by creating an artificial urban environment justified this approach. Indeed, a modern urban area was then thought as to be supplementary and not complementary to the natural environment.

The geometric regularity of the road system expressed the intention of facilitating the traffic flowing and making easy the construction and functioning of the water supply network as well as the wastewater and storm water drainage separated systems. As an example of the adoption of these concepts, during the early years of the capital, most of the streams located in the planned area were lined following the road system (Figure. 1). Later, many of these streams were covered by concrete structures in order to enlarge streets and avenues to deal with traffic problems.

The original urban plan classified the municipal area according to three land use zones: the urban, the suburban and the rural zones. Nevertheless, no land use or building regulations were stated for new urban developments that would eventually emerge in the suburbs and, later on, in the rural areas. As a consequence, from the beginning of the new capital setting up, uncontrolled informal urbanism materialised in these zones. Urban informality characterised these new developments where a lack of the most basic urban infrastructure and services was the rule.

During the following years, the local government undertook different efforts aiming on land use regulation and on the control of new urban developments. Examples are the building regulation and the urban development regulation from the 1930's, followed by land use regulation laws promulgated in the 1940's, 1960's and 1970's. Also in the 1970's, the government of the Minas Gerais state issued legislation stating the management framework for the Belo Horizonte Metropolitan Region (BHMR) and created an organism, the PLAMBEL, with the responsibility of planning and managing the new conurbation (Champs et al, 2005). Water supply and sanitation services were first regulated by BH Municipal legislation during the 1940's.

The period of military dictatorship, from 1964 up to 1986, had a huge influence on the urban development and the water management in Brazil, with consequences that prevail up to the present time. During the 1970's, the military government adopted a centralised and sector-based plan for urban waters, called PLANASA, essentially covering drinking water and sanitation. This plan promoted the creation of public companies at the states level to

provide drinking water and sanitation services, by municipal delegation, a way that constituted the sole one for the municipalities to obtain federal government funding on these domains. A sector-based federal development bank, the BNH, funded the utility state companies and also played the role of sector regulatory agency. This policy contributed to the improvement on quality of the drinking water and sanitation services, although federal investments on drinking water have been clearly more significant than on sanitation. In most of the cases, municipalities kept the responsibility of directly managing sanitation, storm water and solid waste services, a situation that still prevails at present time.

An intense process of urbanisation also characterised the period of military government. During the 1960's and the 1970's many of the Brazilian state capitals and big cities experienced population growth at rates of 6 to 8% per year. Typically, welfare inequalities clearly reflected in the urban space occupation during this process, with a significant increase of informal new developments lacking infra-structure and services and showing high risks related to landslide, flooding and poor sanitation. This scenario is still current in many Brazilian cities, although different municipal government have developed significant efforts leading to the regularisation of these urban areas, a policy usually accompanied by housing, education, water supply, sanitation and other programs.

With the end of the military government, the program PLANASA was stopped and the BNH, the federal funding and regulatory agency, closed. These changes had no impact on the service delegation at the municipal level, since almost all the state utility companies kept their concessions. They also kept their typical centralised approach on planning and management. Furthermore, in the absence of a municipal regulatory capacity due to political weakness or lack of political motivation, these state utilities cumulated functions of service delivery, planning and regulation.

On the other hand, the Brazilian democratisation also brought important innovations on the local policy formulation and institutional development. This process strongly emphasised the need of decentralisation on public policy formulation, public services management and on resources, in general. Promoting an increasing participation of citizens in the decision-making at the local sphere became a major objective, as for instance in the formulation and evaluation of local policies, in the definition of priorities of investment and in assessing the quality of public services. The development of this innovative institutional framework is currently seen as a way of endorsing the emergence of a new citizenship by different means: (i) public involvement in the decision-making process, resulting in the development of a shared responsibility in policy formulation and implementation; (ii) increasing transparency on the decisional process, particularly regarding the definition of investment priorities; (iii) promotion of ethics in politics, resulting in the reduction of corruption and of privileges; (iv) promotion of social control of the public policies setting up, among others (Milani, 2006).

In many Brazilian cities, this significant political change involved different urban sectors: housing, health, education, environment, land use, and water. The present paper focuses on the BH recent experience in this domain, particularly on its local experience in improving the institutional framework towards integrated urban water management (IUWM). Actually, BH is one of the Brazilian cities that proved to be more innovative in stating a well-institutionalised public participation framework on the municipal

administration since the beginning of the democratisation process. In the first part of the paper, one gives some basic figures related to urban waters in BH. This is followed by a broad description of the current BH urban water management framework. In the discussion part of the paper, authors try to point out and to discuss the main challenges for reaching IUWM in the BH context.

## 2. Urban water infrastructure in Belo Horizonte

BH is located in a mountainous region of tropical soils originated from the decomposition of metamorphic rock. Tropical highlands weather predominates in this area, with average yearly rainfall of 1,500 mm and an average yearly temperature of 21°C. The rainy season lasts from October to March, when 90% of the total yearly rainfall occurs. The highest monthly average rainfall (315mm) takes place in December. The intensity of the rainfall is also relatively high (e.g.: 200 mm/h in the case of a 10-year return period event with 5 minutes duration; 70 mm/h for the 50-year return period and 1h duration event). Mean relative humidity reaches 50% during winter and 75% in summer.

The BH water supply system (drinking water) connects to 99.7% of BH residents, with an average supply rate of 286 litres per inhabitant/day. Surface sources predominate, the Velhas River, the Manso, the Serra Azul and the Vargem das Flores reservoirs being the most important system, with production capacities of 6.75 m<sup>3</sup>/s, 4.2 m<sup>3</sup>/s, 2.6 m<sup>3</sup>/s and 1.2 m<sup>3</sup>/s, respectively.

All the systems are interconnected and supply not only BH but also most of the municipalities gathered into the conurbation (BHMR). The total water supply production capacity is 16.3 m<sup>3</sup>/s, which easily meets a current demand of 11.9 m<sup>3</sup>/s for the region. The water supply system presents high standards in terms of operation as well as water quality.

About 92% of the BH inhabitants are connected to the wastewater sewerage system but there is a lack of interceptor pipelines and a limited capacity of the existing wastewater treatment facilities. There are two recent wastewater treatment plants in operation, the Arrudas and the Onça WWTP, with a total capacity to treat 4.0 m<sup>3</sup>/s. In the next future, those WWTP will have their total treatment capacity increased to 8.1 m<sup>3</sup>/s and will then be able to treat almost 100% of the wastewater flow generated within the Arrudas and Onça catchments, including wastewater drained from Contagem town, located upstream.

In BH as well as throughout the BH metropolitan area, a separated sewerage system has been adopted, although illicit inter-connections between the wastewater and stormwater networks and the lack of interceptor pipelines are main causes of heavily polluted receiving bodies in the urban area and in the Velhas River, downstream of the city. About 56% of the required length of interceptor-lines is still to be built.

Traditional stormwater systems prevail in the city, although experiences with detention ponds have existed since the 1950's. There is a 4,300 km network of roads all equipped with gutters, inlets etc. There are some 700 km of perennial creeks in the municipal area. Parts of these creeks have been lined to the extent of nearly 200 km, most of them as culvert concrete channels. Using concrete box culverts as a "solution" to aesthetic, odour,

garbage and water-borne disease problems related to heavily polluted streams demonstrates an oversimplified approach to stormwater management.

The apparent simplicity of stormwater management, as perceived during most of the last century, led to the use of very simple design methods for stormwater systems. One of the consequences of this approach is high uncertainty in hydrologic design. A similar oversimplification also prevailed in hydraulic design; only uniform flow conditions were regularly considered in the design of channel structures, which usually resulted in underestimations of flood risk and flood effects. Also, the BH municipality did not invest in monitoring stream discharges or water quality parameters, increasing uncertainties on hydrologic simulations, hydraulic design and environmental impact assessments.

The intense urban growth during the 1970s combined with inequalities in the distribution of income led to huge impacts on water quality in receiving bodies and an increase of flood risk. This is mainly due to the impacts of new urban developments causing an increase of imperviousness and also to the occupation of flood prone areas. Water pollution by wastewater discharges and diffuse pollution inputs, including solid waste and the products of severe erosion processes have caused the degradation of water quality in streams and the reduction of conveyance capacities of sewers and channels due to sediment deposits (Figure 2 A). Detention basins have also been heavily impacted (Figure 2 B) (Nascimento *et al.*, 1999).

Therefore, improvements to urban creeks, detention ponds, wetlands, and to the Velhas River water quality will require important investments in wastewater interception and treatment. Alternatively, new approaches may be adopted, e.g.: combining the existing end-of-pipe WWTP with decentralised treatment facilities, or the possibility of keeping combined systems in certain areas where in fact this approach has been informally adopted e.g. in many of the shantytowns.

### 3. The participatory process in Belo Horizonte

In BH, urban water management, among other urban domains (e.g. housing, health, cultural policy ...), is performed on the base of a significant public participation, as previously mentioned. The participation of the public on the decisional process takes place through different institutional arrangements such as:

- Participatory planning;
- City conferences;
- Participatory councils, and
- Participatory budget.

Seem, before the 1980's, essentially as a technical document aiming at guiding and regulating urban policies and actions related to the territory (land use), urban development planning became after the 1988 Brazilian new constitution an important instrument of the participatory process. In many municipalities, enhancing public participation during the elaboration of the urban development plan became the start up of a process leading to the institutionalisation of the participatory process at local level. That has been the case for Belo Horizonte, where the elaboration of the municipal constitution, called "Lei Orgânica de Belo Horizonte" (Belo Horizonte Organic Law), from 1990, and of the 1996 Master Plan played a decisive role on the establishment of a new public participation framework in the municipality.

A major contribution to this process came with the 1990 municipal constitution, by the assertion of four axes to orient the municipal government action from then on (Dias et al (2007):

- The political axis, aiming at enhancing citizenship and democracy;
- The social axis, promoting social justice and ensuring the right to the city for everybody;
- The economic axis, promoting income generation and distribution, and
- The administrative axis, boosting participation, decentralisation, transparency and modernisation.

The 1996 BH Master Plan, on the other hand, lead to the development of thematic plans according to sectors of urbanism, including the storm water strategic plan and the environmental sanitation plan, briefly described in the forthcoming topics. Public audience was then a common instrument for public participation employed in urban development planning. This is a consultative tool allowing the municipal government to submit to public evaluation the main guidelines and regulations foreseen for the urban development plan, at different phases of its elaboration. Public audience creates opportunities for public debate but has not a decisional character. Nevertheless, it allows a wide range of social sectors to follow the planning process and to suggest policies, criteria, guidelines and other recommendations.

Following this process of urban development planning, other instruments were implemented that institutionalised and made permanent public participation in the municipal government in BH; examples are the city conferences, the participatory budget and the city councils.

The city conferences, formally designated by municipal conferences on urban policies, are regularly organised in Belo Horizonte since 1995. The conferences play a major role on the formulation of a long-term municipal agenda on urban policy and on urban planning as well as on the statement of priorities for actions in these domains. They may be organised around general urban policy topics or deal with themes by sectors such as the conference on social policy and the conference on environmental sanitation. The city of Belo Horizonte also organised conferences aiming to the formulation of urban policies to be proposed and discussed at the Minas Gerais state and the federal levels, contributing in this way to the dissemination of its experience in the domain.

The participatory councils are usually deliberative institutions with responsibilities of (i) policy formulation; (ii) control of policy application; (iii) prioritisation of investment and actions and (iv) assessment of conformity and effectiveness of actions effectively implemented. Since these councils are organised according to specific domains, each of them has also the responsibility of developing adequate political articulation and coordination with other councils to ensure coherence and integration on their decisions and actions.

According to Milani (2006), the city councils lead to a clear improvement in the state-society relationship. They constitute an improved political space for the government and the society to share responsibilities in the public administration and at the same time to deal with conflicts on policy and management (Costa et al, 2008; Milani, 2006). In this sense, they are relevant instruments in promoting, canalising and articulating popular demands on different domains of the city government agenda: health, education, transport housing, urban development, environmental sanitation and culture (Welter et al, 2008).

The Belo Horizonte municipal administration counts on 5 city participatory councils directly related to urban water management: the Municipal Council on Environment, created in 1985; the Health Municipal Council, created in 1991; the Housing Municipal Council, created in 1994; the Urban Policy Municipal Council (land use regulation), created in 1997; and the Environmental Sanitation Council, recently created (2003). The role of these councils in the urban water management is discussed further on in this paper.

The participatory budget is possibly one of the outstanding instruments leading to public participation on decision-making and to a shared management responsibility between the government and the citizens at the local sphere. In the case of Belo Horizonte, the participatory budget concerns at about 50% of the budgetary resources available for investments, the total municipal budget minus resources assigned to fixed administrative costs, payment of interests and other current obligations. Considering that the participatory budget usually focus on local (district) actions, the remaining 50% of the available resources are usually employed in investments of a more general or diffuse interest for the city, not particularly related to a neighbourhood or a district.

One of the major contributions of the participatory budget has been on the resource allocation profile within the city, either within socio-economic classes (Figure 3) as well as in terms of resources distribution within the municipal territory (Figure 4).

#### **4. Urban water management and the participatory process in Belo Horizonte**

At the Belo Horizonte municipal level, the urban water management policy is regulated by the Municipal Law n. 8260 from 4<sup>th</sup> December 2001, having as main purposes:

- to ensure to the municipality the initiative and control of urban water policies at the municipal level;
- to promote the universality of access to environmental sanitation services, comprising drinking water, sanitation, storm water management, solid waste management and the control of vectors;
- to promote a significant reduction on the pollution of water bodies;
- to ensure that urban waters will be managed on the base of public participatory processes and will also be socially controlled.

The instruments defined by Law 8260 leading to the implementation of the municipal policy of environmental sanitation are as follows:

- the municipal environmental sanitation council (COMUSA);
- the municipal environmental sanitation fund (FMS);
- the municipal environmental sanitation plan (PMS);
- the municipal environmental sanitation conference (COMUS);
- the concession agreements for service providing on environmental sanitation;
- the tariff and tax policies for recovering costs of environmental sanitation services.

The COMUSA is a collegiate organisation composed by 16 members, half of them appointed by the mayor as representatives of the municipal government, and the other half part being representatives of the civil society. COMUSA is in charge of controlling the implementation of the municipal environmental sanitation policy, evaluating the conformity and effectiveness of actions implemented in accordance with the PMS and looking at the use of the FMS resources. Particularly, it has responsibilities as follows:

- state the guidelines for using the FMS resources;
- monitor and regulate the application of these funds;
- approve and monitor the PMS implementation;
- monitor and regulate the actions of municipal organisations in charge of managing environmental sanitation services;
- evaluate propositions of policy change, plan updates, programmes and proposals of new laws in the environmental sanitation domain;
- mediate conflicts between different stakeholders related to the provision of environmental sanitation services.

COMUSA is also in charge of articulating the municipal environmental sanitation policy with those issued from other municipal councils such as the Municipal Environment Council and the Municipal Housing Council (Dias et al, 2007).

The FMS is a fund created by Law n. 8260 and regulated by the Municipal Decree n. 11289/2003. The FMS resources shall be employed only in actions and interventions related to environmental sanitation. Its main source of resources is a percentage collected from the tariffs of drinking water and sanitation services and currently fixed at 4%. The FMS can also obtain resources from the municipal budget and donations coming from international cooperation programmes, public or private donors and others. The amount of FMS resources available for investments is variable; it reaches at about 62 million Euros per year.

The PMS is a planning tool based on a comprehensive assessment of the principal problems and main needs in environmental sanitation at the municipal area. The PMS adopts an indicator, called ISA, as one of the criteria adopted to help COMUSA in prioritising actions and interventions that shall be implemented during spells of four years. After a four-year spell the PMS is updated and the ISA is recalculated, allowing the assessment of the effectiveness of actions done in the previous period as well as the update of priorities for the next four years. The ISA is actually a composition of five indicators, comprising the provision of services on drinking water, sanitation, solid waste management, stormwater management and vector control.

Associated to Law n. 8260 and also a very important instrument to ensure the compliance with its objectives is the new concession agreement for service providing stated between the BH municipality and COPASA, a Minas Gerais state company provider of water supply and sanitation services.

Since its creation in the 1960s till the end of the 1990s, COPASA, like all the other Brazilian state government water utilities, had been in charge of all the phases of service providing in water supply and sanitation, meaning: planning, operation, control and regulation of the BH water supply and sanitation services. Recently, as clearly stated by Law n. 8260, the BH municipality decided to recover its role on environmental sanitation management, including water supply and sanitation planning and regulation, a new policy that led to modifications on the concession rules, as stated in the Cooperation Agreement between COPASA and the BH municipality, signed in November 2002, for the provision of drinking water and sanitation at the municipal area<sup>1</sup>. As one of the outcomes of these political changes, the municipality became a shareowner of the COPASA state utility (Municipal law 8754/2004)<sup>2</sup>. This agreement also states that COPASA must keep a permanent channel of information with the municipality, providing data about different aspects of the operation of the water supply and sanitation systems and that both organisms shall work together on planning and managing these systems.

The execution of the PMS and of policies, formulated by COMUSA, and other city councils is under the responsibility of SMURB, the Urban Policy Municipal Secretary, created by Municipal Law no. 9011/2005 and directly subordinated to the Mayor of Belo Horizonte. Through 2<sup>nd</sup> level secretaries, autarchies and other institutions, SMURBE is responsible for following issues of urban policy: housing (Municipal Housing Secretary), urban (land use) regulation (Municipal Secretary of Urban Regulation), slums upgrading and land regularization (URBEL), works, including drainage (SUDECAP), transport and mobility, solid waste management (SLU: autarchy responsible for garbage collection), and environmental (Municipal Environmental Secretary). Figure 5 illustrates the organisation of SMURB in terms of urban water management.

This institutional arrangement has a certain similarity to other institutional frameworks adopted at different levels of government in Brazil, like the water resources management system and the environmental management system, usually comprising:

- a collegiate organism integrated by representatives of the government and of the civil society and with responsibilities of policy formulation and control of actions implemented;
- an executive organism, in charge of executing the formulated policy, plans, actions;
- a fund of resources, ensuring the finance capacity to the system.

---

<sup>1</sup> For a detailed assessment of this new concession agreement, see Oliveira & Heller, 2007.

<sup>2</sup> This has recently changed since the BH municipality sold its COPASA shares, concluding this operation in the last 25<sup>th</sup> May.

One outstanding example of the application of the BH policy on integrated urban water management is the on-going river restoration programme, DRENURBS. This programme focus on creek recovering in the BH area by means of a participatory process which also involves actions on housing, sanitation, stormwater management, health control, and the creation of green areas and leisure facilities in the urban environment.

The DRENURBS programme benefits from the BH experience on participatory policies, such as the participatory budgeting, the slum upgrading master plan, at the same time as it consolidates this participatory process at the catchment local level (Costa et al, 2008). In each catchment, the programme is implemented from the conceptual phase with the participation of the local inhabitants. A commission of the local community representatives, ensures the required links with the administration, during the execution of the projects, transmitting demands, suggesting project adaptations or changes, and controlling the quality of the project execution. By this process, “local cultural values and backgrounds become key elements of social learning and environmental perception of the public intervention” (Costa et al, 2008). Figures 6 A) and 6 B) illustrate some recent issues of the DRENURBS programme.

### **5. Urban water management at the river basin and metropolitan levels**

According to the Brazilian Constitution, water is a public good to be only utilised under concession of rights of use granted by the Union or by the states, depending on the domain of the water bodies, no matter if the user is a public or private entity. Bodies of water are under the Union domain if they drain more than one state or country or define a border between states or countries; otherwise they are at state domain.

Public participation on water management is also clearly stated by the national legislation: “water resources management shall be decentralized and shall involve participation of the Government, water users, local communities and the organized civil society” (Federal Law Law 9433/1997).

At the river basin level, this is put into practice by an institutional framework comprising the river basin committee and the river basin agency. The river basin committee is a policy formulation organism, with duties of (i) approving and monitoring the implementation of the river basin water resources plan; (ii) proposing values and mechanisms for the water use charging at the basin level; and (iii) arbitrating conflicts related to water uses. The river basin agency acts as executive secretariats of the river basin committee with duties of (i) preparing and updating the river basin water resources plan, (ii) developing studies on water availability, water use and projections on water demand at the river basin; (iii) charging for water use (by delegation) and (iv) planning and monitoring the use of financial resources generated by the charges for water uses at the basin scale.

The Belo Horizonte Metropolitan Area locates at the Velhas and the Paraopeba river basins, both with river basin committees operating since the 1990’s. Nevertheless, so far their respective agencies have not been create, a situation that imposes huge limits to the implementation of the policies and plans currently formulated by them.

Following the end of the military government, the importance of then existing institutional framework for conurbation management suffered a significant reduction.

Currently, efforts on formulating policy and planning at this territorial level are being made, mainly by the initiative of the Minas Gerais state government. The recently promulgated Minas Gerais Constitutional Amendment n. 65/2004 created a new model for the management of metropolitan regions at the Minas Gerais state level. This amendment defines the following as the main public management tasks to be ensured at the metropolitan sphere:

- road system and transportation;
- emergence planning and civil defence;
- environmental sanitation, comprising drinking water, wastewater, storm water, solid waste and vectors control;
- water resources management;
- environmental protection and pollution reduction;
- land use planning and regulation, housing policies;
- health system.

In order to meet objectives of integrating these policies, legislation and management actions at the metropolitan level, the institutional arrangement stated by the constitution of Minas Gerais (Amendment 65/2004) created three organisations. Two of them are in charge of policy formulation, the Metropolitan Assembly and the Metropolitan Deliberative Council; and the third one, the Metropolitan Development Agency has executive charges. The law defines two instruments for the metropolitan management, a planning tool, the metropolitan master plan for integrated development, and a financial tool, the metropolitan development fund (FDM). This institutional framework adopts current arrangements in use in Brazil in the public sphere, including policy formulation and social control institutions, executive agencies, planning and financial instruments.

Nevertheless, the law stating this arrangement for the Minas Gerais metropolitan regions is very recent (Complementary Law n. 88 from 2006) and, in the case of the BHMR, the entire institutional framework is still under construction.

Another important alternative for integrating urban management, including urban water management, at the metropolitan sphere is available with the recently promulgated federal law regulating the association of municipalities to provide public services at regional territorial scales (Law nº 11107, from 6th April 2005). The main interest of this legal framework for water resources management is to facilitate integrated urban water management in metropolitan areas as well as in regions where scattered small towns may benefit of scale economic effects of providing public services on an associated regional base.

## **6. Discussions**

The participatory process adopted in BH for water management as well as for other public issues presents different outstanding interests such as: it contributes to social inclusion at the municipal sphere; it promotes an active citizen involvement into the management of public issues and contributes to the discussion and policy formulation about major urban questions, such as housing, environment, water management, health and culture; it enhances democratic practices and Integrated Urban Water Management in Belo Horizonte, Brazil contributes to ethics in the government; it facilitates citizens cultural

identification and appropriation of their local environment by initiatives such as creek restoration, sanitation, flood control and pollution control at the urban catchment level.

However, in spite of the significant achievements obtained with the participatory process in BH, some challenges regarding integrated urban water management have still to be considered. The provision of environmental sanitation services is still not universalised since there are at about 10 thousand of inhabitants without water supply, 300 thousand without wastewater collection and 100 thousand not counting with solid waste collection (Oliveira and Heller, 2007). At about 50% of the required interceptor pipeline length is lacking and the two main WWTP have a total capacity of treating only 50% of the wastewater flow generated by the municipality, so far. As a consequence, all the receiving waters in the urban area are hugely polluted by wastewater, not mentioning wet weather diffuse pollution, which is badly known due to the lack of a monitoring system.

As pointed out by Oliveira and Heller (2007), the cooperation agreement between the BH municipality and the service provider (COPASA) for the provision of drinking water and sanitation services shows non conformity with the municipal environmental sanitation policy regarding criteria of remuneration, investment commitments, tariff policy, citizen participation and social control issues.

Some relevant issues on urban water management, although present in the agenda of municipal policies, seem not to be currently receiving a significant attention. That is the case of issues such as climate change impact assessment on water resources and on flood risk, wet weather diffuse pollution impacts on receiving waters, sustainable water use and related questions.

Promoting integration among different urban policies and urban development issues is still a challenge. For instance, there is a lack of clear and sensible tools to facilitate the inclusion of water issues in the urban development decision-making process, resulting in decisions on land use and on road systems planning that may restrict alternatives on storm water management, on flood control, on creek management and so on.

Notwithstanding, the BH municipality counts now with institutions and a legal framework, such as the municipal policy on environmental sanitation and the COMUSA, and with some special programmes, like the DRENURBS programme, the sanitation municipal plan and the stormwater strategic planning process, that are potentially leading to a rapid change of the water management context. The DRENURBS programme in particular is a relevant example of integrating different urban policies (sanitation, pollution control, housing, road system, creation of green areas and leisure equipments, health, social inclusion) at the local sphere (urban catchments) that may be generalised, after some adaptations, to the whole municipal territory, in the coming future.

It is relevant to mention here that BH is one of the demonstrative cities of the Sixth EU Framework project SWITCH (Sustainable Water management Improves Tomorrow's Cities' Health), a consortium of 32 partners from 13 countries around the World. "SWITCH focus on the development and application of a coherent and consolidated, integrated urban water cycle approach which is forward looking and sustainability driven. In the SWITCH project, nine demonstrative cities (Accra, Alexandria, Beijing, Belo Horizonte, Birmingham, Hamburg, Lodz, Tel Aviv and Zaragoza), selected to reflect a

variety of climatic, income and water sector development conditions, play the role of supporting the scaled-up implementation of SWITCH research activities into real socially relevant demonstration activities delivered within a complex infrastructure and policy framework subject to a variety of stakeholder interests. Central to the SWITCH project is the adoption of the Learning Alliance concept, an association of stakeholders with a shared interest on the development and application of innovative approaches on urban water management” (Nascimento et al, 2007). This R&D participatory process is coherent with the BH Integrated Urban Water Management in Belo Horizonte, Brazil local government participatory experience, bringing innovations and enhancing the BH role in the scaling up and diffusion of its achievements in the IUWM domains.

The context of water management at the metropolitan level (BHMR) presents considerably more challenges when compared to the BH level. Many of the metropolitan municipalities show high population growth taxes at the same time as local governments lack finance, technical and institutional means to adequately face the impacts of this intense urbanisation process. But also in this domain, prospects may be considered positive since important legal and institutional developments are currently taking place with good perspectives for enhancing cooperation on urban planning, development and management at the BHMR sphere.

Concerning the integration of urban water management within the river basin scale, some legal particularities must be taken into account, as for instance the fact that, in the Brazilian law on water resources management, there is no definition of municipal domain for water bodies or the fact that land use regulation is a prerogative of the municipalities. The implication of these particularities is, for instance, that the concession of water use rights in the case of changes in hydrologic regime due to urbanisation or for regulating the use of receiving waters as final destination of runoff waters is only possible if the urban area is taken as a unique user, a unit of water consumption and wastewater production. It comes to the municipality to develop appropriate urban policies and to adopt managerial and regulatory measures within the urban area to comply with the concession requirements.

Charging for the use of water is applied only in a few river basins in Brazil and charges are still established at too low levels. Implications are that they are not high enough to influence the user decision on using water and that the amount of resources collected are low compared to the needs on investment and on the transaction costs to ensure the participatory process at the river basin.

Nevertheless, the water management system is still under construction, and the fact that the use of all its instruments in some river basins was made possible, that some conflicts on water use could be adequately solved, that river basin committees are contributing to a more effective and participatory water resources management, all these achievements have a very important demonstrative effect for a general adoption of the system.

## 7. References

Brito, S. (1944), *Urbanismo: a planta de Santos*. Saturnino de Brito – Obras Completas, volume 21, Imprensa Oficial, Rio de Janeiro.

Britto, A., Silva, R.T. (2006), Water management in the cities of Brazil: conflicts and new opportunities in regulation. In: *Urban water conflicts: an analysis of the origins and nature of water-related unrest and conflicts in the urban context*. UNESCO Working Series SC-2006/WS/19, Paris, p. 39-52.

Costa, G.M., Costa, H.S., Dias, J.D. Welter, M., (2008), The role of municipal councils in the construction of an integrated urban water policy in Belo Horizonte, Brazil In: 11th International Conference on Urban Drainage, Edinburgh, 2008 (in press: paper submitted to the conference)

Costa, H.S.M., Bontempo, V., Knauer, S., Nascimento, N.O., DRENURBS program: discussing the constitution of learning alliances within the Sanitation Policy of Belo Horizonte, Brazil, In: 12<sup>th</sup> International Conference on Integrated Diffuse Pollution Management, Thailand, 2008 (paper submitted)

Champs, J.R.B., Aroeira, R. and Nascimento, N. 2005. *Visão de Belo Horizonte*. In: BRASIL. *Gestão do território e manejo integrado das águas urbanas*, Ministério das Cidades, Brasília. *Integrated Urban Water Management in Belo Horizonte, Brazil*

Dias, J.D., Costa, H.S.M., Costa, G.M., Welter, M., Nunes, T., Bontempo, V., Knauer, S. (2007), Urban water management in Belo Horizonte: institutional mapping, In: 2nd SWITCH Scientific Meeting, Tel Aviv, 2007 (Accessible: [www.switchurbanwater.eu](http://www.switchurbanwater.eu)).

GGSAN (2004), *Plano Municipal de Saneamento de Belo Horizonte 2004/2007: Saneamento para todos*, Prefeitura de Belo Horizonte, 54 p.

GGSAN (2006), *Atualização do Plano Municipal de Saneamento de Belo Horizonte 2004/2007: Saneamento para todos*, Prefeitura de Belo Horizonte.

Milani, C.R.S. (2006), Le paradoxe du principe participatif dans la gestion publique local. In ; Eeuwen, D.V. (org.), *Le nouveau Brésil de Lula*, Éditions de l'Aube, La Tour d'Aigues, p. 213-238

Nascimento, N.O., Ellis, J.B., Baptista, M.B. and Deutsch, J.-C. (1999), Using detention basins: operational experience and lessons, *Urban Water*, v.1, 2000, p. 113-124.

Nascimento, N.O.;Heller, L., Ellis, J.B., Scholes, L., Revitt, M. Champs, J.R.. *Towards a paradigm SWITCH: Integrating urban water management in Belo Horizonte, Brazil*. In: 6<sup>th</sup> International conference on innovative technologies in urban drainage, NOVATECH, Lyon, 2007, v. 1, pp. 373-380.

Oliveira, A.P.B.V., Heller, L. (2007), Governance of water supply and sanitation in Belo Horizonte, Brazil: an assessment of the relationship between the municipality and the service provider, In: 2nd SWITCH Scientific Meeting, Tel Aviv, 2007 (Accessible: [www.switchurbanwater.eu](http://www.switchurbanwater.eu)).

PBH (2005). *Política Municipal de Habitação: avanços, dificuldades e propostas*. Prefeitura de Belo Horizonte.

Welter, M., Costa, H.S.M., Costa, G.M., Dias, J.D. (2008), O papel dos conselhos municipais na gestão das águas urbanas em Belo Horizonte: protagonistas ou coadjuvantes? In: *Seminário de Economia Mineira, Diamantina, 2008* (in press: paper submitted to the conference)

8. Figures and tables

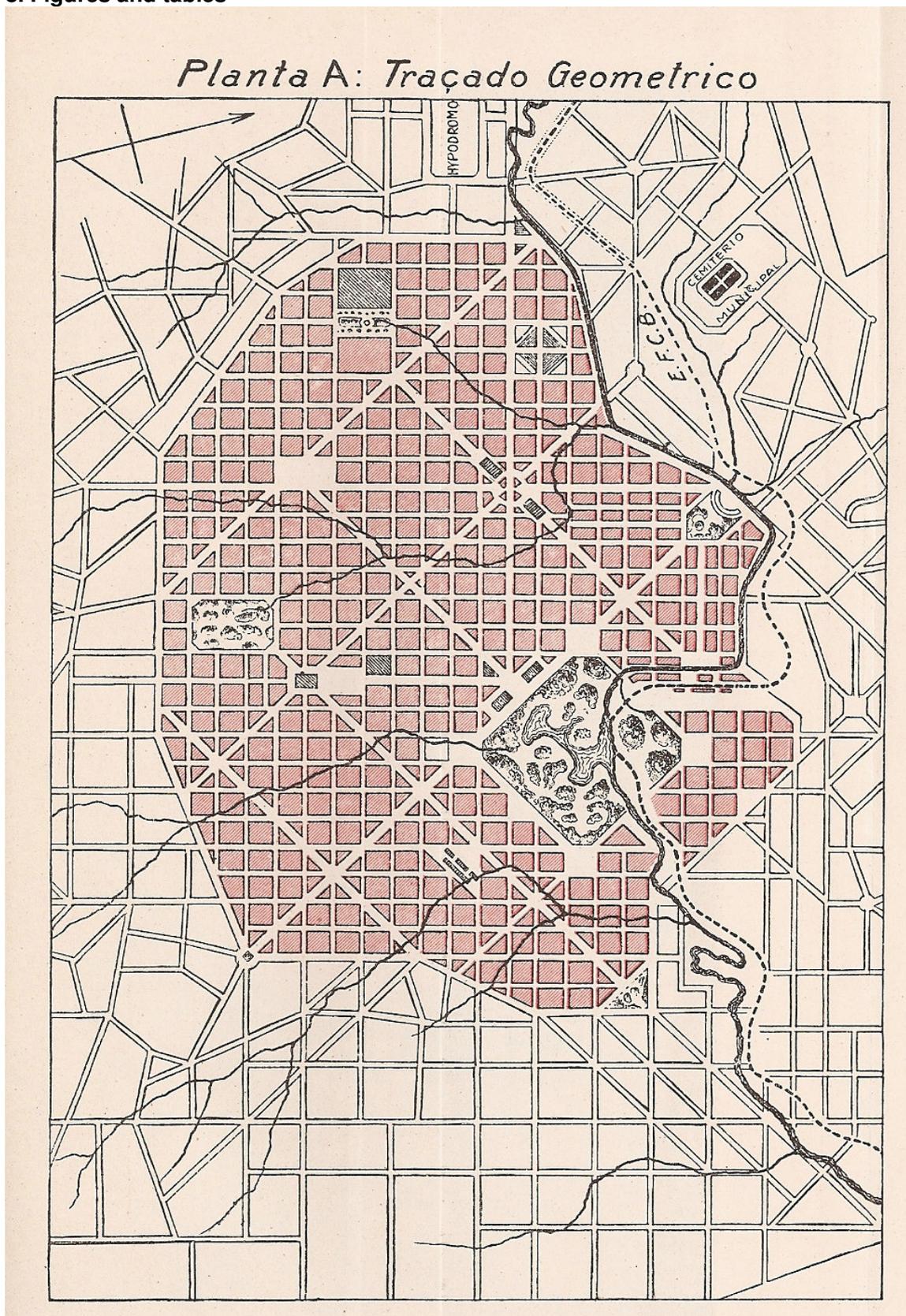


Figure 1. Belo Horizonte: map of the planned area (Brito, 1944)



Figure 2. Sediment and trash deposits: A) in a canal; B) in a detention basin

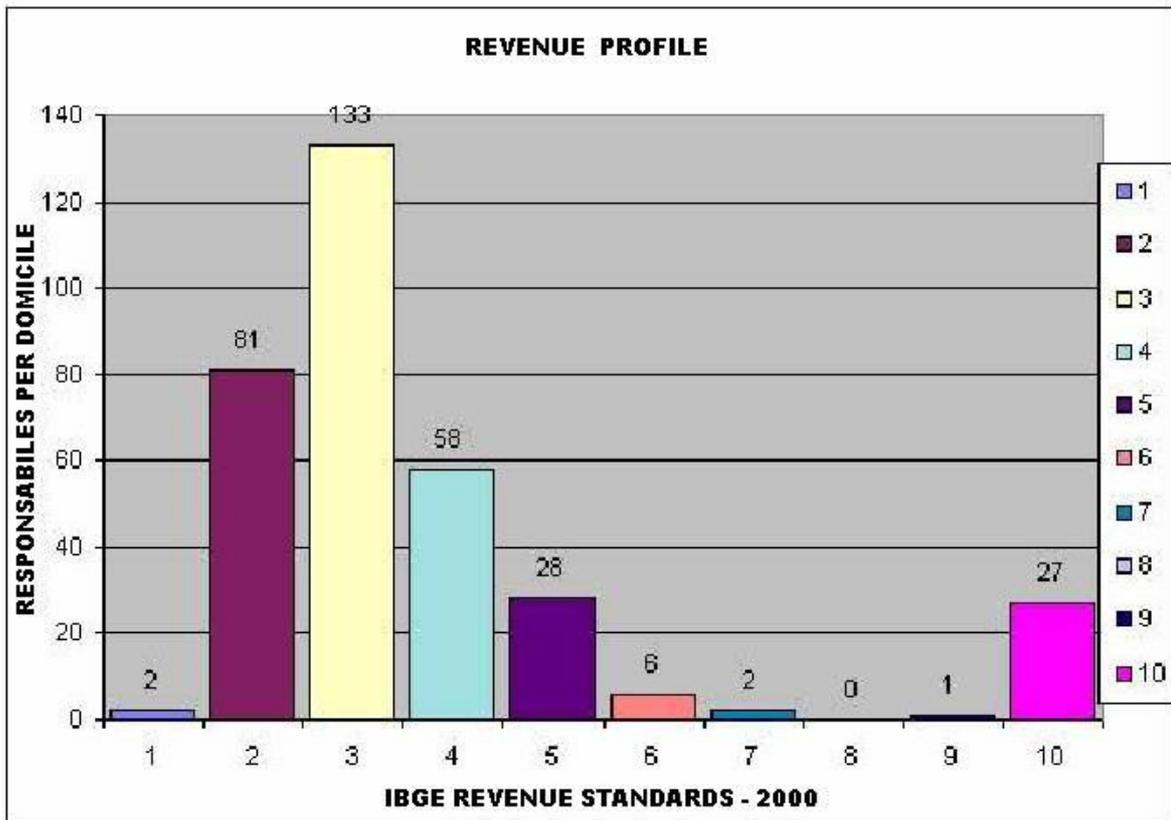


Figure 3. Revenue profile of families benefited by the participatory budgeting program (PBH, 2005)

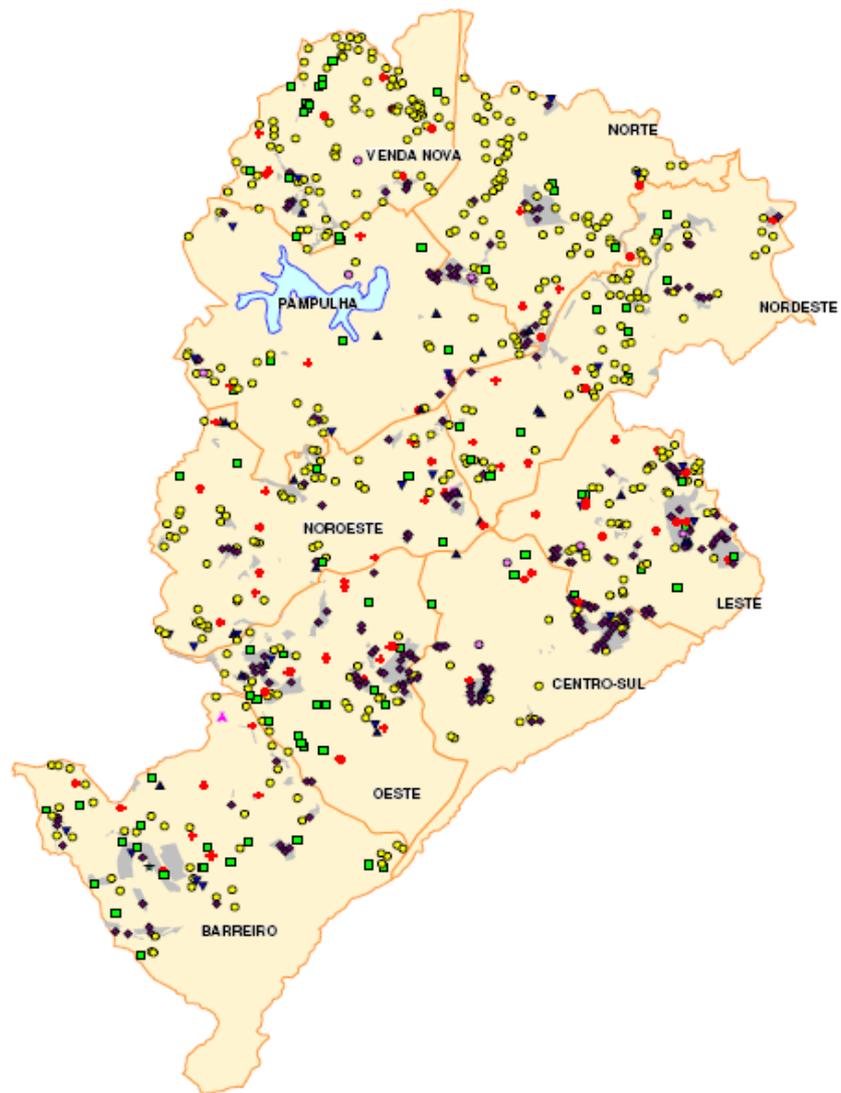
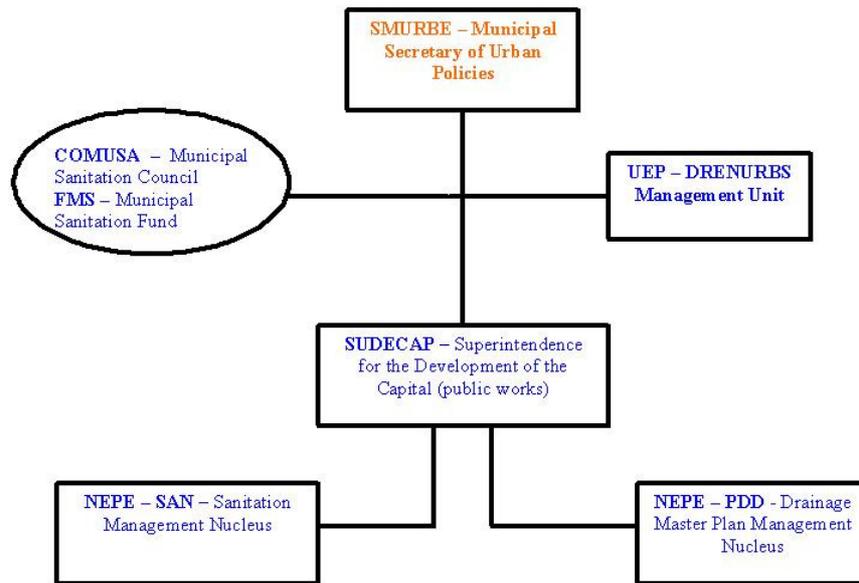


Figure 4. Participatory budgeting interventions in BH from 1993 until 2004 (PBH, 2005)

## Integrated Urban Water Management in Belo Horizonte, Brazil



### Urban Water Management

Figure 5. Urban water management in Belo Horizonte city (Dias et al, 2007)



Figure 6. DRENURBS 1º de Maio catchment: A) Green corridor; B) DRENURBS commission visiting the 1º de Maio catchment (with some SWITCH team researchers)

