



**HAL**  
open science

## Assessing social compliance for waste water management in urban areas of Belo Horizonte (Brazil)

Martin Seidl, Valdete Bontempo

### ► To cite this version:

Martin Seidl, Valdete Bontempo. Assessing social compliance for waste water management in urban areas of Belo Horizonte (Brazil). The Sanitation Challenge, 19 to 21 May 2008, Wageningen The Netherlands, May 2008, Wageningen, Netherlands. hal-03568873

**HAL Id: hal-03568873**

**<https://hal.science/hal-03568873>**

Submitted on 12 Feb 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## **Assessing social compliance for waste water management in urban areas of Belo Horizonte (Brazil)**

Martin SEIDL\*/\*\* and Valdete Bontempo\*\*\*

\* UFMG EHR, Universidade Federal de Minas Gerais, Av. do Contorno 842, 30110-060 - Belo Horizonte, MG, Brazil /

\*\* Université Paris-Est, Cereve ENPC, UMR-MA102 -AgroParisTech, 6-8 ave B.Pascal, F77455 Marne la Vallée cedex 2 France (E-mail: [martin.seidl@cereve.enpc.fr](mailto:martin.seidl@cereve.enpc.fr))

\*\*\* Prefeitura de Belo Horizonte, Sudacap, Av. Afonso Pena 4000, Belo Horizonte, Brazil

### **Abstract**

The object of our study is a hardly used flood detention pond of about 1 Ha crossed by two sewage contaminated creeks, situated within a low-income, urban area without parks or leisure equipments. This area should be revitalized by creating a multifunctional zone for flood detention, in-stream treatment waste water facility and leisure zone for the community. A part of the project was the evaluation of community compliance for the new infrastructure. The social mapping was done involving the network of Brazilian public health, helping to introduce a questionnaire to 1% of the households within 1 kilometre distance of the future wetland. The use of gender oriented questionnaires, combined with GIS can reveal some interesting aspects.

The inhabitants see as main problem of their living area the unsafety and consequently they desire a safe community space with good management in the area to be revitalized. The majority is keen to participate in the management through environmental education and community organization. Though the global tendency is the same for young and adults and for men and women, some significative differences between these groups exist. In general, children and women are, more cooperative than men.

### **Keywords**

Urban, drainage, waste water, creek, detention pond, environmental perception, revitalization, restoration, management, community participation, gender, indicator, social engineering, social impact assessment,

## **INTRODUCTION**

Brazil is known for its innovative approaches in the field of urban management. As example we can mention the participatory budget in the cities like Porto Alegre and Belo Horizonte or the condominal sewage in the city of Brasilia. Many experiences show that urban equipments not only should be accepted by the local government, but far more by the local population to function and to serve properly for long period. In the case of Belo Horizonte, a new social approach is used by the municipal company for urban development to secure and to restore urban water streams in defavorized peri-urban areas. This program called Drenurbs places the infrastructure works in the light of social acceptance and better environmental perception. Each project of rehabilitation starts with environmental and social mapping before the works, usually including displacement of habitants in risk situation, principally urban flooding and land sliding. During the works, the community is prepared for the displacement and learned how to care the (new) environment. After the completion of the works and community capacitating, a second social mapping is done to evaluate the community preparedness for the new situation.

In the past decades, the systems for the treatment of urban waste water flow; were created as a system of collectors within the urban area and a treatment outside of it. These systems not only

need a major part of investment for the system of collection, but impact greatly the communities and the ecosystem downstream of the urbanized area. Nowadays these problems led in the industrialized countries to decentralization of treatment and creation of small units upstream to preserve the living environment downstream. This approach is not only valid for the flux of pollutants but is moreover valid for the hydraulic loads during wet weather events. Within the European project Switch, the municipality of Belo Horizonte (PBH), together with the Federal University of Minas Gerais (UFMG), decided to implement a small scale plant treating and regulating the flux of pollutants upstream in an urbanized watershed. The treatment facility of Vilarinho should be an artificial wetland regulating the flux of pollutants during dry and the flow during wet weather. The presence of high density of population imposes a multifunctional use of space, combining flood control, wastewater treatment and creation of recreational area. The difficulty of the project is not only the need of multifunctional space, but also the presence of shanty towns upstream, accompanied by an important flux of solid waste and insecurity, creating an additional challenge for the construction and management of the future facility (Seidl et al 2008). The best way to achieve these goals is community based participative approaches as mentioned above. To measure the community compliance existing methodology was adapted and new social indicators were developed.

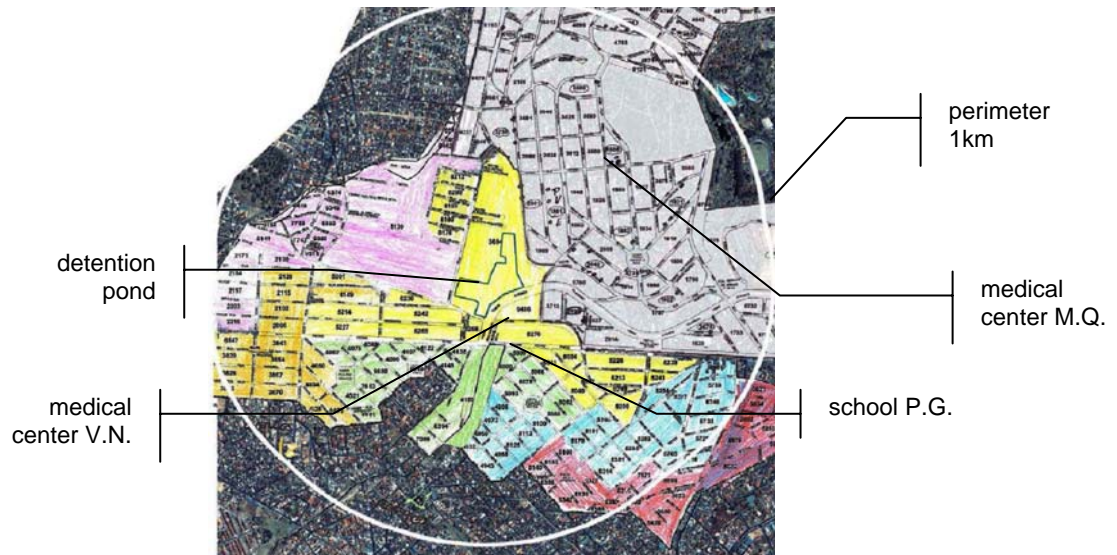
## **Objectives**

The experience of the Belo Horizonte local authorities in the past showed the necessity of approval of infrastructural works within the community to guarantee a functioning over long period. Within the Switch program these experience led to implementation of a social assessment before the construction of the artificial wetland. The main objective of this study was to evaluate the environmental perception of the actual zone and the proposition for the future wetland adapting the approach of Drenurbs (PBH 2005) describe above. The secondary objective was to map the geographical and gender differences.

## **METHODOLOGY**

### **Study area**

The object of the study is a hardly used flood detention pond of about 1 Ha crossed by two sewage contaminated creeks (Seidl et al 2008), situated within a low income urban area without parks or leisure equipments. This area should be revitalized by creating a landscape zone for community use combined with an in-stream treatment facility for one of the creeks. The working hypothesis used was that the perception of an object (the detention pond) should be related to the distance from the object (distance between the living area and the the detention pond). For this purpose a sector was selected within 15 minutes of walk of the future wetland, equal to an ovoid of 1 kilometer radius.



**Figure 1: Satellite photo of the study area. The sampled area is delimited by the white circle (1 km perimeter) and by the blocks superposed on the photo. Each colored block represents one team of ACS or about 750 households.**

### Data collection and treatment

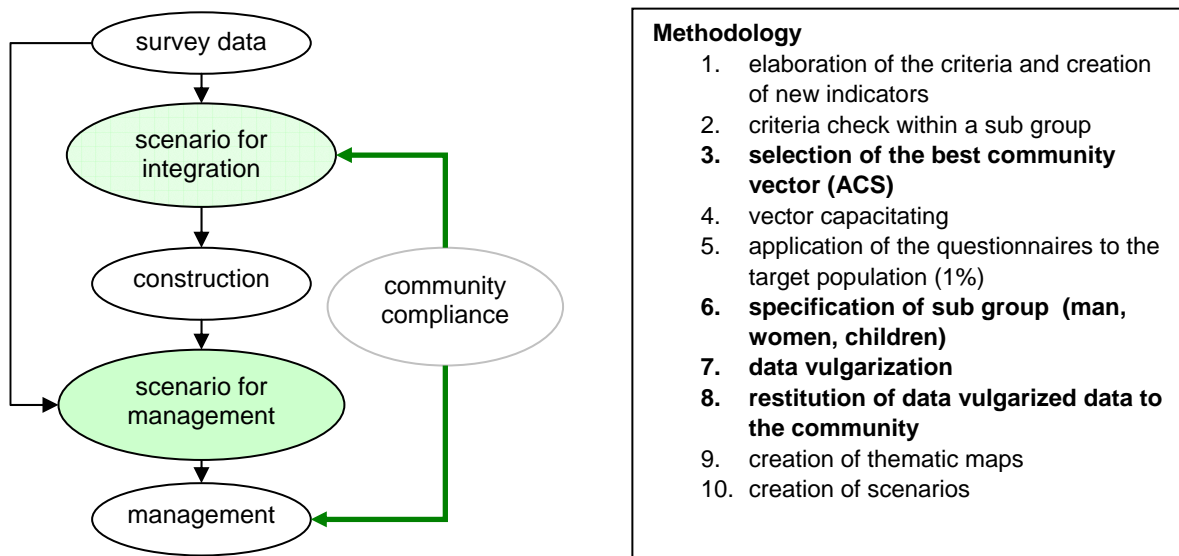
The social mapping of our study was done using the network of Brazilian public health care SUS (Sistema Único de Saúde). The regional network in Belo Horizonte is divided in districts, each serving several tenths of thousands of habitants and equipped with a free public medical center. Each center is subdivided in sectors of few thousand habitants surveyed by a team of community health agents ACS (Agente Comunitario de Saúde), doctors and technicians for disease vector control. The task of each ACS is to promote the health within the population and to take care after about 250 families (Gusmão et al., 2003, Azevedo et al 2002 Ferraz et al., 2004). The ACS's were elected for the data collection for their familiarity with the area and community, making it possible to access all sectors even under difficult social circumstances like, extreme poverty, use of drugs and presence of organized criminality. The absence of additional costs for the data collection was an additional advantage.

Two medical centres were selected to cover the area of investigation. About 50 ACS were capacitated about the objectives of the research and trained for data collection. During two weeks (June 2007), a team composed of ACS and students worked the whole area, sub-sector after sub-sector. The data were collected from 9 AM to 5 PM on working days, choosing aselectly one to two household within a block. A block is defined as the smallest rectangle or polygon of constructed housing without any public road inside. The sampled households correspond to 1% of the households present within the research area.

Within the selected household the questionnaire were applied simultaneously to the household representative and one adult of opposite sex. The usual duration of data collection within a household was about 45 minutes. Due to the absence of children during the day, a simplified questionnaire were applied to about 100 children between 10 and 18 years of the school, situated the nearest to the detention pond. The application was done in 3 classes of different ages in the form of an open environmental course.

The questionnaire of 55 questions was divides in five parts i) identification of habitants, ii) general environmental knowledge and perception of urban waters, iii) satisfaction with sanitation services, iv) public health related to water born diseases and v) community

compliance with the future wetland / landscape zone. The simplified questionnaire (40 questions) for the children does not contain the household identification and question about satisfaction with public services.



**Figure 2: The overall scheme of the used methodology**

The output of the questionnaire was used in different form, straight in percentage as simple histograms, transformed in indicator and combined with GIS in the form of thematic maps. More than 90% of the visited households were indexed in the GIS of the local government or that of the Brazilian institute of geography and statistics (IBGE). About 10% of households, often informal livings, could not be referenced within the SIG and will be corrected manually in the field in the future.

The indicators were created by grouping thematically several questions. For each question the answer was discretized and transformed in a numerical value varying from 1 to 10 according to the most negative (1) and the most positive (10) perception (Seidl et al 2007). The indicator is calculated as a simple sum of the numerical values of each question included.

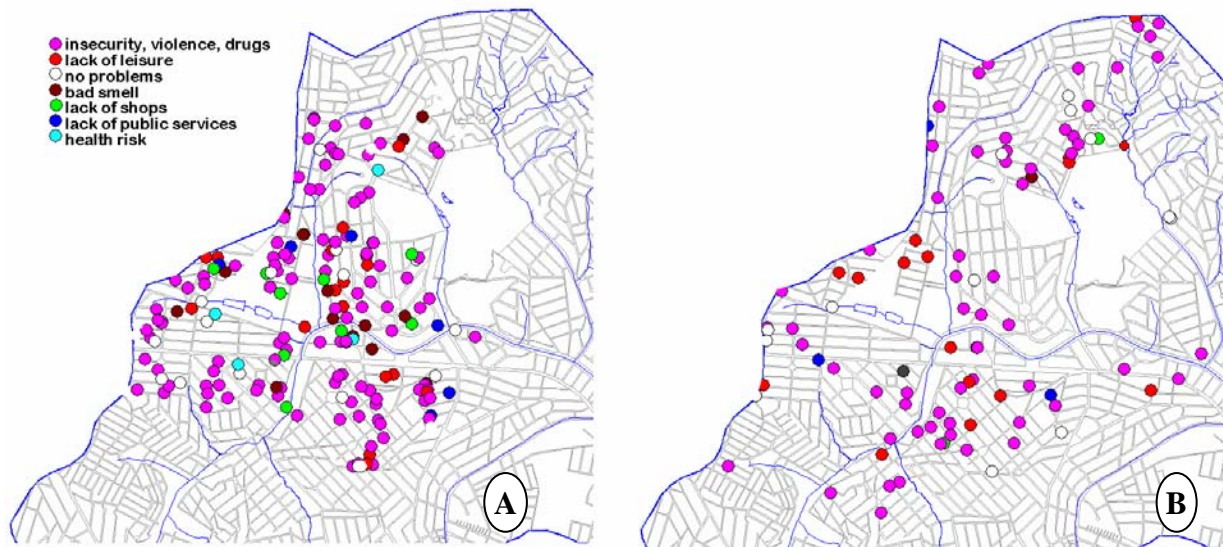
## **RESULTS AND DISCUSSION**

### **Perception of living environment**

The objective of the social survey was double. On one side to see what is the perception of the habitants of urban waters and what the inhabitants would like to have in the area of the detention pond and how their would like to manage this area.

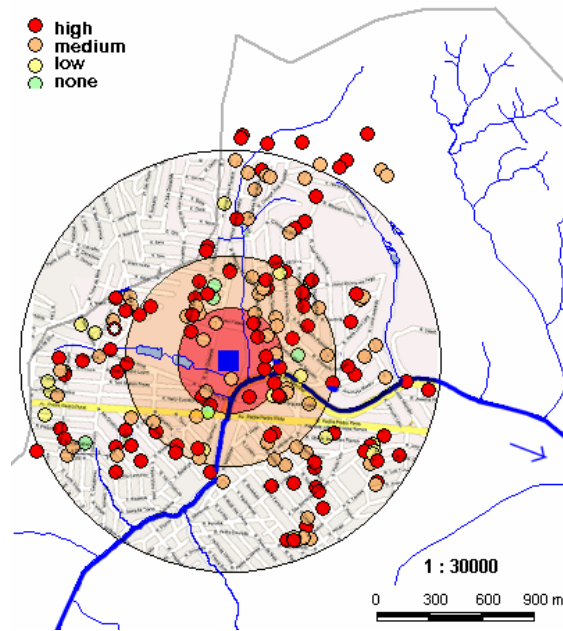
Before construction of any urban equipment it's important to look who the habitants are and how they think about their living environment, to know how they will accept a new urban equipment. More than 75% of the persons are living in the neighborhood for more than 10 years. The households visited have at mean 4.5 members living in 2.7 rooms. Less than 25 % has finished the secondary school and almost 50% earn less than 6 USD /day. About 25% of the family heads are women. The mentioned unemployment is 22% and 30% of the children mention to participate in some kind of economic activity. The teachers mention one violent death under the age of 25 a week, results which seems to be confirmed by the questionnaire. The adults, as well the children, indicate in the first place as the most important problem of the

living area the insecurity (60%), followed by the lack of leisure facilities (10 – 20 %). Nevertheless no geographical dependency could be identified nor for adults (figure 3 A) nor for the children (figure 3 B).



**Figure 3 A, B: Spatial distribution of the questionnaires and the problems of the living environment in the study area: A: adults, B: children. Scale 1: 30 000. The water courses and the limit of the watershed are visible as blue lines.**

Another interesting data is the perception of urban water waters. The living distance to an urban water body (creek) does not have an impact on its perception. The majority (74%) prefer the creeks hidden and closed. The rest accept them visible, open, canalized or not. A possible explication might be partial information and the urban politics of the local authorities in the past. Contrary to the movement of the civil society in Northern Europe and North America for revitalization and re-appropriation of urban waters (MANN 1998), in Belo Horizonte this movement is just coming up and only a few voices demand revitalization of the creeks, canalized some years ago. The local government (PBH) have actually a contradictory politics referring to the urban creeks. The creek Vilarinho (thick blue line in the figure 4) has been recently covered and transformed to pedestrian zone. The upper stream of the creek Quaresma has been closed a month ago. On the other hand a lot of work is actually done in other zones to consolidate and revitalize urban creeks in shanty towns. The project Drenurbs (IADB, 2004) might be even one of the biggest in Latin America. The inhabitants of the study are experiencing new green area instead of bad smell and bad water quality. More over they are constantly informed that open water is equal to health risk due to dengue and malaria and don't have access to information about other possibilities of urban management. The consequence is a perception of higher risk of contamination with environmental diseases close to detention pond and the preference to keep the urban creeks shut. The risk perception might be stronger, closer the habitant lives to the impacted area. If we look at the perception of the detention pond, we can see that in the adjacent zone of the pond (within the perimeter of 300 meters from the centre of the area) a significantly higher risk for disease contamination is perceived (63% ) than further from the centre (51%). These results have to be confirmed with a slightly larger buffer, preferentially polygonal to respect the form of the detention pond.

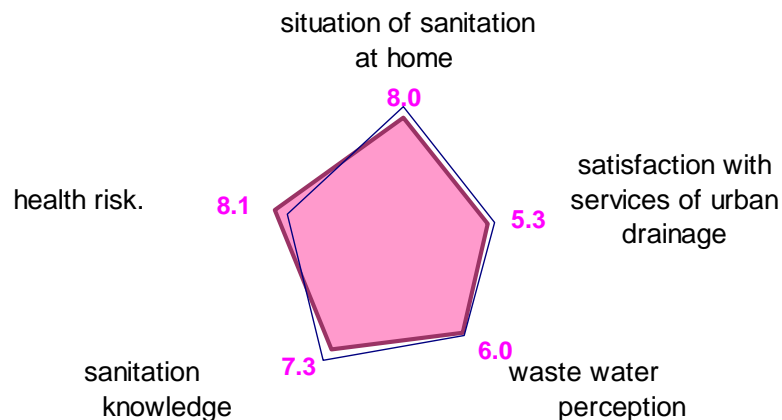


risk of disease	n	high	medium	low	none
living within 300 m of the d. pond	27	<u>63%</u>	26%	11%	0%
living between 300 and 600 m	80	50%	34%	9%	8%

**Figure 4: Thematic maps for the perception of the living environment. A: perception of the health risk as function of the distance to the detention pond. Scale 1: 30 000**

The perception of the living condition can be the best resumed with a simple indicator (Figure 5). The indicator transforms a question with multiple replies to one numerical answer, high score for positive appreciation and low score for negative appreciation, taking into account on additive and equal basis, all opinions. There was slight difference between men (7.2) and women (6.9), women being less satisfied. This difference disappears if we take only the chiefs of households (62 men and 64 women). The indicator confirms a high health risk perception, reveals relative un-satisfaction with the urban drainage and an almost negative perception of waste waters.

**Figure 5: Indicator for perception of urban waters. The solid surface give the perception of the women (n=195) and the simple line represents the men (n=90). The numbers represents the score for women with the maximum positive score of 10. For example the score of 5.3 \10 for drainage resumes 10 % of very satisfied, 60% of satisfied, 18% with limited satisfaction and 12% unsatisfied.**



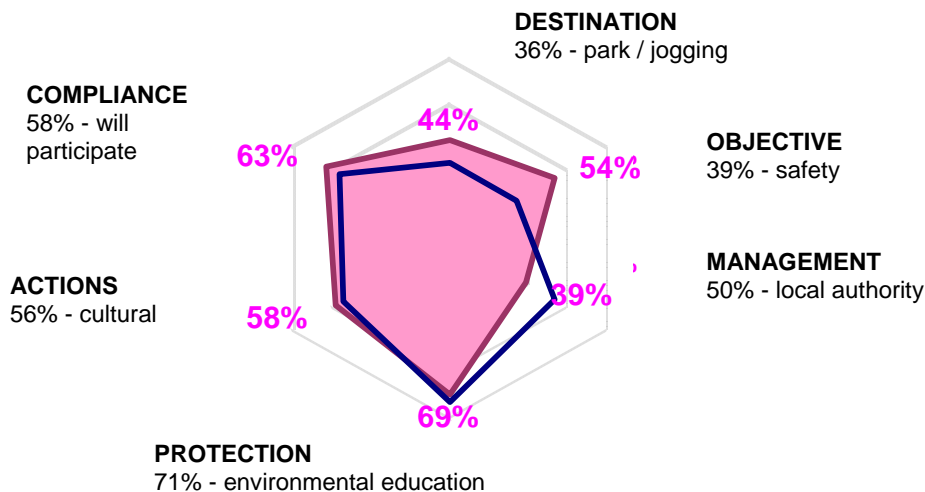
## Compliance

To imagine and decide a scenario for the future space and its management a lot of different information is needed:

- the destination for the future area
- the aspects of the management
- the structure to manage the area
- the actions to be held within the community
- the willingness of the community to participate in the management

This information can be resumed in a radial diagram, with the difference to that of indicator, that the answers could not be transformed numerically as there does not exist any scale of values for personal preferences. In the graph we put a special attention to the difference between men and women. Women are as twice as frequent in the households during the day and will use probably for this reason more the future infrastructure.

**Figure 6: Preferences of the adult habitants for the destination and management of the future area. The solid surface give the perception of the women (n=195) and the simple line represents the men (n=90). The numbers in red represents the percentage for women. The small numbers in black are weighted percentages for an equilibrated population.**

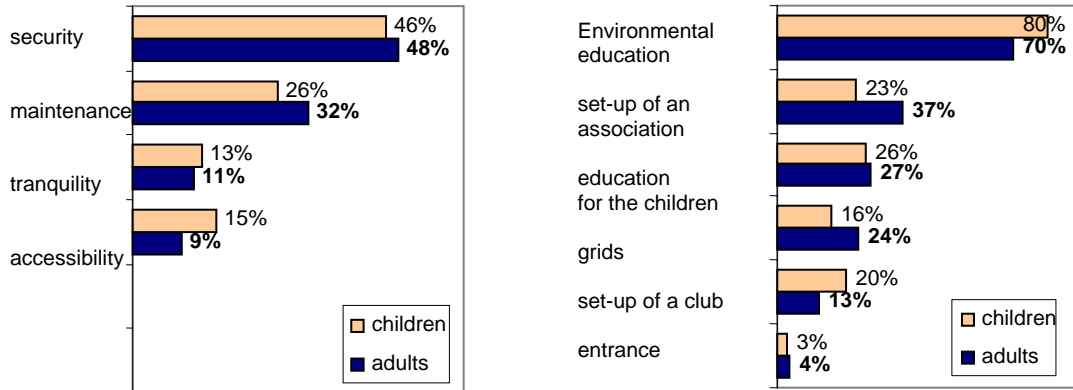


If we look at the destination of the future space the desire, of young as well of adult, is a safe community space for leisure with good maintenance. The children, as the adults have chosen for a square in the first place. Nevertheless if we put together “space for walking” and “park” the latter would be preferred. The men have tendency to prefer “square” rather than “park”. The men judge also the maintenance more important than safety, contrary to women. A third difference is the preference of women for community organization contrary to men which trust more the local government. Finally everybody think that the best manner to contribute to the management and protection of the future area is more and better environmental education, the children give slightly more importance to this item than adults. Respectively 80% of the children and 70% of adults have mentioned this item, most of them in the first place. The second most frequently mentioned item was the set-up of an association of inhabitants, significantly more mentioned by the adults (37%) than by the children. The difference between adults and children (figure 7) is due to their socio-professional environment, putting more accent whether on education or on professional organisation. The desire is clearly an



open and accessible area for all as the physical and financial means to restrict access are disapproved.

**Figure 6 A,B : Commitment to the management of the future urban space.**



6A: Number one priority for the new urban space (one answer possible).

6B: Factors which contribute the most to protect and secure the new urban area (several answers are possible).

Another point of difference between men and between women, as well for the young and the adult, is the willingness to participate in a community action concerning the new space. On one hand the children are more enthusiastic and more willing to participate than adults. On the other hand the women, young as well adult, are significantly ( $\geq 10\%$ ) more willing to collaborate than the men.

## CONCLUSIONS

The above results show that a low income community, living in a periphery of an extended urban area, with relatively good sanitation services, but with lack of public security, choose for safe community space if the occasion is given. This occasion is in our case the revitalization of a detention pond. Despite the mediocre living environment perception, the inhabitants are keen to (re)appropriate the new urban space by means of community action and environmental education. There might be significant difference in opinion as function of geographical location of habitat, the age or the sex of the habitants involved. The local authorities should take into account these aspects and put accent on the educational function of the future wetland, its accessibility to scholar public and give an important role in the management to the women and the local health community agents.

## ACKNOWLEDGEMENT

The study was made possible through financial support of Brazilian Counsel of Technological and Scientific Development (CNPq), the foundation H2o France and Prefeitura Belo Horizonte through the Switch program. The authors are specially greatfull all cumunity agents of Venda Nova and Mantiquera and Kamel and Fabienne for their precious help with data collection and treatment.

## LIST OF REFERENCES

- AZEVEDO , Joana da Silva Ana Sílvia Whitaker Dalmaso (2002) Community health agent and his attributions: challenges facing the training process of human health resources *Interface - Comunic, Saúde, Educ*, v6, n10, p.75-94, fev 2002
- EKOS (1998) The use of social indicators as evaluation instruments - Final Report - August 1998 Human Resources and Social Development Canada (HRSDC) Government of Canada. 54p.
- FERRAZ L e AERTS DRGC (2005) O cotidiano de trabalho do agente comunitário de saúde no PSF em Porto Alegre, *Ciência e saúde coletiva* 10 (2), pp.347-355.
- GUSMÃO O, ABRÃO N e LOPES F (2003) O trabalho do agente comunitário de saúde na percepção da comunidade de Anastácio, Estado do Mato Grosso do Sul , *Acta Scientiarum. Health Sciences Maringá*, v. 25, no. 1, pp. 95-101.
- IADB (2004) Brazil Belo Horizonte environmental restoration program (BR-0397) Inter-American Development Bank 55p.
- IBGE (2006) Síntese de indicadores sociais 2002, Estudos e Pesquisas, Informação Demográfica e Socioeconômica, número 19. Ministério do Planejamento, Orçamento e Gestão, Instituto Brasileiro de Geografia e Estatística
- MANN Roy B. (1988). Ten trends in the continuing renaissance of urban waterfronts. *Landscape and Urban Planning Volume* 16, Issues 1-2, October 1988, Pages 177-199 doi:10.1016/0169-2046(88)90042-4
- PBH (2004) Plano Municipal de Saneamento de Belo Horizonte 2004/2007 "Saneamento para Todos" Textos *Prefeitura de Belo Horizonte*, MG, Brasil Maio/2004 192p
- PBH (2005) Drenagem urbana saneamento e educação ambiental 50p. *Prefeitura de Belo Horizonte*
- SEIDL Martin, Fabienne Perucca, Kamel Bouhmad, Sonia Knauer, Valdete Bontempo & Nilo De Oliveira Nascimento. (2007) Social compliance in waste water treatment in urban areas of Belo Horizonte.- Methodological contribution *Conferencia internacional Latinosan 2007, de 12 a 16 de Novembro 2007, Cali Colômbia*.
- SEIDL Martin, Paulo Castro, Nilo Nascimento and Marcos Von Sperling (2008) Instream treatment facility for creek revitalization, Belo Horizonte (Brazil) – setup and pollutant load. *11th International Conference on Urban Drainage ICUD, Edinburgh, Scotland, UK, 2008*