Brazilian Regulatory Process: including groundwater in urban water management

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Abstract

Cities have a crucial role in groundwater management. The urban pressure tends to cause great impacts on aquifers. This work is a legal study and aims to verify how Brazilian law about water and urban policies promote better integration of groundwater into urban management processes. The methodology used was a qualitative analysis of environment and urban legislation in São Paulo state, Brazil and urban planning legislation edited by municipalities located in the Guarani aquifer recharge area. The lack of a specific national policy which guides state and local actions is a major problem, especially considering that aquifers trespass the local scale. The state policies most of the time are insufficient and have problems in implementation. Without a regulatory model, local policies rely only on public administration's will which tend to be very susceptible to economic pressure. Despite this, watershed-based management tools starts to bring some guidance to urban director plans.

Keywords

Management; decision support systems; sustainable development; geopolitics; social conflicts

INTRODUCTION

The urban development has caused an intense and profound environment manipulation. Population concentration in the Brazilian urban areas, social exclusion and spatial segregation that are characteristics of urban industrial societies, combined with the public administration limitation regarding the urban planning and control of the land occupation have created a chaotic urbanization process. This generates the progressive environmental degradation of the cities and threats the population quality of life.

This fast and unplanned growing of cities make hydric resources be exposed to great pressures which may compromise the public water supply functioning in the long term. The negative effects of the land use can be easily seen in the superficial water resources. As for groundwater the harm perception is much more complex. It depends on the administration will to establish monitoring programs and to reveal data. Thus social mobilization for groundwater protection is considerably inferior to the superficial one.

The municipal role is vital to the groundwater protection, especially to the aquifers' most vulnerable areas. The watershed is the spatial unit used to delineate the water management. The water extraction control depends on state or national authorization. On the other hand, soil management is a constitutional municipality's competence. However, it is not possible to work

on groundwater protection without taking soil regulation measures. Unfortunately the Hydric Resources National Policy presents limitations to include them in the water management system.

After the release of the Federal law n° 10.257/2001, entitled The City Status, the municipalities had to include the environmental aspect in urban planning. The city layout should be based on urban laws and environmental legislation. Thereby, it is important to check if the environmental legislation provides guidelines to municipalities so that they can include groundwater protection within their urban land rules. The main objective of this paper is to verify how Brazilian laws regarding water and urban policies promote better integration of groundwater into urban management processes.

According to the Basic Sanitation National Research, 62 % of the 8.656 districts that own water supply infrastructure use groundwater as their main source (IBGE, 2000a). This resource is also consistent in the other 1.192 districts with no water supply systems given that it is the first water source alternative in 47% of these regions (IBGE, 2000b). The groundwater intense use and its importance in the ecosystem maintenance, combined with the growing contamination risk and the soil sealing process justify the necessity to look for new ways of integrated water resources and soil management even though with all the conflicts related to this duty.

MATERIAL & METHODS

This is a descriptive study of the laws related to groundwater protection and its qualitative analysis trying to establish how water legislation articulates with the urban planning rules. The study was based on environment and urban legislation of Brazil, São Paulo state and urban planning legislation edited by municipalities located in the Guarani aquifer recharge area of São Paulo state.

This work is a juridical study of the legislation related to groundwater protection in an urban context. The choice for this type of analysis is motivated by the importance of law as an instrument capable of influencing the production of urban space. The legislation study main focus is on the quality aspect of groundwater in which municipalities regulation have a direct impact. Although overexploitation has quality impacts on groundwater, extraction controlling rules will not be approached given that they are Union and state member's competence only. Groundwater quality protection rules may impose restrictions in land use. Thus, these rules can have an impact on the urbanism law and consequently on the property right. This characteristic can create serious conflicts, especially in the urban context where land is a rare and expensive resource.

The research uses public administration documents and the existing bibliography about water management. Besides, the Federal and São Paulo state legislations were consulted about the theme. Regarding urbanism law, the urban plans from the Guarani Aquifer recharge area municipalities were analyzed, especially from Ribeirão Preto, São Paulo (figure 1). The laws examined were: National Hydric Resources Policy (Federal law nº 9.433/97), National Hydric Resources Council resolutions, São Paulo State Hydric Resources Policy (Law nº 7.663/91), specific state laws about groundwater (Law nº 6.134/88 and State Decree nº 32.955/91), São Paulo State Hydric Resources Council resolutions and São Paulo state Water Spring Protection Policy (Law nº 10.257/01). The National Environmental Policy (Federal Law n° 6.938/81), the

City Statute (Federal law n° 10.257/91) and Environment National Council resolutions (resolutions n° 357/2005 and n° 396/2008) were also considered.

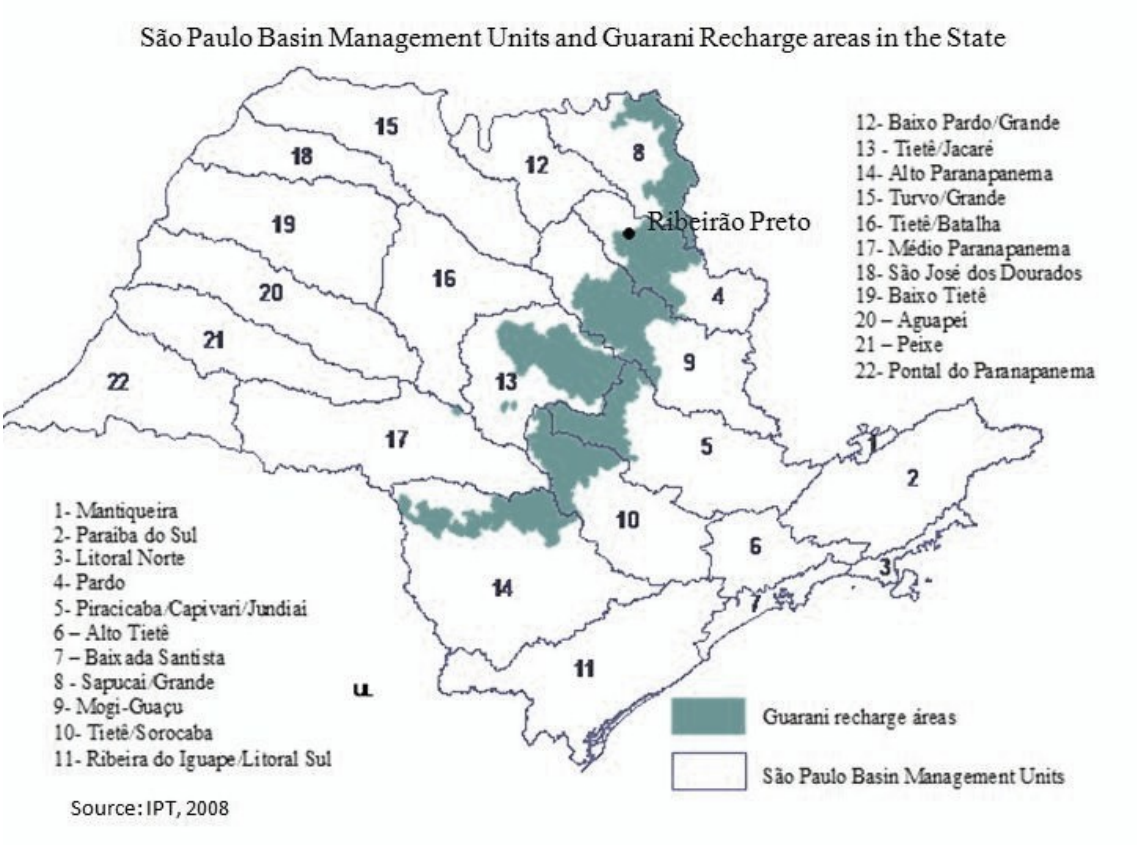

Figure 1: São Paulo Basin Management Units and Guarani Recharge areas in the State.

Moreover, central stakeholders involved with the water and soil management were interviewed such as: Executive, Legislative and Judicial power representatives, state and municipalities technicians and community leaders from the State of Sao Paulo and the city of Ribeirão Preto. The interviews were semi-structured and the main objective consisted into knowing the groundwater management practices.

RESULTS AND DISCUSSION

The National Policy for Hydric Resources (Federal Law 9.433/97) represented a great move in water management. This law introduced a new concept of water management based on decentralized, participative and integrated model which choose the watershed as its territorial base. In order to build articulated action between Union, state members and municipalities, this law created the National Water Management System, known by the acronym SINGREH (figure 2). This system counts with collegiate structures that minimize the centralist government character of water management and allows social and private actors participation.

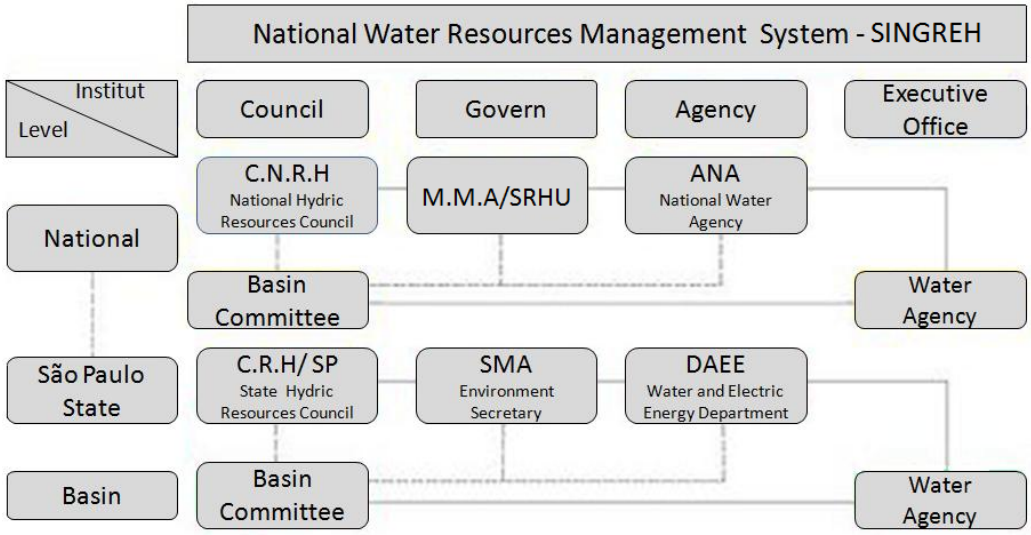

Figure 2: National Water Resources Management System – SINGREH

The SINGREH is composed in the Federal level by: the Environmental Ministry represented by the Hydric Resources and Urban Environment Secretary (SRHU), the National Water Agency (ANA) and the Hydric Resources National Council (CNRH) (figure 2). At the State level, the SINGREH is formed by the state secretaries responsible for water management, hydric resources state council and technical organisms. Moreover, the Union, state and municipalities public organs related to water issues are parts of the system. The base of the system is the basin committee and the water agencies. This policy also foreseen series of instruments to promote a better administration of water: watershed plans, the water body classification, the hydric resources information system, water pricing, water permissions and licenses. With certainty all these innovations have a positive impact in groundwater management.

Watershed plans and the water body classification are the main instruments created to articulate water and territorial management (PORTO, 2008). The water body classification determines the maximum pollution quota that can be released in an area according to the aquifer classification. Initially, this instrument was limited to superficial water (Environment National Council resolution 357/2005). Only 3 years later, it was extended to groundwater (resolution nº 396/2008). This instrument provides general directives for the water agency which will propose to the basin committee the aquifer classification according to its characteristics and main uses. This instrument applicability still depends on committee regulation which must define the classification of the aquifers located in the basin respecting the terms of resolution 396/2008.

The watershed plans are defined as guiding plans which intend to orient the implementation of the Hydric Resources National Policy and the water resources management (Federal law 9.433/97, article 6º). This instrument should provide a social, economic and environmental diagnosis of the basin. Regarding groundwater, they must evaluate its contribution in the hydric balance, characterize aquifers, estimate the water recharge and discharge, calculate the exploitable water reserves and verify the physical, chemical and biological characterization of water. Besides, plans should determine the protection and conservation measures to be adopted in groundwater management, which may include areas with restriction of use.

The territorial base, in which those instruments are applied, is the watershed basin whose extension goes past the municipality limits. The watershed approach has as its premise that many water quality and ecosystem problems are best solved at the watershed level rather than at the individual water body or discharger level. This new management unit is based on geographical aspects and not in the administrative divisions. Although this new form to manage water resources gave a wider view of space conditions and permits designing more adjusted public policies, it presents difficulties to be internalized in municipal urban plans.

Another issue is that the watershed does not match with the hydrogeological basin. Aquifers usually trespass the watershed and may have recharge and discharge zones that belong to more than one watershed basin. This characteristic contributes to create conflicts. Most of the times the recharge area is located in a watershed which is not the same one where the discharge or resource use occurs. How does the basin water user will influence the other basin that is a recharge area, especially if it doesn't use the groundwater? Restrictions and/or prohibitions on land-use activities for permeability maintenance or prevent contamination will have a positive impact on water availability and quality in the user basin. However, it can also have negative economic impacts on municipalities located in the most vulnerable aquifers areas. Defining an action plan for this kind of situation will require a higher grade of articulation between Union, state member and municipalities that share the groundwater resources.

Until now, there is not a federal policy that establishes specific guidelines to groundwater protection. Therefore, protection legislations were performed almost exclusively by State members with requirements and implementation levels completely different. According to the Brazilian Constitution, aquifers belong to state members, even though they trespass state limits. Only São Paulo, Pernambuco, Ceará, Goiás, Minas Gerais and Mato Grosso have specific laws dealing with groundwater. Other states have tried to integrated groundwater measures in the Water state policies like Paraná and Piauí. Although these efforts are positive, they have a series of juridical, institutional and technical limitations (MMA, 2001).

The Hydric Resources National Policies and the resolutions edited by the Hydric Resources National Council delegate to the Integrated Hydric Resources Management System the role of guiding the municipalities in the promotion of groundwater management in their territory according to the watershed plans. The watershed plans face the challenge of harmonizing actions of several agents and try to integrate numerous administrative organs, as well as private sectors. These plans are responsible for state aquifer protection measures which can include restriction on the soil use, but these statements are bound to the municipalities. In this sense what is the juridical nature of this instrument?

In fact the watershed plan promotes a kind of territorial zoning but it can not be inferred that it has a legal binding effect on the municipalities. The analysis of Hydric Resources National Policy and Hydric Resources National Council resolutions do not allow this conclusion. The spirit of these norms is based on a negotiated management and cooperation between sectors, which recognize that municipalities are responsible for soil planning. Water management organs should engage and incentive municipalities to take the measures established in these plans.

The SINGREH organs do not have legal power to compel actions foreseen in the water plans. They also can not impose penalties to municipalities that ignore the recommendations to improve water management. The watershed plans present a collective effort to define goals and build a consensus about the desired scenery considering the economic, social and environmental viability (PORTO, 2008). They have a technical and political nature, but not juridical. These

plans do not constitute a command and control instrument capable of creating legally binding obligations to municipalities in the use of soil, unless these recommendations are formally included in the state or municipality legislation.

The City Status sets up that the municipality must incorporate environmental issues into the development of the social function of the city and urban propriety. It is undeniable that watershed plans are important references to underlie and guide municipalities' environmental policies, especially in water management issues. This attempt to include environmental issues within the urban law produces new conflicts between economical, social and environmental interests (SCHUSSEL, 2007). Groundwater protection reaches not only water users but also soil users. Controlling water extraction or restricting the soil use can harm interests from economical influential sectors which are not willing to have their market liberty limited by more strict environmental laws.

It is impossible to consider the aquifers management without taking into account the integration between water and soil. These resources matter to all collectivity since they represent the two main political natural resources. Production takes place in a territorial base defined by property rights which express a traditional relation of power. On the other hand, water is an indispensable input for economic production (RAFFESTIN, 1993). Although it has a public nature in most of the legal systems, water appropriation for productive sectors occurs in a private manner.

Conciliating all the economic interests with environmental protection overcomes the juridical solutions. Although the existence of formal legislation about the subject is a necessary condition, it is not enough to encourage a better groundwater management. Environmental law is usually ahead of reality in the comprehension of environmental/economic conflicts. The case of permanent preservation areas is a good example of the disparity between law and reality. The Forestall Code (Federal law n° 4.771/65) establishes that vegetation surrounding the rivers or any water body must be preserved to protect the water resources (article 2°, a, b, c). Until now, this piece of legislation finds great resistance in its implementation. Even if the benefits of the vegetation is scientifically demonstrated to stabilize water body banks and keep water quality, most of urban and rural areas have ignored this legal demand. This scenario has started to change because of the progressive society pressure and the actuation of District Attorney members. However, the application of this dispositive stills leaves much to be desired.

Vulnerable areas of aquifers do not have a legal dispositive with direct application to restrict the soil use like the superficial waters. These areas must be identified by scientific methods and recognized worth of protection by a juridical instrument, which was not established yet. The content of watershed plans may motivate political actions to reach this juridical approach which will require great efforts to be really implemented.

The São Paulo state and groundwater: the case of Ribeirão Preto.

São Paulo was the first state to outline a legal framework to groundwater. Its first law edited was Law nº 6.134/88 which deals with the preservation of groundwater natural deposits in the state of São Paulo. This rule was regulated by the state decree nº 32.955/91. Groundwater protection was also considered in the state constitution which obliged the creation of permanent conservation and protection programs against pollution and overexploitation for it (article 206). The Water Resources State Act (Law nº 7.663/91) was approved before the National Policy and established

an institutional structure to water management very similar to the one approved in the National level denominated Hydric Resources State Management System.

Although these laws date from the end of the eighties and the beginning of the nineties, they still are filled with flaws and were not fully transposed to reality. Public administration concern with groundwater gains force only after 2000 when it was possible to identify effectiveness in water management tools in a better way, especially in the case of state water permissions and licenses.

Implementation problems are not exclusive to groundwater acts. In fact, numerous environmental laws do not have conditions to become effective due to amplitude, imprecision or omission problems contained on them. They constitute mostly legislation discourses that give an illusion that something is being done regard this subject. This gap between legislation and practice comes from calculated or consented political flaws, or still from governors' incapacity to reach the established goals (LEITE; AYALA, 2004, p. 26).

The problems in the groundwater state legislation impact municipalities' sphere. Even if most of municipalities have regulations to protect water resources, most of the times these legal dispositives are too general or do not come along public actions required to make them applicable. The case of Ribeirão Preto municipality is a good example of how the political conflict between protection and economic interests is heightened in the legal field. This municipality is located in the northeastern region of the State of São Paulo, Brazil (figure 1). This region presents a very peculiar relation with groundwater which constitutes the only source of public water supply for its more than 500 000 inhabitants. Intensive groundwater use generates significant water levels depletion. Besides, the economic vitality of this urban center produces contamination risks and the progressive occupation of the recharge areas of the Guarani Aquifer (VILLAR, 2006).

The Guarani Aquifer is a hydrogeological system that extends over an area of at least 1,200,000 km^2 of Brazil, Paraguay, Uruguay and Argentina. It has an average thickness of 250 m and reaches depths in excess of 1,000 m. The total volume of freshwater in storage is estimated around 40,000 km^3 (Foster et al., 2006). The strategic importance of this aquifer motivated the Guarani Aquifer Program for groundwater resource sustainability and environmental protection (also known as Guarani Aquifer Project). This Project was a joint initiative of the governments of Brazil, Argentina, Uruguay and Paraguay, and also in association with the Organization of American States, World Bank and the Global Environment Facility to promote a common institutional, legal and technical framework for the management and preservation of the Guarani Aquifer for the current and future generations. Ribeirão Preto was considered that it gathers the main challenges in groundwater management. Therefore, it was chosen as one of the 4 pilot areas of the Guarani Aquifer Project. The other areas were Concordia/Salto, Rivera/Santana, Itapuá Department. Another important project developed in this city was the Information System of Groundwater Resources Environmental Management in the Outcrop of the Guarani Aquifer in the São Paulo State. It was a cooperative project between State of Baviera (Germany) and State of São Paulo which intended to develop an information system with all the space data already collected. The information analysis recommended the creation of soil and water restriction areas.

The water restriction area suggested by these projects turned into the Hydric Resources State Council deliberation nº 065/06 (figure 3). This one limited the perforation of new wells in the urban area for two years and then extended to more two years. This instrument was very important to minimize the water level depletion. Moreover, it has encouraged a better integration

between municipalities and the state water control organ (Water and Energy department) since it established a joint procedure in water licenses process.

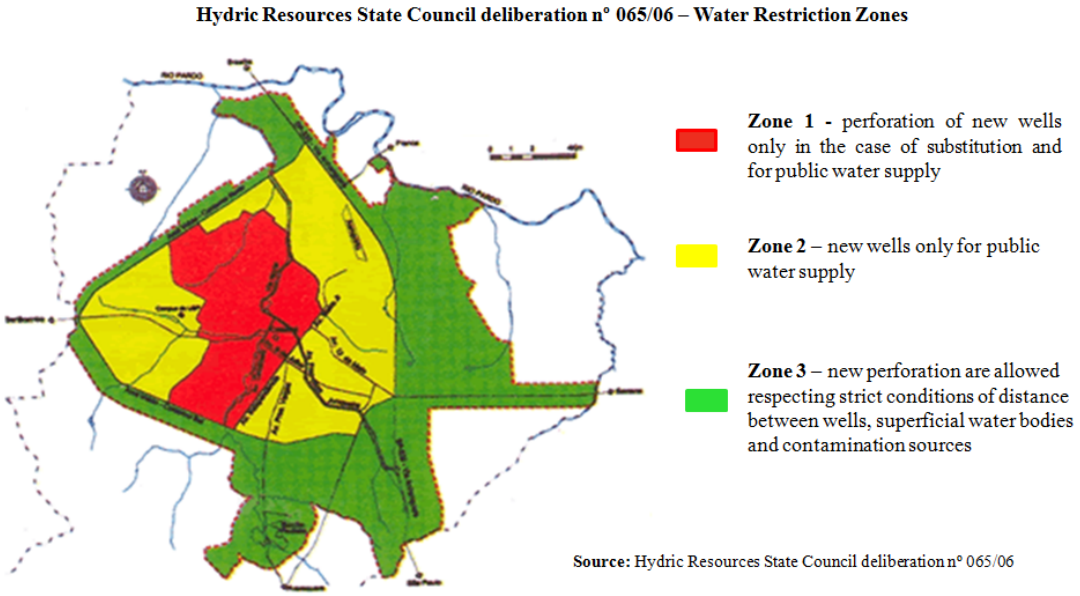

Figure 3: Hydric Resources State Council deliberation nº 065/06 – Water Restriction Zones.

Unfortunately, the soil use restriction proposal depends on State or municipalities laws. Even though there are technical documents establishing the most vulnerable areas of the aquifer, São Paulo still have not legally determined which ones will be granted maximum protection or regulated guidelines, restrictions or nonconforming uses in these areas. In this current scenario, municipalities are completely free to manage their territory, and consequently the occupation of aquifers' vulnerable areas. They will be responsible for deciding whether the aquifer protection will be a politic priority included in their environmental and urban policies or not.

The local governments have as main goal to develop the territory and protect the priority economic interests. They generally deal with more immediate concerns or with greater politic relevance subjects. In the case of Ribeirão Preto, the identification of groundwater problems, the realization of two international projects and the fact that groundwater is the only source of water should transform this issue into a government priority. Indeed, this concern was expressed in the municipality urban and environmental legislation. Nevertheless, after a qualitative analysis of this legislation, it is possible to identify that the protection measures adopted were made in a contradictory sense.

Ribeirão Preto most vulnerable zones of aquifers are located in areas with high economic value and great potential for housing. Restriction in soil use could harm the interests of important sectors. To conciliate environmental and economic demands, the Urban Director Plan established that vulnerable areas should have low densities and maintain permeability in the recharge areas of the Guarani aquifer. On the other hand, the law about soil use and occupation define low density as 1.500 hab/hec and the minimal measures for the plots are 130 m^2, which is very close to the constitutional minimum of 125m^2. In this sense, people have the illusion that the aquifer is protected meanwhile economic interests can continue their activities without limitations.

Actually, metropolitan density patterns were established to a very sensible area located in the countryside with other possibilities of urban expansion.

CONCLUSIONS

Current juridical framework is not favorable to stimulate municipalities to find forms of including the groundwater protection in urban planning. Subterranean hydric resources need more detailed laws that must delimit the vulnerable areas of aquifers and the limitations or restrictions applicable to groundwater protection. Deficiencies on Federal and São Paulo State legislation let the municipalities as the only responsible to chose how or if they will restrict or not the use of their territory. This kind of environmental approach can generate damages not only in local groundwater but also in other municipalities.

The case of Ribeirão Preto demonstrated that the existence of technical studies and data about groundwater do not guarantee satisfactory policies to this resource, even though it is a fundamental condition. Restriction in the property use depends on clear and adequate laws. Despite this, they still will face problems to be carried out for the conflicts they create and the little government support to environmental policies. Society unaware about groundwater impairs the insertion of this resource in an efficient protection law. Most of the people does not realize groundwater risks or can not identify where it occurs.

The watershed plans, even though present limitation in the juridical field, until now are the main initiative to stimulate groundwater protection measures and integrate water and soil polices in state and municipalities level. The water body classification may have an important political potential in water municipalities management, however its application is still unpredictable as it was not implanted by the basin committees.

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