Sustainable water management in the tropics and subtropics

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WATERS OF METROPOLITAN AREA OF SÃO PAULO: TECHNICAL, CONCEPTUAL AND ENVIRONMENTAL ASPECTS

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INTRODUCTION

Though it might seem to be a paradoxical affirmation at these days, the issues concerning hydric resources are historically recent. This aspect can be confirmed at a research at last decades environmental documentation. These documents alerted about the speed rate of industrialization rhythm, warned about the rapid population growth, indicated the depletion of non-renewable resources and recursively, for large scale environmental pollution.

However, these same texts devoted to the issue of water no more than a few scattered references. They also did not signaled the water crisis possibility that is visible nowadays. Briefly, water resources was still perceived as still abundant. The scarcity possibility seems to be something out of question. Therefore, the absence of the theme on those documents.[1]

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[1] This can be noted at *The limits to growth*, written by *Club of Rome* at April, 1968. Although it had been written no more than four decades ago - namely a time that could be historically perceived as "yesterday" - this text, as well many others done at the same period, does not explore any deep analysis concerning the exhaustion of fresh water, a subject which prominence today is undeniable.

Another key aspect at this debate is the accelerate urban growth (DAVIS, 2006 and ALIER, 2005). This phenomenon is linked to the water crisis by the very fact of the urban setting be voracious on water demands. Moreover, the urban life style demands raw materials and supplies that need a great proportion of water to be produced and / or extracted. A synthetic survey shows that the urban areas, accounting for only between 2.5% - 6% of the Earth land surface, accounts for the oncoming 75% of planetary resources and 70% of fresh water supplies (DIAS, 2002:15).

From a logistical point of view, the importance of freshwater supply for the urban area justifies the implement of large numbers of hydric-spatial objects. Among others, it could be mentioned storage dams, pumping stations, reservoirs, aqueducts, tunnels, canals, pipelines, water-towers, waterworks, water treatment stations, distribution systems, etc. It´s clear that the the demands of urban water occurs in a context marked by strong alteration of the natural environment.

Thus, as an engineering system (SANTOS, 1978, 1988 and 1988), the network technique-oriented urban water supply contrasts conceptually with the perception that it is addressed, usually making use of the concept of hydrographic basin. However, it should be noted that far more than natural or ecological systems, the cities generally enjoy access to water by means of technical systems. This concerns much more about the concept of environmental basin than the hydrographic basin itself (RUTKOVSKI, 1999a and 1999b).

In this sense, the aim of this paper concern is focused on the issue of freshwater supply in the São Paulo Metropolitan Area (Região Metropolitana de São Paulo - RMSP), particularly the dynamics of engineering systems to evaluate the problem of water in this vast metropolitan conurbation, the most important metropolitan area in

Brazil. Therefore, it will be the better or worse management of the the artificial system of supply that can explain the magnitude of problems facing RMSP, the fourth largest metropolitan area of the world. It is expected that the RMSP will add 20 million inhabitants in 2015, surpassed only by Tokyo, Mumbai and Mexico City (NYT, 2009:486).

TECHNOSPHERE, GREATER SÃO PAULO AND METROPOLITAN WATERS

It´s broadly agreed among the geographical point of view that the modern man's interference in the environment has arisen, unfolding an intense artificiality of living space (SANTOS, 1988). In particular, it´s dynamic reflects the injunctions of a modern social rhythm of time considered as linear and progressive, fundamental for the emergence of an space ruled by highly artificial circuits, in which are set technical objects and other artificial roughness (WALDMAN, 2006a, 2006b and 1994). Thus, the cultural landscape has replaced the natural landscape. Concomitantly, the artifacts got status increasingly privileged on land surface. The social organization of space is dominated by the presence of artificial objects devised by humans and linked by means of fluxes corresponding to a compartment territorial engendered by human Gesellschaft, only subjected to their command. The technosphere - ie a technical sphere - formats the final result of this process.[2]

Objectively, as an space of activity of the humankind, the presence of technosphere is so incisive and its influence occurs on such a scale that has become inevitable conceptualize it as a separate

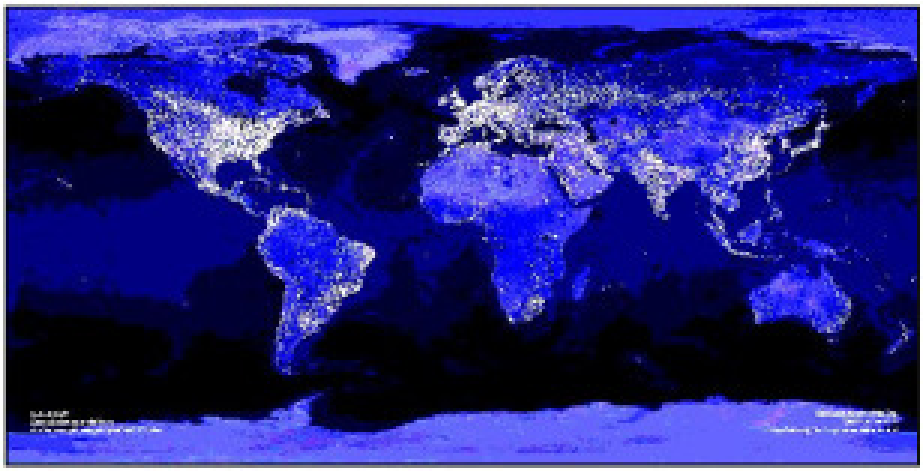
[2] Among the names used by some authors, we would have: *artificial sphere*, *human sphere, intelligence sphere*, *technical layer* or *noosphere.* The latter terminology was conceived by Vladimir Vernadsky (1863-1945) and Teilhard de Chardin (1881-1955), defining the spiritual world and the human thought, a inhabited *stratum* by free intelligence, with the aim of ascension of consciousness.

operating element. So it began to enjoy similar status as layers as the lithosphere, hydrosphere, cryosphere, atmosphere and biosphere. Recalling a speculation central thought of Milton Santos, the technosphere configure a technical-scientific-informational space. In a few words we could say that it is the spatiality of modernity. It articulate the city, large technicality portions of the countryside, as well as its technical, structural and systemic predicates. Its dynamics catalyzes increasing demands on the energy matrix and water resources needed to ensure the fluxes and speed for the whole system. The time acceleration, typical of the urban lifestyle of modernity, is the most striking and inescapable essence of contemporary city (SANTOS, 1998:31/33, 44/45, 127/128 and 139/140).

Truly, it is necessary to recognize that the technosphere lose intelligibility in the case of being dissociated from the understanding of the urban environment as its activating core. The cities materializes the heart of economic, social and politic order, turning the entire planet into an space of subjection to its processes of reproduction. This points out that the global urban network and technosphere is intimately related to each other, enhanced by the synergy among them. Such interaction is legitimized by fixes and fluxes (SANTOS, 1998, 1988 e 1978), in many different textures and consistencies, engendering the distinctive materiality of the modern world, whose majesty is shown through the paradigmatic image produced by NASA in 2000 (Fig. 1).

This fact is made explicit by itself, it is inevitable to understand that meeting the demands for urban water cannot be dissociated from the dynamism of artificial space that has at its kernel the city and its lifestyle, shaping and imposing technical systems for the management of

Figure 1 - The lights of technosphere



The Planet at dawn (11-27-2000), showing "galaxies of light": urban agglomerations and another spatial luminous objects (Astronomy picture of the day, Nasa: <antwrp.gsfc.nasa.gov/apod/astropix.html>. Acess: Jan. 2010)

hydric resources. In this regard, notes the urbanologist Emília RUTKOWSKI:

> "The urban-industrial culture (...), generates an exponentially increment of water demand, forcing a continuous search for water sources, and promotes the urbanization of aquatic spaces creating new interdependent hydrographic design, that overlaps each other in the same landscape. Any urban function - residential, commercial or industrial - chiefly depends on the existence of water to meet their needs, both for the direct, such as watering, and indirect, such as hydropower" (1999a:16).

Regarding the theme of this text, a fundamental approach reports the actual geographical expression of urban growth, shaping the São Paulo Metropolitan Area (RMSP) or, as reflected in the actual voice of the people, Greater São Paulo (Grande São Paulo - GSP). As we shall see, this geographic substratum is linked with the agenda of the metropolitan water at GSP and reverberates technically, socially and environmentally at its space.

Accordingly, an essential element correspond to the prominence of the city of São Paulo in the Brazilian spatial formation. This city, capital of one unit of the federation which has the same name (the state of São Paulo: Estado de São Paulo - ESP), form the core of a massive conurbation attracting neighboring counties, thus making the RMSP. The RMSP consists of 39 municipalities (Fig. 2), including the capital, and it is known as a financial, industrial, commercial, cultural and economic center of Brazil.

Figure 2 - Map of the municipalities of OF RMSP

(<http://ww2.prefeitura.sp.gov.br// arquivos/guia/mapas/0001/mapa_grande_sao_paulo.jpeg>. Approximate scale: 1:636.520. Acess: Jan. 2010)

In GSP, the largest municipalities are São Paulo (approximately 11 million people), Guarulhos (1,3 million), São Bernardo do Campo (810,000), Osasco (718,000), Santo André (650,000), Mauá (417,000), Diadema (397,000), Carapicuíba (392,000) and Itaquequecetuba (360,000).[3] Besides São Paulo city, the ABC Region,

[3] Data from 2009, Instituto Brasileiro de Geografia e Estatística (IBGE): Brazilian Institute of Geography and Statistics - Intercensal Estimate (See http://www.ibge.gov.br).

ABCDMRR or Seven Municipalities (São Bernardo do Campo, Santo André, São Caetano do Sul, Mauá, Diadema, Ribeirão Pires and Rio Grande da Serra), in the southeast of GSP, is another important location for industrial corporations and processing factories em general. The RMSP comprising a total area of 8,051 kilometers², almost 3,3% of ESP and 0,094% of Brazilian territory, that is to say, less than thousandth of this.

The continuous urban agglomeration of GSP (Fig.3) was 2,209 km² in 2002, equivalent to approximately 221,000 blocks. Observing that this area was about 335 km² in 1930, 874 km² in 1962 and 1,370 km² in 1980, these numbers indicates a truly staggering urban growth. Further forecasts point to an expansion of the urbanized area in an order of 230 km² by 2020. This expansion occurs at the expense of natural landscapes or areas with small degree of anthropogenic changes, that in many cases, are the origin of water supplies in the RMSP.

Today, areas responsible to fresh water supply ("áreas de manancial") comprises 4,116,30 km², chiefly in the GSP borders. The urban growth of RMSP extends mostly from West to East, from the city of the Jandira to Mogi das Cruzes. In the North-South axis, form a belt whose marks would be the sub-district of Parelheiros at South and the neighborhood of Tucuruvi in the North, both within the municipality of São Paulo.

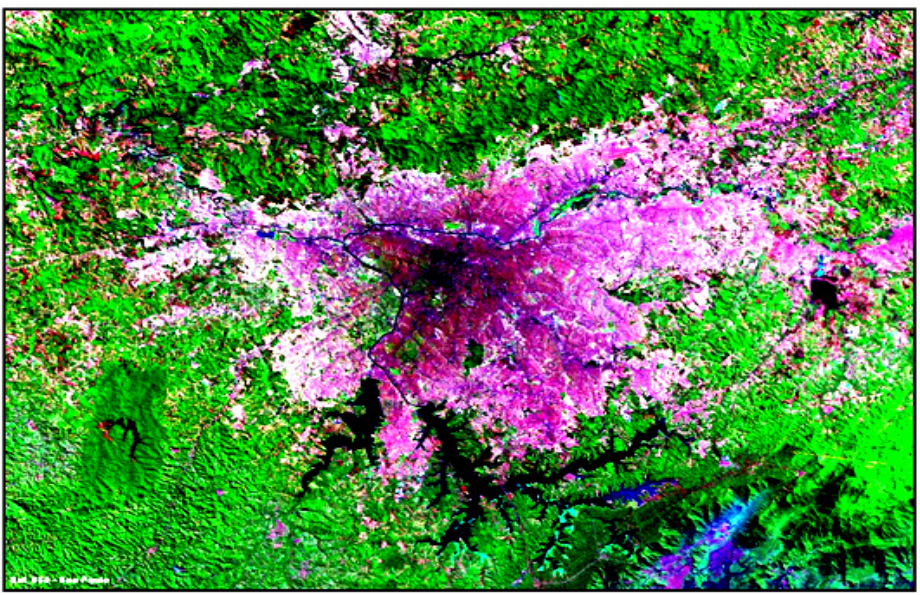
Despite representing a small proportion of the Brazilian territory, in the economic field the metropolis of São Paulo concentrate (2009 info) 47,6% of ESP´s GDP and 16,7% of Brazilian GDP.[4] Functionally, even housing some 40,000 industries, from the nineties its function is no longer predominantly manufacturing. Nowadays, we observe the increasing of tertiary activities, like

[4] Data from Empresa Paulista de Planejamento Metropolitano S/A (EMPLASA): São Paulo Metropolitan Planning Company S/A. (http://www.emplasa.sp.gov.br)

administration, digital services, cultural ativities, tourism, business, etc. The city, which since the forties and fifties rehearsed position on the condition of Greater São Paulo, enters the new millennium under the sign of a remarkable metamorphosis, reconfiguring it´s role in time and space. Clearly, the GSP is structured as one of multiple centers of the technosphere, an epiphenomenon of the globalization of urban society (CARLOS, 2001:31).

Thus, pointed as a global metropolis, the RMSP is invigorated further its presence in the Brazilian socio-spatiality. Obviously, its importance is maximized when Brazil reached, in the 21th century, the status of 8th largest economy in the world. Confirmed as center of the processes of spatialization, the city is empowered to disrupt and organize "to their expense and for their benefit, the peripheral activities and issues important to the process of regional development" (SANTOS, 1993:103). In other words - whatever the parameter that we will use - no one should underestimate the greatness of this movement its dynamics for Brazilian space organization.

Figure 3 - Satellite photo of RMSP agglomeration in 2004



(<http://www.brazilbrazil.com/s/sat_058.jpg>. Acess: Jan. 2010)

Due geographical and historical reasons among past and present, São Paulo city remains a core space of demographic concentration. The conurbation home 19,889,559 inhabitants in 2009, ie 48% of the population of the ESP and 10,4% of the Brazilian population. However, São Paulo still maintain a key demographic position at the national scenario. At the same time, in 2009 São Paulo concentrated 55% of the population of all RMSP and 5,7% of the Brazilian population.[5]

Taking this scenario as background, problematic aspects related to access to fresh water turned out to have critical contours at GSP region. This is very evident when specialists pay attention to the fact that the ESP, while constituting the unity of the federation's most populous country (accounting for about 21,6% of the population in 2009 IBGE estimate), is covered with only 1,638% water potential available within the country (REBOUÇAS, 2002a: 31).

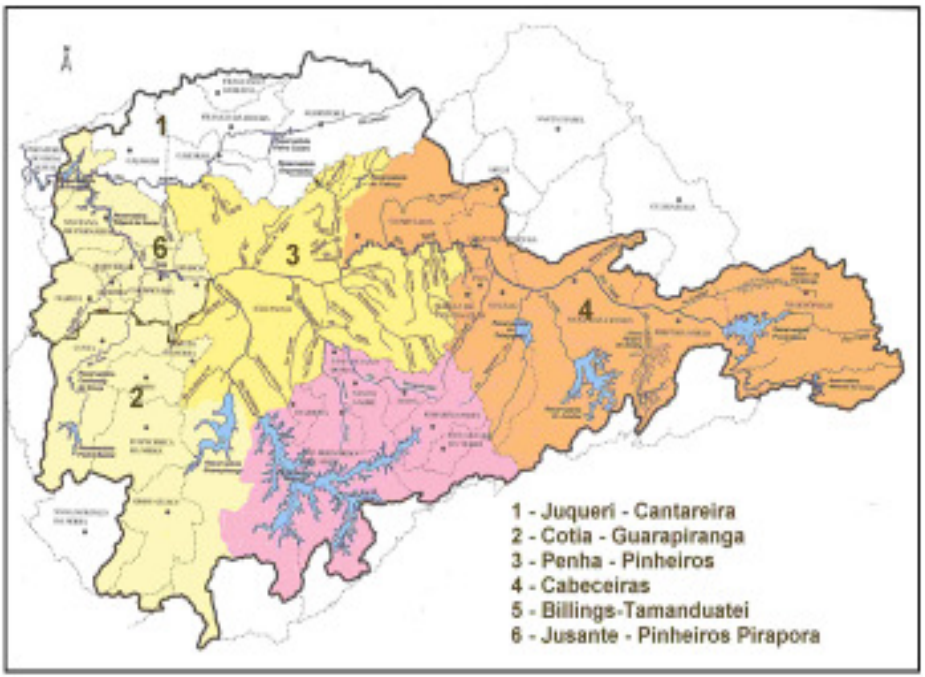
Then, this situation becomes complex considering that the RMSP has only 4% of fresh water available from ESP. In the RMSP, the hydric drainage is essentially originated from the flow of the Tietê's River Upper Basin. The basin of Upper Tietê is the most important provider of surface water in the metropolis of São Paulo. Its amounts to 5,650 km² of hydrographic basin, ie 70,17% of the metropolitan area of GSP. It is responsible for irrigating - totally or partially - 34 of 39 municipalities in the RMSP and is subdivided into six sub-basins (Fig. 4).

It is important to point out that although this hydrographic basin is dense and it is fed, among other natural mechanisms, with convective rains, its flow is mostly originated from heads of basin rivers. From the standpoint of physical geography, the flow of surface water is unfavorable to RMSP because it is located precisely at the area where the available volumes of water are

[5] Data from IBGE (http://www.ibge.gov.br).

necessarily smaller when compared with the downstream regions. Its flow, around 90m³/s, is very low for the needs of the metropolis. Incidentally, the RMSP is the only major conurbation in the world situated in a region of the head of rivers. The availability of water in the city, estimated at about 112,57 m³/person/year, inscribe GSP as an arid region as many others of the world,[6] an alarming situation from any point of view (WALDMAN, 2010b, SABESP, 2004 and CAMPOS, 2001).

Figure 4 - Map of hydrographic basin of upper Tiete and divisions at sub-basins



(<http://www.rededasaguas.org.br/observando/alto_tiete.htm>, Approximate Scale: 1:595.000, Acess: July 2005)

[6] To make clear this disponibility it´s worthy to recall that the Brazilian´s hidrical stress indicators has as its reference the number 1,000m³/person/year (REBOUÇAS, 2002a:19 and 2004:68/69). With this reference we obtain 2,740 liters/person/day, which is a great contrast considering 112.57.

THE RMSP HIDROTHECNICALS OBJECTS SYSTEM

The GSP has exiguous water resources available considering that it has only the drainage of the waters of Upper Tietê and do not have any other great flow to it (RUTKOWSKI et OLIVEIRA, 1999:39). Simultaneously, the RMSP embodies enormous concentration of population, factories and companies, that in the process of consolidation through a techno-scientific-informational, ask for enormous demands of water resources.

Given this situation, the requests of water by RMSP relay to a wide peripheral space formed by regions which also need to take care of their needs. Facing the impasse on addressing large demands - especially as the RMSP consumes much more water than is produced in its specific area of coverage - and the virtual absence of a coordinated policy action, the city began to take ownership of all waters available from regions under his direct influence. Moreover, by reversing the neighboring river basins, water from sources far from their end users were diverted to meet its needs, a procedure that became a source of various conflicts, current or potential.

The distribution of a water supply system as large as this one is matched by a company also huge. This is the Basic Sanitation Company of the State of São Paulo (Companhia de Saneamento Básico do Estado de São Paulo - SABESP), considered the largest water public company in the world's (BARLOW et CLARKE, 2003:153). Responsible for water services and sanitation in 366 of 645 cities at ESP[7] (as to that, 56.7% of total), SABESP is one of the keys at the understanding the water supply network at the metropolitan area. With the exception of some little local authorities, the RMSP is largely serviced by this company. At GSP, eight systems - all of them monitored by

[7] Data from May 2009 SABESP (http://www.sabesp.com.br).

SABESP - are responsible by the fresh water for its inhabitants. These systems are: Cantareira, Guarapiranga-Billings, Cabeceiras, Rio Grande, Alto (Upper) Cotia, Baixo (Lower) Cotia, Ribeirão da Estiva and Rio Claro (Fig. 5).

Figure 5 -The eight water suplly systems of RMSP

The RMSP and his Water Supply Systems: Cantareira (1), Guarapiranga/Billings (2), Cabeceiras (3), Rio Grande (4), Rio Claro (5), Alto Cotia (6), Baixo Cotia (7) and Ribeirão da Estiva (8).

Connected, this set forms the Metropolitan Pipeline System (Sistema Adutor Metropolitano - SAM), which works similarly to a system of communicating vessels. SAM equalizes the supply to all cities connected to the network, allowing water to travel dozens of kilometers to finally drain cocks in reservoirs far removed from the home. For this to happen, there are 1,516 kilometers of pipelines and 331 installations like water tanks, little reservoirs

and water-towers, able to store 1,8 million gallons of drinking water.

The deployment of this network of reservoirs involved the construction of various works of infrastructure, in many cases large and requesting huge investments (Fig. 6). Admittedly, many of the area providers, which together form the Integrated Water Supply System of GSP (also managed by SABESP), are far from the urbanized area and their metropolitan area. In the case of Cantareira System, some of the sources of rivers that sustain it are located in the neighbour state of Minas Gerais, so beyond the limits of the ESP. In total, eight water production systems currently provide about 67,400 liters of potable water per second to RMSP. This is equivalent to 2,350 olympic swimming pools per day.

Figure 6 - Rio Claro system aqueduct

Located at 82 kilometers of São Paulo's "Marco Zero¨ (geographical reference from wich is counted the distance from any other point of this city), Rio Claro System comprising the Ribeirão do Campo reservoir, water treatment station and one long aqueduct. Above, Ribeirão Pires section of Rio Claro Aqueduct, on the RMSP agglomeration periphery (Photo: M. Waldman, June 2005).

Apparently bulky, the amount of water injected into the supply system would, under one point of view merely quantitative, to offer an average of 326 liters/person/day. This quantity would be considered modest by any expert. However, confirming the "usual" domestic waste drinking water, the percentage of distribution losses in the RMSP - a megalopolis that thirst by the very force of necessity should take precedence for the efficient management of water resources - reached exorbitant rates, 25% - 40%. This index is composed of physical losses (volumes which had not arrived to the users because of logistical and operational problems) and for loss of business (volumes consumed and not billed in the face of the inaccuracy of meters, illegal connections, etc).

Therefore, each individual formally connected to the public actually has only 196 liters per day. In short, the treatment plants are producing much more drinking water than the amount actually consumed, accounting for one level of losses that only aggravates an context permeated by the lack of resources (REBOUÇAS, 2004:42). Against this background, the possibilities of expanding the supply of potable water are limited. The production of water by suppliers systems has remained virtually the same in the last decade (Table 1).

Table 1 – Rmsp water supply systems (*) (*): Excluding exploration of artesian wells by SABESP

SYSTEM	WATER PRODUCTION (M³/S)	WATER SUPPLIED POP.(MILLION)
Cantareira	31,7	8,8
Guarapiranga/Billings	13,2	3,7
Cabeceiras	9,7	2,7
Rio Grande	4,7	1,2
Rio Claro	3,8	0,9
Alto Cotia	1,1	0,4
Baixo Cotia	0,9	0,3
Ribeirão da Estiva	0,1	0,02
TOTAL	65,2 (*)	18,2

Data from Plano Diretor de Abastecimento de Água da RMSP, SABESP, March 2004

An expedient which the RMSP has used in the recent past would be materialized in reversals of adjacent water basins. However, the proposal is currently riddled with objections by the people who inhabit the rivers flows downstream, not to mention the prohibitive cost of many of these projects. Moreover, the old method of granting the unlimited access to the waters is no longer politically viable. In the case of the Cantareira System water policy - that is to grant to the user his rights to use water from the river basin (regional or federal) - dated back to 1974 (in Brazilian military government period) and guarantee unlimited access to the resources of the Piracicaba River basin. However, under pressure from various social groups in areas that supply water to the Cantareira System, a ceiling was imposed for the withdrawal of water for the RMSP. Explicitly, the most diverse segments of the provider area rebelled against the capture that GSP was doing, which quite rightly thought they had priority in use. Based on this scenario, any kind of water flow reverse is simply out of the question.

Looking forward to optimize the supply of fresh water available for the RMSP, there is certainly the possibility of delaying the process of deterioration of the Billings, Guarapiranga, Upper and Lower Cotia reservoirs, by starting its recovery. However, once they have been harassed since the 60 by "informal urban growth", leading to multiple forms of environmental injury, the period of implementation of remediation of these systems is long, being unable to meet the imminent needs of the population (SANTOS, 1993).

Therefore, the RMSP can count only on the expansion of hydric production in the Cabeceiras sub-basin. This hydrographic system sustains three water reservoirs - Taiaçupeba, Jundiaí and Ponte Nova - at the east of the metropolitan region. It also receives the free watercourse flow of Rio Claro river, which is retained by the reservoir

of Ponte Nova.[8] The sub-basin of the Cabeceiras System currently provides 9,7 m³/s to the metropolis, a volume that can be expanded to a maximum of 15 m³/s. Beyond this level, it would be necessary to operate with others dams. But times have changed and there is no facility to deploy new reservoirs. The licensing of new works is paralyzed for decades for a number of precautions suggested by environmental impact studies. Thus, the dams projects as Biritiba and Paraitinga - located in the Cabeceiras sub-basin - although presented in the early 70's, still do not have a date set for begin operation.

For these reasons, all conspire to remind the inherent possibilities in the management of demand, investing on replacing procedures aiming conservation of water resources. Indeed, this strategy suggests the adoption of the Four R's: Rethink, Reduce, Reuse and Recycle (WALDMAN, 2003a, 2003b and 2003c). By this point of view, with a supply management (loss control, adoption of technologies for reuse, sustainable water use, rainwater capture, etc.), could contribute to or delay the worsening of a scenario of shortages, by which the RMSP, pushed into a hydrological cul-de-sac, would enter, recalling Milton SANTOS words, into a spiral of "short-circuit" (1988).

Even so, it would be difficult to accept a priori that the hypothesis of the rational use of water alone have the capacity to address the difficulties faced by the GSP. Moreover, the adoption of this approach at a time when the water crisis becomes more pronounced, has as its assumption the very own critical degree into which the question of water resources turned out to be. Besides the rationalization of the demand, what else could be done about the shortage crisis? Of course, nothing better than postulating once more the emergence of a strategy to

[8] Technically, this fact justifies that the Rio Claro and Cabeceiras Systems are considered as an integrated system.

protect the sources of fresh water existing in the RMSP, starting with the Billings reservoir, the largest of the GSP (WALDMAN, 2008, 2007a and 2004).

Another important step would be to abandon practices as canalizing and rectification of the course of rivers, which with the sealing of the urban soil, that leads to the lack of drainage and inflow of rainwater, prevents the recharge of aquifers and leverages the floods. It´s worthy to repeat the calculus that points out that a rainfall of 100 mm flowing over 1,522 km² at São Paulo municipality area, turn out to be the same as 150 million tons of water, which looses its natural ability to originate from stormwater runoff and inflow, and are transformed into a vector of disasters rather than meet the demands of people who lives in the city (WALDMAN, 2006a:430).

Another policy would also suggest actions for the sewage collection and treatment. However, the RMSP is not dissociated from the rule made in the national sanitation public model that accounts for the saying tout à l'égout, prevalent in nineteenth-century Europe (REBOUÇAS, 2004:174). By this model, perennial rivers become in meres sewage effluent channels, a genuine policy of destruction of water resources. This is what can be analyzed at the data in Table 2, regarding the waste water collection and treatment at RMSP. Developed with the latest data available provided by the Covenant of Water[9] -"Pacto das Águas" - states inter alia:

1. The existence of alarming rates of absence of treatment and zero (ie none) in many municipalities of the metropolitan region; Another important observation is the precariousness of the surveys and official reports, which exclude illegal connections of all kinds, and therefore put in check the certification of the actual data;

[9] A program of hydric resources conservation made by Estado de São Paulo´s Environment Secretary that begin in 2009.

TABLE 2 - Sewage collection and water treatment at RMSP in 2009 (*)

MUNICIPALITIES	SEWAGE COLLECTED (%)	SEWAGE TREATMENT (%)
Arujá	57	57
Barueri	55	0
Biritiba-Mirim	95	100
Caeiras	62	0
Cajamar	63	0
Carapicuíba	56	5
Cotia	39	37
Diadema	92,5	13
Embu	41	0
Embu-Guaçu	21	100
Ferraz de Vasconcelos	78	56
Francisco Morato	23	0
Franco da Rocha	56	0
Guararema	41	0
Guarulhos	73	0
Itapevi	43	0
Itapecerica da Serra	4	0
Itaquaquecetuba	58	7
Jandira	57	0
Juquitiba	13	100
Mairiporã	57	62
Mauá	72	0
Mogi das Cruzes	88	42,5
Osasco	61	28
Pirapora do Bom Jesus	30	54
Poá	88	93
Ribeirão Pires	65	40
Rio Grande da Serra	25	85
Salesópolis	100	100
Santa Isabel	78	0
Santana de Parnaíba	26	0
Santo André	96	0
São Caetano do Sul	100	100
São Bernardo do Campo	84	3
São Lourenço da Serra	20	100
São Paulo	97	70
Suzano	82	70
Taboão da Serra	77	0
Vargem Grande Paulista	20	0

(*) Data from: http://www.ambiente.sp.gov.br/pactodasaguas/pacto2/visual.php?cod_ibge=350660

2. A very worrying situation for the city of São Paulo, due to the large volume produced. The untreated sewage from leader city of the metropolitan area would be the total generated by three cities as large as Campinas, the third city of ESP: 1,070,000 inhab. in 2009;[10]

3. The existence of municipalities in areas of vital importance for the production of water, such as Itapecerica da Serra, Embu and Taboão da Serra (at Cotia's sub-basin), São Bernardo do Campo, Mauá and Ribeirão Pires (at Billings sub-basin), whose huge volumes of sewage are released in natura at the watercourses of the Upper Tietê;

4. It also draws attention to the framework of the municipalities aligned in the headwaters of the Upper Tietê, which have direct relationship with the system Cabeceiras. As pointed out, this is the only basin in which it is possible to think an expansion of water supply for the RMSP. However, the situation is very precarious in Biritiba-Mirim, Itaquaquecetuba, Guararema and Suzano;

5. Another relevant aspect is the fact that the mineral water bottlers are prospecting for large-scale production in several municipalities of the RMSP. This activity, for obtain the qualification a special care is required namely for anthropogenic interventions located on the surface and underground, a prerequisite that has not necessarily been complied;

The huge amount of waste generated by the RMSP is necessarily a factor worthy of attention because it is intimately linked to the issue of water quality. Failures at the system of garbage collection contribute, according to SABESP, with 35% of water pollution of the GSP (WALDMAN, 2010a, 2009b and 2007b). Statistically, it is known that the 39 municipalities in the metropolitan area have spent 11,456.6 tonnes of household waste in 2004,

[10] Data from 2009 IBGE Intercensal Estimate (http://www.ibge.gov.br).

of which 86%, according to the standards of the Environmental Technology Company São Paulo State (Companhia de Tecnologia de Saneamento Ambiental - CETESB), receives allocation deemed appropriate. But, the "percentage remaining" 14% without correct disposal would be a mountain of waste equivalent to those generated by a city the size of Salvador, the third Brazilian city (WALDMAN, 2006a:433). Another aggravating factor revealed by surveys of CETESB is that a good number of municipalities whose conditions of waste disposal are considered inappropriate is located in regions with an explicit interest in water. This would be the case, for example, Juquitiba, Mogi da Cruzes and Cotia.

The scenario worsens with illegal discharges of chemical and industrial waste, a situation that turns out to be a delayed explosion that makes its noise specially at the borders of RMSP. One of these cases occurred in 2001. In this year, the public became aware of a serious problem of environmental pollution in the ABC region. In the town of Mauá, it was discovered that an apartment complex - Parque São Vicente - inhabited by 5,000 people was built on the terrain of a landfill of industrial waste abandoned to their fate by a company in the region. Accumulating 44 types of toxic compounds, the site offered dangers that lay spontaneous outbursts and the most dramatic damage to the health of residents.

So, if combined with the lack of services for sewage treatment, the precariousness of sectoral policies regarding the disposal of solid waste, soil use and occupation or even the outright lack of urban planning - in most cases restricted to strategies for remediation impacts and damages already caused - anyone can wonder how would be possible not occur extensive deterioration of the water. Nowadays, the RMSP has a hopelessly critical framework: 51% of all water present in the area would be compromised by pollution and about 35% of the water quality is considered poor or very poor, especially given the concentration of phosphorus (CAMPOS, 2001).

This situation end out to endorse works as the Tietê Project. Considered one of the largest environmental projects in Latin America, this initiative would be to broaden the sewage collection and treatment at metropolitan area, reducing the release of pollutants in rivers, improving water quality in the Upper Tietê basin. Preceded by intense social pressure, the project was created in 1992 by the state government of São Paulo, involving organs such as the CETESB, the Water and Power Department (Departamento de Águas e Energia Elétrica - DAEE) and municipal administrations. However, a renowned expert on water resources, even with the startup of other treatment plants of this project, the situation would be, according to data available in 2002, the following:

> "... The capacity of sewage treatment in the metropolitan area of São Paulo will be limited to a mere 45%. Approximately 15% of the sewage generated in the region are not yet collected, and the waters of the Pinheiros river, crossing one of the finests areas of São Paulo city, will remain approximately 90% of sewage by the year 2003 if there are no other delays in the development of the Tietê Project " (HESPANHOL, 2002:270).

Another omen is that the current stage of environmental collapse of the metropolis, the sewage collection and treatment could even appear to be a strategy zeroed due to diffuse pollution that expands incessantly due to the increase of harmful substances released into the urban environment. Therefore, the loss of water quality due to the rising tide of pollutants has led to increased amount of chemicals needed for the services for producing potable water. The cost of water treatment at Cantareira, Guarapiranga and Cabeceiras systems doubled, leading to high rates of water supply for consumers. Still, the quality of the liquid is far from the expected. The complaints of the population has increased year by year, forcing the authorities to report on the quality of water supply (WALDMAN, 2006a:436).

The accumulation of difficulties to access of superficial fresh water contributed to the spread of artesian wells and the growth of a new business horizons with specialized companies on groundwater exploration. In particular, the condominiums, the hotel chain, hospitals and industries are the main users of the aquifers. Not just so: municipalities as Juquitiba, São Lourenço da Serra, Santana do Parnaíba, Francisco Morato, Guararema and Biritiba Mirim, have among 25 and 50% of supply from groundwater (DEL PRETTE, 2000:123). At the beginning of the millennium, it is believed that 10% of the demand of the metropolitan region is being met from groundwater sources. Projections of numerous experts from the Geosciences Institute of São Paulo University (USP), points to the possibility of aquifers meet in the medium term, up to 19% of total demand.

However, all goes against the easy optimism. The quality of groundwater depends on an optimal management of activities on soil, and also a rigorous technical monitoring of the water well perforations. It is believed that the 12,000 perforated wells currently exist in the RMSP, about 80% are illegal, in most cases exploiting water beyond natural carrying support. As the problems extends from the lack of care in the final disposal of waste to the sealing of the urban soil, preventing the water reaches the reservoirs in the needed quality and quantity, not to mention that most perforations occurs ignoring any monitoring and geotechnical parameter, the situation declines in losses of all kinds for groundwater.

In this particular, a truly surreal data is that at least 60% of water drawn from underground aquifers at metropolitan region of São Paulo originates from leaking pipelines and water losses through leaks caused by disruption of the network pipe distribution of SABESP. Paradoxically, water losses turns out to be part of the one

groundwater system. According to geologist Ricardo Hirata, from Geosciences Institute of USP: "the aquifer and the Upper Tietê Basin would be in a critical situation if they did not receive water from leaks".[11] Thus, nothing leads us to say that the potential use of the exploitation of groundwater is an answer to the urban water crisis at RMSP.

Another variable at the supply issue, respecting in totum the market rules, would be the commerce of mineral water. As has been consistently reported, a decline in quality of water that reaches the taps has direct link with the consumption of bottled water (REBOUÇAS, 2004:174). The expansion of the mineral water market in the state of São Paulo, from 1997 to 2000 was 52% and in the RMSP, 92%.

This growth was researched by the Institute for Technological Research (Instituto de Pesquisas Tecnológicas do Estado de São Paulo - IPT), which shows that RMSP is responsible for 58% of the bottled water production at São Paulo state and 21,5% of the country. This concentration, which could surprise the unwary observer, is connected to two basic factors. The first unfolds from the favorable geological conditions exist in many municipalities in the metropolitan area. The second is associated with the access to RMSP, the largest consumer market in Latin America, therefore it is point of considerable importance to the logistic on commercialization of bottled water. According to a interesting survey of Brazilian Development Bank (Banco Nacional de Desenvolvimento Econômico e Social - BNDES), the freightage, accounting for about 25% of the composition of the mineral water price, enhances the proximity to a geographical factor first order for the marketing of the product (GUAZZELLI, 2004:82).

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[11] *Manchetes Socioambientais*, 06-14-2005 in WALDMAN, 2006a:437.

However, nothing ensure in favor of efforts to obtain a groundwater that could at least offer a safe watering. Repeating a warning: bottled water is not always more reliable than tap water and some of them are even less (BARLOW et CLARKE, 2003:171). Despite the growing importance of bottled water to supply the population, the ESP has only a few employees to monitor collection and bottling of mineral water. Aiming to control the sterilization of mineral water wells and see if it is contaminated with residues of agriculture or sewage, it would take, according to the National Department of Mineral Production (Departamento Nacional de Produção Mineral - DNPM), which supervises the activity in the country, at least 40 employees focused on this function (WALDMAN, 2006a:438).

The framework for problems related to water resources in the RMSP is accentuated when we turn our eyes into the socials aspects of the lack of water, known as social water stress. Besides the demand to be led by a social group and a lifestyle whose disclosure could outweigh any gains realized, we can not fail to notice the predominant thirst that affects large segments of the population on the outskirts of the metropolis, whose demands must be met especially if what is on focus is the universality of a basic benefit. Indeed, the ghost of dry taps, more than a terrifying metaphor addressed for the future is a question of effective day-to-day lives of millions of metropolitans. The low-income population, of which 35% do not have plumbed water supply - compared to 3% of the wealthiest sectors - are the first to be hit by rationing or by cutting the services on behalf of the economic downturn (REBOUÇAS, 2004:174).

However, it highlights that this narrative composed of deleterious actions directed contrary to the hydrological balance is mostly recent. The history of occupation of the RMSP could confirm that the lived context does not always was this one, on the contrary, in the past, the region has

enjoyed the happy condition of the "Land of Many Waters" (WALDMAN, 2005).

Thus, the complexity of factors at play in the RMSP discharge any quick or superficial reading. Focus on specific aspects, including the relevant factors to the commitment of the hydrological balance in the GSP can at best draw a picture of a nebulous problem that is much broader. What arises is the need to decipher a causal statement of issues and conflicting interests, a procedure that becomes not only important but also essential to understand the issue of water resources in the GSP.

CONCLUSIONS

Clearly, in times when the perception is changing, routinely changing our relationship with the world, the issue of fresh water at RMSP would understand the presentation of four basic premises, namely:

1. In regarding the management of freshwater, since the RMSP is bounded only by Upper Tietê basin and the sources responsible for its flow, the context of the demands of the metropolis suggest a strict management of scarce water resources. At this point of view, meeting the priority needs of the urban environment in continuous expansion (ie, drinking water and electricity supply), could not do without optimal and multiple uses of existing water. It is also clear that this proposition does not offer, at least in principle, any difficulty. Ultimately, the use of water for domestic supply and for energy generation implies at multiples uses and functions of water services, as well an integrated water resources management. Therefore, respecting various suggestions, the two destinations of fresh water should be undertaken with the assistance of a methodology in which the conservation of water resources would be the central concern. Supported by a common plan coordinator and putting down the simultaneous use of waters it would be possible to use water for public supply and for energy matrix without sacrificing any of the two

purposes. Remember that historically, "the waters in the region of São Paulo were used in accordance with the needs of each sector, although there is no coordinated policy action" (RUTKOWSKI et OLIVEIRA, 1999:39). Following this logic, the resolution of one problem, without the simultaneous solution of the other, would lead the growth of the city to collapse. Procedure that requires urgent amendment.

2. Another key aspect is directed to the spatial resolution of the basins system that supply the RMSP. The concept of hydrographic basin, corresponding to an area irrigated by a particular river or fluvial system, has been widely accepted as a fundamental geomorphological unit, under whose protection it can capture the dynamics of the flow surface of a network of drainage (CHRISTOFOLETTI, 1990). Therefore, the hydrographic basin approach has been taken as a territorial unit of the utmost importance for the integrated planning of water resources management and the human activities related to the waterways. However, what we observed in GSP may be anything but a drainage system built by nature. The SAM integrates hydro-technical objects resulting from anthropogenic actions, referring to a range of interventions that challenge from every point of view, the cycles of the natural environment. In this interpretation, the reservoirs at GSP would not be reducible to the concept of hydrographic basin but they are, above all, to be conceived as a environmental basin. The space of an environmental basin configures a dynamic conformation, in which the physical dimension, which boundaries are flexible and relative, subject to a set of interrelationships of various levels, an analysis that expands when the focus is an urbanized area, an anthropic space (RUTKOVSKY, 1999b). In summary, the limits of a environmental basin are not physical, but above all, socio-spatial. This concept, being dynamic and flexible in its definition, is a living space of conflict and organization of social relations, key variables

for understanding the solution of problems like those existing in the system of reservoirs of GSP .

3. In recent years, we have to mention the emergence of several Hydrographical Basin Committees (CBH), a new reference to understand fresh water issue in Brazil. As a direct result of environmentalists actions, particularly those related to the protection of aquatic spaces, a large legislation related to the management of water resources conquered legal configuration. Its major landmark was the 1988 Brazilian Federal Constitution. In the section related to water resources, this document established the obligation to obey the National System for Water Resources Management (Title III, art. 21, XIX). In terms of units of the federation, this legislation resulted in the formation of water state systems, in which the participation of civil society was legally empowered. In the ESP, the Law nº 7.663/91 (12-30-1991), implemented the Integrated Water Resources Management (Sistema Integrado de Gerenciamento de Recursos Hídricos - SIGRH) and carried out since the installation of the 21 River Basin Committees currently in operation. The Upper Tietê Hidographical Basin Committee (Comitê de Bacia Hidrográfica do Alto Tietê - CBH-AT), also known as the Waters Parliament, comprises the water system that drains the headwaters and rivers that form the upper reaches of the Tietê.[13] The CBH-AT was installed in 1994. Since 1997, as part of decentralization police of its structure, were created five sub-committees: Cotia-Guarapiranga (1997), Juqueri-Cantareira (1997), Billings-Tamanduateí (1997),

[12] Confirming this affirmative, recalls the geographer Antonio Cezar LEAL, would be necessary to analyze "each specific case of territorial delimitation, not considering just the natural limits of the hydrographical basins, but the use and occupation of soil, the social organization and the hydraulic systems of water and sewage reversions integration" (2003:74).

[13] See more at a detail analysis of CBH-AT made by Marcos Estevan DEL PRETTE (2000:131/148).

Tietê-Cabeceiras (1997) and Pinheiros-Pirapora (1998). It is important to note that the CBH-AT was the first to be created in Brazil. As a pioneer experiment, the CBH-AT condensed a rich history of social mobilization in defense of fresh water in its region. The CBH-AT unite as its staff representation from ESP authorities, RMSP municipalities and civil society institutions. An important aspect are the links held by CBH-AT with the water dynamics of the GSP. Of the 39 municipalities that make up the metropolitan area, only three (Santa Isabel, Guararema and Vargem Grande Paulista), are not included in the CBH-AT. Another point to be emphasized is that the CBH-AT began to gain public visibility and become a reference for the discussion of water resources for this metropolis. However, it is a political representation still under construction, with the challenge to posit a social action within a political architecture that in the case of Brazil, has imposed various altercations to the exercise of citizenship, in a range that extends from authoritarianism of the government agencies to a structure of fear deeply internalized in the Brazilian national ethos (DURAN, 2005:141/186). Thus, the discussion about basin committees still needs more researches and mobilizations before they can make the true extent of their jurisdiction.

4. Reaffirming that we are not focusing on a strictly ecological issue, but environmental, the concept of fresh water supply areas ("áreas de manancial"), defined as the natural concentration of water, needs a better model. A broad meaning of this term can be found, for example, in publications as the ones made by CETESB, where water supply area ("área de manancial") is defined as "the source of water that can be, for example, a river, a lake, a spring or well water, from the the superficial or underground water" (CEPAM-FPFL, 1991:154). But due to the prior announced preference for environmental basin concept, we could not recall parameters permeated in purely natural aspects, on technical considerations, nor based on common sense of ecological meanings. At this last ones,

the terminology water supply area ("manancial") ends to be restricted to the source of rivers or for locations where the water can be obtained to supply people needs, it is this understanding that justifies its general perception and protection as a "natural element". However, the geography, physical or human, simply goes beyond these variables. In our study, the waters suppliers ("mananciais") would designate areas for water production. Thus, the definition not only refers to the natural deposits of liquid that rests in the watered ground, flow from springs or seeps into lakes, but any object (natural or social), linked to what Milton SANTOS understood as "modern engineering systems" (1978, 1988 and 1998). Adopting this criteria, the hydrographical basins must be understood as participants in technical systems related to access to hydric resources, especially those focused on the urban environment. Therefore, the term water production that could go wrong because of "technicalities" bias would, in this exact sense, highlight the fact that the water in the contemporary world is no longer a free resource of nature, and is now available primarily through the human intervention.

Obvious fact, these four assumptions are intelligible only through a complexity in which the modernity requires rethinking the fresh water supplies in a manner quite different from the times when the waters was enjoyed without the variety of sanctions that nowadays rules its obtaining and management (RAFFESTIN, 1993:231). Hence, the development of complex theoretical models that seek to consider issues involving access to this resource so vital to life is fundamental.

So, this paper aimed to feed this discussion by providing conceptual tools related to the the social perception and their effect on the attitudes of many different social actors, supporting objectively this issue when the subject being discussed are the fresh waters of the GSP. Immersed in artificial water systems which ensure

survival, a management excellence can contribute to the perpetuation of RMSP in troubled times in which we live today.

BIBLIOGRAPHY

ALIER, Juan Martinez. El Ecologismo de Los Pobres - Conflictos Ambientales y Lenguajes de Valoración. Barcelona, Espanha: Icaria-Antrazyt-Flacso. 2005;

BARLOW, Maude et CLARKE, Tony. Ouro Azul: como as grandes corporações estão se apoderando da água doce do nosso planeta. São Paulo: M. Books, 2003.

CAMPOS, Valéria Nagy de Oliveira. Aspectos Institucionais da Gestão da Água e a Participação dos Usuários no Processo de Decisão e Implementação das Ações: o caso da Região Metropolitana de São Paulo. In: Encuentro de las Águas: Agua, Vida Y Desarrollo, 10-03- 2001, Santiago, Chile. 2001.

CARLOS, Ana Fani Alessandri. Espaço-Tempo na Metrópole: a fragmentação da vida cotidiana. São Paulo: Contexto, 2001. (Série Acadêmica).

CEPAM-FPFL. Política Municipal de Meio Ambiente. São Paulo: Fundação Prefeito Faria Lima/ Centro de Estudos e Pesquisas de Administração Municipal, 1991.

CETESB Inventário dos Resíduos Sólidos 2002.

CHRISTOFOLETTI, Antonio. Geomorfologia. 2² ed. São Paulo: Edgard Blucher, 1990.

DEL PRETTE, Marcos Estevan. Apropriação dos Recursos Hídricos e Conflitos Sociais: A Gestão das Áreas de Proteção aos Mananciais da Região Metropolitana de São Paulo. 2000. Tese (Doutorado em Geografia) Geography Department São Paulo University. 2000.

DAVIS, Mike, 2006, Planet of Slums. Verso Editorial, London & New York;

DIAS, Genebaldo Freire. Pegada Ecológica e Sustentabilidade Humana. São Paulo: Gaia, 2002.

DURAN, Marina. O Medo e os Vínculos Sociais no Brasil. 2005. Tese (Doutorado em Ciências Sociais) Pontifícia Universidade Católica de São Paulo. São Paulo, 2005.

GUAZZELLI, Vera. Pés no Chão e Olho no Subsolo. Livre Mercado, São Bernardo do Campo, p. 82, jan. 2004.

GIDDENS, Anthony. As Conseqüências da Modernidade. São Paulo: UNESP, 1991.

HESPANHOL, Ivanildo. Água e Saneamento Básico: uma visão realista. In: REBOUÇAS, Aldo da Cunha; BRAGA, Benedito; TUNDISI, José Galiza (Orgs.). Águas Doces no Brasil: capital ecológico, uso e conservação. 2. ed. rev. e ampl. São Paulo: Escrituras, 2002.

ISA. Mapas da Bacia Hidrográfica Billings. In: Relatório Billings 2000. São Paulo: Instituto Socioambiental, 2002.

LEAL, Antonio Cezar. Gestão Urbana e Regional em Bacias Hidrográficas: interfaces com o gerenciamento dos recursos hídricos. In: BRAGA, R.; CARVALHO, P. F. (Orgs.). Recursos Hídricos e Planejamento Urbano e Regional. Rio Claro: LPM/ Deplan/ IGCE/ UNESP, 2003.

NYT. The New York Times 2009 Almanac. New York: Penguin, 2009.

RAFFESTIN, Claude. Por Uma Geografia do Poder. São Paulo: Ática, 1993.

REBOUÇAS, Aldo da Cunha. Uso Inteligente da Água. São Paulo: Escrituras, 2004.

_____. Água Doce no Mundo e no Brasil. In. ___.; BRAGA, Benedito; TUNDISI, José Galiza. (Orgs.). Águas Doces no Brasil: capital ecológico, uso e conservação. São Paulo: Escrituras, 2002a.

REBOUÇAS, Aldo da Cunha; BRAGA, Benedito; TUNDISI, José Galiza. (Orgs.). Águas Doces no Brasil: capital ecológico, uso e conservação. São Paulo: Escrituras, 2002b.

RUTKOVSKI, Emilia. Bacia Hidrográfica e Bacia Ambiental. São Paulo: SABESP; Secretaria de Recursos Hídricos, Saneamento e Obras do Governo do Estado de São Paulo, 1999a.

_____. Desenhando a Bacia Ambiental: subsídios para o planejamento da águas doces metropolitan(izd)as. 1999. Tese (Doutorado em Arquitetura) Faculdade de Arquitetura, University of São Paulo. 1999b.

RUTKOWSKI, Emilia et OLIVEIRA, Ernestina Gomes de. A Gestão das Águas Paulistanas. São Paulo: SABESP; Secretaria de Recursos Hídricos, Saneamento e Obras do Governo do Estado de São Paulo, 1999.

SAM. Mapa do Sistema Adutor Metropolitano, SABESP. In: Intervenção Programada no Sistema Cantareira, São Paulo. 1993.

SANTOS, Milton. Técnica, Espaço e Tempo: globalização e meio técnico-científico informacional. 4ª ed. São Paulo: Hucitec, 1998.

_____. A Urbanização Brasileira. São Paulo: Hucitec, 1993.

_____. Metamorfoses do Espaço Habitado: fundamentos teóricos e metodológicos da geografia. Texto escrito com a colaboração de Denise Elias. São Paulo: Hucitec, 1988.

_____. Por Uma Geografia Nova. São Paulo: EDUSP; Hucitec, 1978.

VERNADSKI, Wladimir. The Biosphere and the Noösphere. EUA: Executive Intelligence Review. 2005.

WALDMAN, Maurício. Lixo: Cenários e Desafios. 1. ed. São Paulo (SP): Cortez Editora, 2010a.

_____. Metrópole das Águas Escassas. Boletim dos Funcionários do Instituto ACQUA - Ação, Cidadania, Qualidade Urbana e Ambiental. Ribeirão Pires (SP): edição especial para o Dia Mundial do Meio Ambiente. Acess on line in: <http://www.mw.pro.br/mw/geog_metropole_das_aguas_escassas.pdf>. 2010b.

_____. Água: Debate Estratégico para Brasileiros e Angolanos. Paper, XIVª Jornadas Técnico-Científicas da Fundação Eduardo dos Santos (FESA). Palácio dos Congressos/Assembléia Nacional, Luanda, República de Angola. Acess on line in: <http://www.mw.pro.br/mw/geog_fesa_luanda_2010>.pdf. 2010c.

_____. O Desafio das Megacidades. Coluna do Waldman. São Paulo (SP): site Cultura Verde, 2009a.

_____. Noções e Conceitos Básicos sobre Saneamento Básico - Água e Esgoto - Resíduos Sólidos e Tecnologias da Reciclagem. Americana (SP): Consórcio Intermunicipal das Bacias Hidrográficas dos Rios Piracicaba, Capivari e Jundiaí (CONSÓRCIO PCJ) e Fundação Estadual de Recursos Hídricos (FEHIDRO). Acess on line in: <http://www.mw.pro.br/mw/geog_texto_apoio_pcj.pdf>. 2009b.

_____. Billings: Cenários da Escassez, Jornal Diário do Grande ABC. Santo André (SP): DGABC, p. 2 - 2, 13 nov. 2008.

_____. De Olho na Billings, Jornal Diário do Grande ABC. Santo André (SP): DGABC, p. 2 - 2, 26 nov. 2007a.

_____. Desafios da Água e do Lixo, Jornal Diário do Grande ABC. Santo André (SP): DGABC, p. 2 - 2, 23 dez. 2007b.

_____. Água e Metrópole: Limites e Expectativas do Tempo (Water and Metropolis, Limits and Expectations of the Time). Tese de Doutorado em Geografia. Geography Department of FFLCH/USP. Acess on line São Paulo University Digital Library: <http://www.teses.usp.br/teses/disponiveis/8/8136/tde-20062007-152538/>. 2006a.

_____. Meio Ambiente & Antropologia. 1ª. ed. São Paulo (SP): Editora SENAC. 2006b.

_____. Sede no País das Muitas Águas. Paper. São Bernardo do Campo (SP): AGDS - Associação Global para o Desenvolvimento Sustentado. Acess on line in: http://www.mw.pro.br/mw/geog_sede_no_pais_das_muitas_aguas.pdf. 2005.

_____. A Tragédia dos Mananciais do Grande ABC. Paper. São Bernardo do Campo (SP): AGDS - Associação Global para o Desenvolvimento Sustentado. Acess on line in: <http://www.mw.pro.br/mw/geog_tragedia_dos_mananciais.pdf>. 2004.

_____. Cidadania Ambiental: natureza e sociedade como espaço de cidadania. In: PINSKY, Jaime; PINSKY, Carla B. (Coord.). História da Cidadania. São Paulo: Contexto, p. 545-561. 2003a.

_____. Recursos Hídricos: os impactos da produção de alimentos e dos resíduos sólidos, SEPEGE - Seminário de Pesquisa em Geografia. São Paulo: Programa de Pós-Graduação em Geografia Humana Departamento de Geografia. University of São Paulo. 08-10 dez. 2003b.

_____. Mais Água, Menos Lixo: Reciclar ou Repensar?. In. Boletim Paulista de Geografia, nº 79, pp. 91-106, Julho de 2003, Brazilian Geographers Association, São Paulo Sector, 2003c.

_____. Recursos Hídricos e Rede Urbana Mundial: Dimensões Globais da Escassez. In: XIIIº Encontro Nacional de Geógrafos, 2002, João Pessoa, Paraíba: Anais do XIIIº Encontro Nacional de Geógrafos - Caderno de Resumos. São Paulo: AGB - Associação dos Geógrafos Brasileiros. Acess on line in: http://www.mw.pro.br/mw/geog_recursos_hidricos_e_a_rede_urbana_mundial.pdf. 2002.

_____. Tempo, Modernidade e Natureza. Caderno Prudentino de Geografia, Presidente Prudente, nº 16, pp. 24-73, set. 1994. Brazilian Geographers Association of São Paulo , Presidente Prudente Sector. Acess on line in: <http://www.mw.pro.br/mw/geog_tempo_modernidade_e_natureza.pdf>. 1994.

_____. Divisão Internacional dos Riscos Técnicos e Ambientais. CEDI - Centro Ecumênico de Documentação e Informação: Tempo e Presença (revista), São Paulo e Rio de Janeiro, nº 261, Edição Especial Meio Ambiente. Acess on line in: http://www.mw.pro.br/mw/geog_divisao_intern_riscos_1992.pdf. 1992.

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