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The multidimensional nature of the Environmental Contribution for environmental qualification in São Paulo

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SUMMARY

This paper describes the conception of the Environmental Contribution instrument in the municipality of São Paulo, with the aim of exploring the multidimensional nature of this instrument, namely: its potential to promote improvements in the city's drainage system, microclimate conditions and biodiversity, as well as encouraging the development of sustainable buildings through certification and promoting environmental quality in the densification process. It also takes stock of the implementation of the instrument in the city of São Paulo between 2016 and 2023, through the project approval reports from the Municipal Urban Planning and Licensing Department (UPLD). In this context, the multidimensional nature of the instrument and its high potential to promote improvements in the city's environmental quality and to contribute to São Paulo's adaptation to the impact of climate change are proven. At the same time, the instrument's scope is limited, and it urgently needs to be improved so that the Environmental Contribution has a wider reach in the territory and is consequently more effective in improving the city's environmental quality.

KEYWORDS: Environmental Contribution, Zoning, São Paulo.

1. INTRODUCTION

The Environmental Contribution is an instrument created in 2016 in the Municipality of São Paulo during the process of revising the zoning law (Municipal Law No. 16.402/16). In essence, it consists of a set of land use and building parameters that must be observed in new projects that are built on lots with a land area of more than 500 m² and also in cases of renovation of existing buildings with an increase in built area of more than 20%. The aim of these parameters is to improve the environmental quality of these new developments. But what does this environmental qualification mean?

The process of formulating the Environmental Contribution took place during 2015, which was marked by a major water crisis in the state of São Paulo: the Cantareira system, which is mainly responsible for supplying water to São Paulo's Metropolitan Region, experienced a severe drought, which compromised the distribution of water to the population. At the same time, in the same year, there were no serious drainage problems in the city. So what prompted the proposal for the Environmental Contribution?

The Environmental Contribution did not emerge as a response to a specific and momentary environmental problem, or to an extreme event that generated a disaster, but as a holistic solution conferred by urban regulation to bring about environmental improvements related to at least three major themes: improvement in the drainage system, improvement in the microclimate and improvement in biodiversity. In addition to these three major themes, the Environmental Contribution was also designed to encourage improvements in the sustainability of new buildings and existing buildings to be renovated.

The study carried out by Caetano (2016) is one of the most complete works in terms of describing the foundations, concepts and references used to formulate the Environmental Contribution. In fact, the author was one of those responsible for proposing the instrument, which did not depend on hiring specialized technical consultants, having been formulated by technicians and managers from São Paulo City Hall.

In turn, to describing the Environmental Contribution mechanism, Santos, Watanabe, Gallardo, Brites and Pereira (2023) examined the performance of its application in the Aricanduva River basin in São Paulo. The authors reached the following conclusion:

ISSN 2318-8472, v. 12, n. 85, 2024

> The detailed study of the developments located in the Aricanduva basin focused on solutions related to urban drainage and showed that if 100% of the developments on plots of more than 500 m² in the region are considered, using a reservoir volume equal to 43.8 m³, it is possible to compensate 58% of the proposed reservoir volume for flood control, in accordance with one of the alternatives (third) in the Aricanduva Basin Notebook. This figure shows a significant contribution to urban drainage at source level, from the plot itself. We can also add that if we consider the option of applying EQ for plots smaller than 500 m², considering a reservoir volume equal to 1 m³, and all the other calculation hypotheses used in this study, it would be possible to deduct 28% of this volume from the third proposal. (SANTOS, WATANABE, GALLARDO, BRITES and PEREIRA, 2023, p. 21)

Recently, Anelli and Kiste (2024) examined the applicability of the Environmental Contribution in the context of urban drainage in the municipality of São Paulo. The authors drew attention to the instrument's limitations, especially with regard to its scope, since it only covers new buildings and renovations with a 20% increase carried out on plots with an area greater than 500m².

Silva, Benites, Monteiro and Duarte (2019) carried out a comparative analysis of the Environmental Contribution with similar mechanisms in other cities: the Biotope Area Factor (BAF) in Berlin, Germany; the Green Space Factor (GSF) in Malmö, Sweden; and the Green Factor (SGF) in Seattle, USA. The study recognizes the potential of the Environmental Contribution to improve the vegetation of the lot compared to other models but considers that "the true environmental contribution of certain combined elements and the level of performance of the ecosystem services achieved in relation to the required score are still unknown" (SILVA, BENITES, MONTEIRO and DUARTE, 2019, p. 19).

Although the works mentioned above have examined the characteristics of the Environmental Contribution and some of the results of its application, none of them have explored its multidimensional nature, in other words, the multiple dimensions or functions of the instrument. It is understood that the Environmental Contribution mechanism has multiple purposes, potential and virtues, which can be identified in some dimensions: promoting improvements in the city's drainage system; promoting microclimate improvements in the city; promoting improvements in biodiversity; encouraging the development of sustainable buildings through certification; promoting environmental quality in the city's densification process.

The aim of this article is to demonstrate the multidimensional nature of the Environmental Contribution instrument, assessing how this mechanism can contribute to the dimensions or purposes described. It also aims to present an assessment of its implementation from 2016 to 2023, describing how the projects approved during this period addressed these five dimensions.

2. OBJECTIVE

The aim of this article is to describe the conception and take stock of the implementation of the Environmental Contribution instrument in the municipality of São Paulo between 2016 and 2023, in order to explore the multidimensional nature of this instrument, namely: promoting improvements to the city's drainage system; promoting microclimate improvements in the city; promoting improvements in biodiversity; encouraging the

ISSN 2318-8472, v. 12, n. 85, 2024

development of sustainable buildings through certification; promoting environmental quality in the city's densification process.

3. METHODOLOGY

To develop the work, the instrument was first described using the normative reference (Municipal Laws No. 16.402/16 and 18.081/24 and Municipal Decree No. 57.565/16) and the work developed by Caetano (2016).

In sequence, a survey was carried out of the project approval reports of the Municipal Secretariat of Urbanism and Licensing, which are available on the secretariat's website[1].

Based on the survey, a matrix was drawn up of all the projects that applied the Environmental Contribution instrument by year, in order to identify the construction, landscaping and environmental solutions adopted in the projects.

A map was also drawn up showing the location of the projects that applied the Environmental Contribution.

After the matrix and map had been drawn up, the data was analyzed in order to take stock about the application of the instrument, examining the dimensions identified: promoting improvements in the city's drainage system; promoting microclimate improvements in the city; promoting improvements in biodiversity; encouraging the development of sustainable buildings through certification; promoting environmental quality in the city's densification process.

Finally, the text of the article was consolidated.

4. DESCRIPTION OF THE ENVIRONMENTAL CONTRIBUTION INSTRUMENT

To understand how the Environmental Contribution mechanism works, it is first necessary to identify the scope of the instrument. According to articles 76, 79 and 80 of Municipal Law 16.402/16, any new building or renovation project with a change in floor area of more than 20% must meet the minimum Environmental Contribution score defined in Table 3A and Map 3 of the law, in addition to the installation of a runoff control reservoir and a reservoir to use rainwater from the roofs of buildings for non-potable purposes. Exceptional cases exempt from complying with the minimum score and the aforementioned reservoirs are properties in the Urban Intervention Area in Central Sector, whose existing and regular occupancy rate is higher than 0.7 and properties located in the Urban Containment and Sustainable Use and Natural Ecosystem Preservation Macro Areas, grouped in the Environmental Qualification Perimeter - PA13.

[1] Available at: https://www.prefeitura.sp.gov.br/cidade/secretarias/licenciamento/servicos/index.php?p=156417

GC Revista Nacional de Gerenciamento de Cidades
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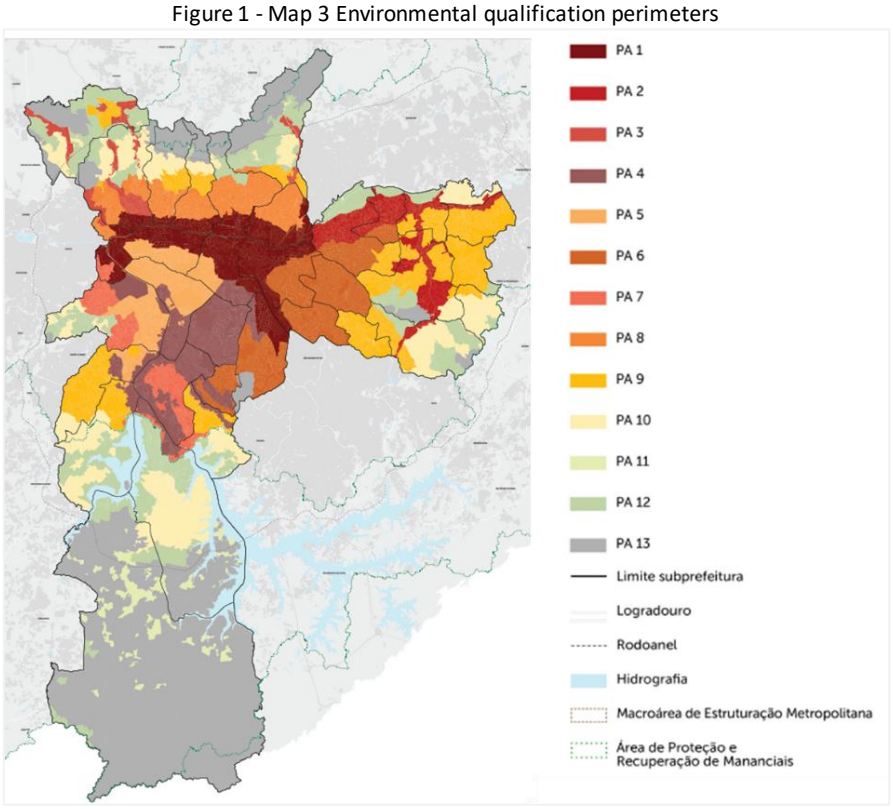
Figure 1 - Map 3 Environmental qualification perimeters



Source: Municipal Law No. 16.402/16 and SMDU, 2016

Figure 2 - Table 3A Environmental Contribution: minimum score, minimum permeability rate and environmental qualification perimeters

Perímetro de Qualificação Ambiental	TAXA DE PERMEABILIDADE (a) (b)		PONTUAÇÃO QA MÍNIMO					FATORES	
	Lote ≤ 500 m²	Lote > 500 m²	Lote > 500 e ≤ 1000 m²	Lote > 1000 e ≤ 2500 m²	Lote > 2500 e ≤ 5000 m²	Lote > 5000 e ≤ 10000 m²	Lote > 10000 m²	Cobertura Vegetal (alfa)	Drenagem (beta)
PA 1	0,15	0,25	0,45	0,60	0,70	0,80	1,00	0,5	0,5
PA 2	0,15	0,25	0,40	0,52	0,64	0,70	0,86	0,5	0,5
PA 3	0,15	0,25	0,37	0,48	0,60	0,65	0,78	0,5	0,5
PA 4	0,15	0,25	0,37	0,48	0,60	0,65	0,78	0,5	0,5
PA 5	0,15	0,25	0,29	0,37	0,46	0,50	0,57	0,4	0,6
PA 6	0,15	0,20	0,34	0,44	0,55	0,60	0,71	0,5	0,5
PA 7	0,15	0,20	0,31	0,41	0,51	0,55	0,64	0,3	0,7
PA 8	0,15	0,20	0,37	0,48	0,60	0,65	0,78	0,5	0,5
PA 9	0,10	0,15	0,37	0,48	0,60	0,65	0,78	0,5	0,5
PA 10	0,20	0,25	0,23	0,30	0,37	0,40	0,42	0,6	0,4
PA 11	0,20	0,30	0,26	0,34	0,42	0,45	0,49	0,6	0,4
PA 12	0,20	0,30	0,26	0,34	0,42	0,45	0,49	0,5	0,5
PA 13 (c)	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notas:

NA = Não se aplica

a. Nos lotes inseridos em ZEPAM, ZPDSr, ZPDS, ZCOR, ZPR e ZER deverão ser aplicadas as seguintes taxas de permeabilidade mínima: 0,90, 0,70, 0,50, 0,30, 0,30 e 0,30, respectivamente, independente do tamanho do lote;

b. Quando a somatória da taxa de permeabilidade do Quadro 3A com a taxa de ocupação do Quadro 3 for superior à 1,00 (um inteiro), a taxa de permeabilidade deverá ser respeitada e a taxa de ocupação reduzida proporcionalmente;

c. O PA 13 corresponde às Macroáreas de Contenção Urbana e Uso Sustentável e de Preservação dos Ecossistemas Naturais, nas quais não se aplicam as exigências da Quota Ambiental.

Source: Municipal Law No. 16.402/16 and SMDU, 2016

As can be seen in Table 3A of Municipal Law No. 16.402/16, depending on the environmental qualification perimeter in which the property is located and its size, the minimum score required also changes. Thus, the larger the land area, the higher the minimum score required for a project to be approved.

ISSN 2318-8472, v. 12, n. 85, 2024

To achieve the minimum score, the intended project must use the architectural, landscaping and construction solutions listed in Table 3B of Municipal Law 16.402/16[2] . There are several alternatives, such as: landscaped areas on natural soil and on slabs, small, medium and large trees, green roof, green wall, vertical garden, semi-permeable sidewalk, among others.

For each solution, a value was set for the environmental effectiveness factor of the vegetation cover indicator (FV) and another value for the drainage factor (FD). Depending on whether the project adopts the available solutions, the score achieved follows the formula set out in calculation notes I and IV in Table 3B of Municipal Law 16.402/16:

Score achieved = P x FV (or FD) / A, where:
P: Proposed project, according to the unit indicated;
VF: Environmental effectiveness factor for the vegetation cover indicator;
DF: Environmental effectiveness factor of the drainage indicator;
A: Plot area, in square meters.

The sum of the scores achieved for each VF and DF factor results in a partial value, and to obtain the final values, the following formulas must be observed, according to calculation notes III and VII in Table 3B of Municipal Law 16.402/16:

FINAL SCORE FOR THE VEGETATION COVER INDICATOR (V):
FINAL V = V PARTIAL/0.38, where:
FINAL V: final score for the vegetation cover indicator;
PARTIAL V = sum of the score obtained for FV;
0.38 = reference value for the vegetation cover indicator.
FINAL SCORE FOR THE DRAINAGE INDICATOR (D), calculated according to the following variables:
if SD ≤ 0.38; then D FINAL = 1.0
if DP > 0.38; then D FINAL = 1-(0.0105 x (VP/A)-DP+0.38)/(0.38-DP), where:
FINAL D: final score for the drainage indicator;
PD: PARTIAL D, calculated according to the sum of the scores obtained for FD;
PV: Proposed runoff control reservoir volume, as per item III H, in liters;
A: Plot area, in square meters.
Note: The PV volume does not include the volume of rainwater reservoirs on the roof.

It is also important to note that alpha (α) and beta (β) weighting factors were created according to the different environmental qualification perimeters (Table 3A of Municipal Law 16.402/16), which are taken into account when consolidating the final score, according to calculation note VIII in Table 3B of Municipal Law 16.402/16:

FINAL SCORE ENVIRONMENTAL CONTRIBUTION: $EQ = V^{\alpha} \times D^{\beta}$, where:
EQ: Environmental Contribution score achieved;
V: final score for the vegetation cover indicator, according to the calculation note (III);
D: final score for the drainage indicator, according to the calculation note (VII);
α: alpha factor, according to table 3A;
β: beta factor, according to table 3A.

In addition to these solutions, every project must provide for the installation of a runoff control reservoir and a reservoir for using rainwater from building roofs for non-potable

[2] For more information on Table 3B, please refer directly to the law, available at: https://legislacao.prefeitura.sp.gov.br/leis/lei-16402-de-22-de-marco-de-2016/anexo/664cd3501411922869d4e0b9/Quadro%203B%20-%20Composi%C3%A7%C3%A3o%20da%20pontua%C3%A7%C3%A3o%20da%20Quota%20Environmental.pdf

ISSN 2318-8472, v. 12, n. 85, 2024

purposes. The sizing of the runoff control reservoir must be done in accordance with calculation note VI of Table 3B of Municipal Law No. 16.402/16 described below:

> Min. Vol.= 6.3x A, where:
> Min. Vol.: Minimum reservoir volume required to control surface runoff, in liters;
> A: Total area of the plot, in square meters.

In turn, the sizing of the reservoir for the use of rainwater from the roofs of buildings for non-potable purposes must be done in accordance with the provisions of article 80 of Municipal Law No. 16.402/16:

> I - in the case of waterproof roofs:
> Vri = 16.00 x ACi, where:
> Vri: minimum reservoir volume for the use of rainwater from impermeable roofs, in liters;
> ACi: impermeable coverage area, in square meters;
> II - in the case of green roofs:
> Vrv = 5.4 x ACv, where:
> Vrv: minimum reservoir volume for using rainwater from green roofs, in liters;
> AGC: area of green cover, in square meters.
> In the case of mixed roofs (waterproof part/green part):
> MRV = Vri + Vrv, where:
> MRV: minimum reservoir volume for the use of rainwater from mixed roofs, in liters;

As you can see, the minimum score for the Environmental Contribution means that a given project generates solutions aimed at improving drainage and vegetation simultaneously, with the latter having the potential to improve both biodiversity and microclimate conditions, especially as a result of the shading provided by the trees.

A little-explored aspect of the Environmental Contribution instrument is the Environmental Contribution and Certification incentives, which are included in articles 82 and 83 of Municipal Law 16.402/16, respectively.

In the case of the Environmental Contribution Incentive, this is a discount on the value of the financial contribution of the Onerous Concession of the Building Rights due on the intended project, which is levied on developments that adopt a score higher than the minimum required, according to the following formula in article 82 of Municipal Law 16.402/16:

> EQI = [2 x (CAP - 1) / (CAP)] X EQF X At, where:
> EQI: Environmental Contribution Incentive, in reais (R$);
> IUC: Intended Utilization Coefficient of the development;
> EQF: Environmental Contribution Incentive Factor, in reais (R$) per square meter, available in Table 3C, according to the size of the land, the Environmental Qualification Perimeter where the development is located and the Min EQV, which corresponds to the ratio between the numerical value of the EQ achieved by the development project and the minimum EQ value required.
> LA: land area in square meters.

ISSN 2318-8472, v. 12, n. 85, 2024

Figure 3 - Table 3C Environmental Contribution incentive factor

Perímetro de Qualificação Ambiental	Lote > 500 e ≤ 1.000m²				Lote > 1.000 e ≤ 2.500m²				Lote > 2.500 e ≤ 5.000m²				Lote > 5.000m²			
	pontuação ≥ 1,5 e < 2 vezes QA min	pontuação ≥ 2 e < 3 vezes QA min	pontuação ≥ 3 e < 4 vezes QA min	pontuação ≥ 4 vezes QA min	pontuação ≥ 1,5 e < 2 vezes QA min	pontuação ≥ 2 e < 3 vezes QA min	pontuação ≥ 3 e < 4 vezes QA min	pontuação ≥ 4 vezes QA min	pontuação ≥ 1,5 e < 2 vezes QA min	pontuação ≥ 2 e < 3 vezes QA min	pontuação ≥ 3 e < 4 vezes QA min	pontuação ≥ 4 vezes QA min	pontuação ≥ 1,5 e < 2 vezes QA min	pontuação ≥ 2 e < 3 vezes QA min	pontuação ≥ 3 e < 4 vezes QA min	pontuação ≥ 4 vezes QA min
PA 1	28	34	44	52	30	34	44	54	30	40	58	76	32	42	60	76
PA 2	26	32	40	50	26	32	40	50	28	38	58	76	30	38	58	76
PA 3	26	30	38	48	26	30	38	48	28	34	44	54	32	44	70	80
PA 4	28	32	42	52	28	32	42	52	30	40	60	78	36	42	60	78
PA 5	24	28	36	44	24	28	36	46	28	32	40	50	28	36	54	72
PA 6	26	30	40	50	26	30	40	50	28	32	44	54	28	38	58	76
PA 7	28	32	40	48	30	32	40	48	32	36	44	52	32	36	44	52
PA 8	28	32	42	52	28	32	42	52	28	38	58	76	30	38	58	76
PA 9	28	32	42	52	28	32	42	52	30	40	60	78	36	42	60	78
PA 10	20	22	26	30	20	22	26	32	20	24	30	36	20	24	30	38
PA 11	20	24	28	32	20	24	28	34	20	24	30	38	20	24	32	40
PA 12	22	24	30	36	22	26	32	36	24	26	34	42	24	28	36	42
PA 13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Nota:

NA = Não se Aplica

a. Em Reais (R$) por metro quadrado.

Source: Municipal Law No. 16.402/16 and SMDU, 2016

As an alternative to the incentive in the form of a discount on the value of the financial contribution from the onerous grant, when the project achieves between 2 and 4 times the minimum Environmental Contribution score, the entrepreneur can opt to receive a benefit in the non-computable area incentivized, according to the following formulas:

> For land located in the PA-1, PA-4, PA-5, PA-6, PA-7, PA-10, PA-11, PA-12 environmental qualification perimeters:
> NCEQ = (EQV Min - 1) x At x 0.07
> For the other environmental qualification perimeters:
> NCEQ = (EQV Min - 1) x At x 0.09, where:
> EQ: additional non-computable area, in square meters, resulting from the increase in the Environmental Contribution;
> EQV Min: ratio between the numerical value of the EQ achieved by the project and the minimum required value of the EQ, ranging from 1.5 to 4, in accordance with Table 3A of this Law;
> At: land area

It should be noted that the incentive described applies to developments that use the additional building potential in relation to the basic utilization coefficient (as these are situations in which the Onerous Concession of the Building Rights is applied), which means that these are high-density developments. In other words, the Environmental Contribution, in these cases, would be contributing to the environmental improvement of building density.

Another incentive provided for is the Certification Incentive, which also consists of a discount on the financial contribution from the Onerous Concession of the Building Rights, for new buildings or renovations with an increase in built area of more than 5% that obtain specific sustainability certification recognized at national or international level. The value of the incentive depends on the type of certification adopted and must be calculated in accordance with article 82 of Municipal Law 16.402/16:

> IC = FC x LA x IUC, where:
> IC: Certification Incentive, in Reais (R$), to be deducted from the total value of the financial counterpart of the Concessional Grant of the Right to Build;

ISSN 2318-8472, v. 12, n. 85, 2024

FC: Certification Factor, according to the degree of certification:
I - for the minimum degree of certification: FC = R$ 56/m²;
II - for the highest level of certification:
FC = R$ 300/m²;
At: land area in square meters;
CAP: Intended Utilization Coefficient of the development.

The municipality will be responsible for assigning the incentive amount according to the degree of certification, by means of regulations to be issued by the Municipal Secretariat of Urban Development (now the Municipal Secretariat of Urbanism and Licensing), which must take into account the guidelines set out in the sole paragraph of article 16 of Municipal Decree 57.564/16.

Similar to the Environmental Contribution Incentive, the Certification Incentive also seeks to promote the environmental qualification of developments that require the application of the Onerous Concession of the Building Rights and which are consequently buildings with a higher construction density. The big difference in this case is that, in order to obtain certification, the project must adopt a wide range of architectural, landscaping, plant and construction solutions, as well as work execution procedures that meet various sustainability parameters. To the extent that the incentive encourages projects to adopt the highest levels of certification in order to obtain greater discounts on the value of the financial contribution from the onerous grant, it also makes it possible to create sustainable buildings.

5. RESULTS

As mentioned, in order to examine the application of the Environmental Contribution, we used the approval reports made available by the Municipal Secretariat of Urbanism and Licensing on its website. This database does not contain developments that have actually been built, but only data relating to approval permits and execution permits for new buildings and renovations. In other words, it is not known whether the projects have been carried out or not. Even with this uncertainty, this study has made progress in analyzing the data on project approvals, as this is relevant evidence of the probable viability of real estate projects, since the construction authorization act is costly and time-consuming to issue and, therefore, those who request it and follow up on its issuance probably intend to actually carry out a project.

Table 1 shows data on the approval of new building and renovation projects, identifying the complete universe of permits issued and the universe in which the Environmental Contribution was applied during the period. It can be seen that from 2016 to 2023, the Environmental Contribution was present in only 4.21% of the projects approved in this period, totaling 415 projects that applied the instrument. This is a small universe, since the Environmental Contribution does not apply to Social Housing Projects - EHIS, Popular Market Housing Projects - EHMP and Projects in Special Zones of Social Interest - EZEIS. In addition, the Environmental Contribution is only levied on plots of land with an area of more than 500m², on new buildings and on renovations with an increase in built area of more than 20%.

Table 1 - Permits issued from 2016 to 2023

GC Revista Nacional de Gerenciamento de Cidades
National Journal of City Management

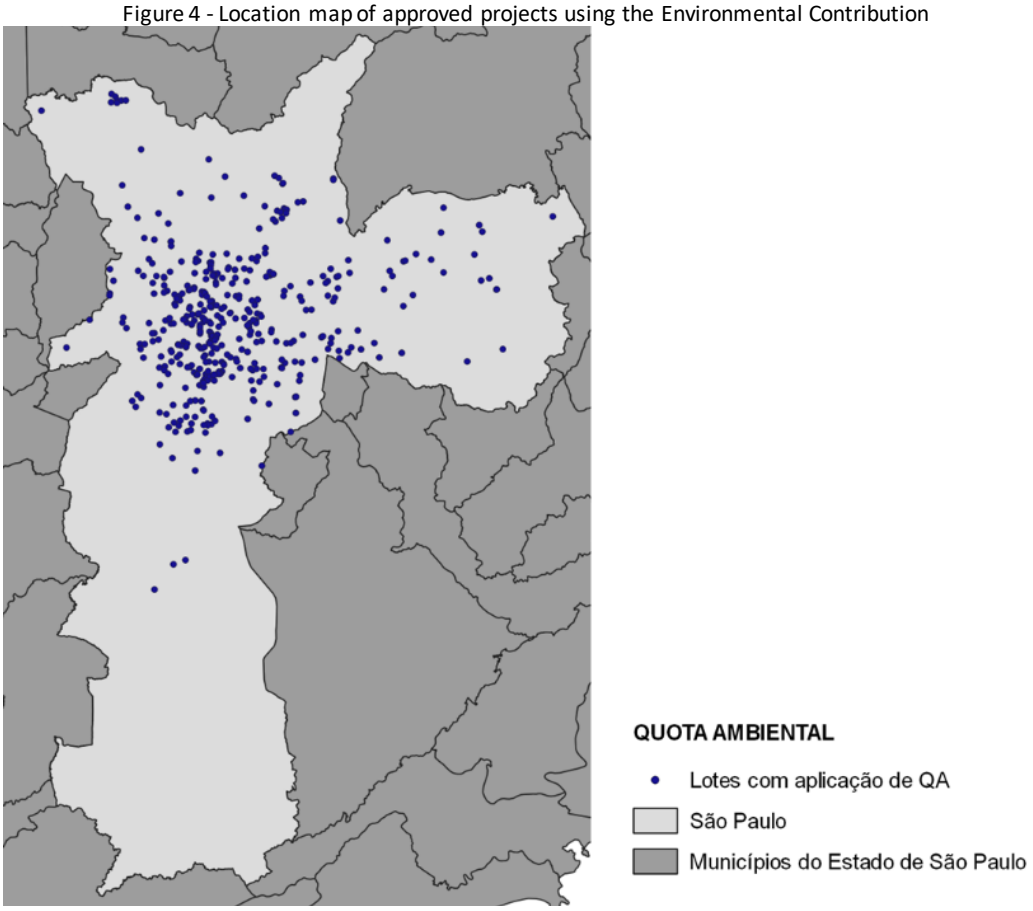
ISSN 2318-8472, v. 12, n. 85, 2024

Permits issued per year	2016	2017	2018	2019	2020	2021	2022	2023	TOTAL
Total new building and renovation permits	686	655	711	994	1.145	1.420	2.027	2.214	**9.852**
Total new building and renovation permits with Environmental Contribution	2	23	41	15	3	5	47	276	**415**
% of permits with an Environmental Contribution in relation to the total	0,29%	3,51%	5,91%	1,51%	0,35%	0,42%	2,32%	12,47%	**4,21%**

Notes:
(1) Only approval permits and permits for new buildings and renovations were taken into account.
(2) EQ does not apply to EHIS, EHMP and EZEIS projects.
(3) EQ only applies to plots with a land area of more than 500m².
(4) EQ only applies to new buildings and renovations with a 20% increase in floor area.

Source: Project approval reports - UPLD

Figure 4 - Location map of approved projects using the Environmental Contribution



Source: Prepared by the authors

With regard to the location of the developments, Figure 4 shows a map with the location of the 415 projects that used the Environmental Contribution. There is a greater concentration of developments in the city's expanded center, demonstrating that the instrument is applied in association with real estate development, especially in vertical development projects.

As for the proposal for a landscaped area on the plot (a basic and obligatory measure for all projects that use the Environmental Contribution), if we consider all the projects that have used the Environmental Contribution, 267,956.09m² of permeable landscaped area has been set

ISSN 2318-8472, v. 12, n. 85, 2024

aside for a universe of 1,049,680.02m² of land area, which corresponds to an average permeability rate of 25.53%.

With regard to the proposal for vegetation on the lot, of the 415 approved projects that applied the Environmental Contribution, 337 (81%) provided for the use of different types of trees, totaling more than 10,149 small, medium and large trees, as well as palm trees to be planted or maintained on the lots. It is important to note that in only 13.67% of the cases was provision made for the preservation of existing vegetation, and there was no information on the practice of tree management. This is an average ratio of approximately 10 trees for every 1,000m² of private land.

Table 2 - Projects using trees from 2016 to 2023

Projects with EQ application	2016	2017	2018	2019	2020	2021	2022	2023	TOTAL	%
Projects using trees	2	18	31	10	0	4	36	236	337	81%
Projects without the use of trees	0	3	4	0	3	1	5	22	38	9%
Projects in which there is no information on the use of trees	0	2	7	5	1	1	6	18	40	10%
TOTAL	**2**	**23**	**42**	**15**	**4**	**6**	**47**	**276**	**415**	**100%**

Source: Project approval reports - UPLD

Table 3 - Quantification of trees planted or maintained (2016 to 2023)

Year	Small	Medium	Large	Palmeiras	Maintenance of existing trees	Total
2016	4	24	12	14	45	99
2017	393	231	42	153	88	907
2018	170	201	1718	126	99	2.314
2019	8	17	4	21	47	97
2020	0	0	0	0	0	0
2021	8	14	0	0	7	29
2022	270	214	94	134	280	992
2023	1.595	2.128	278	889	821	5.711
TOTAL	**2.448**	**2.829**	**2.148**	**1.337**	**1.387**	**10.149**

Source: Project approval reports - UPLD

With regard to the proposal for runoff control reservoirs (or retention reservoirs), if we consider all the projects that used the Environmental Contribution and their respective land areas (which totals 1,049,680.02m²), a total reservoir volume of 6,798,483.85 liters would be required. However, the projects foresaw a much larger volume of 17,603,063.81 liters. This is an average reservoir ratio of 16.77 liters per square meter of land area.

With regard to the use of the Environmental Contribution incentive, only 16 projects planned to use the incentive, which corresponds to 3.86% of the total number of projects that used the Environmental Contribution. In the case of the Certification Incentive, only 24 projects planned to use this instrument, which corresponds to 5.78% of the total number of projects that used the Environmental Contribution. It is clear that the incentives have not yet been widely adopted.

With regard to the profile of approved projects that have applied the Environmental Contribution, the majority are vertical developments, as 90% of all these projects have a building

ISSN 2318-8472, v. 12, n. 85, 2024

height of more than 6m (or 2 floors) and 56% have a height of more than 12m (or 4 floors). This data shows that most of the projects that apply the Environmental Contribution are vertical buildings, proving that this is an instrument applied in conjunction with building densification.

The data proves the multidimensional nature of the Environmental Contribution instrument, as the approved projects do in fact provide for improved drainage through various solutions, especially the use of runoff control reservoirs, resulting in an average reservoir ratio of 16.77 liters per square meter of land area; they provide for the improvement of the microclimate and biodiversity of the surroundings of the projects that use the instrument through the proposal of 10.149 small, medium and large trees, as well as palm trees to be planted or maintained on the lots, which corresponds to an average ratio of approximately 10 trees for every 1.000m² of land area; although still incipient, the projects approved provide for the adoption of various sustainable solutions through the application of sustainability certification; this is an instrument that effectively promotes the environmental improvement of building density, since most of the projects on which the Environmental Contribution is applied are vertical buildings that provide for runoff control reservoirs, landscaped (or permeable) areas, planting or maintenance of vegetation on the plot, among other solutions that contribute to the environmental improvement of the vertical building system.

6. CONCLUSION

This study demonstrates the multidimensional nature of the Environmental Contribution to promote environmental improvements in the city of São Paulo, by proving that this instrument is being used in projects approved between 2016 and 2023, as well as by the construction, landscaping and technological solutions that have been adopted in these projects.

It can also be said that the Environmental Contribution instrument has a high potential to contribute to adapting the city of São Paulo to the impact of climate change, especially with regard to the occurrence of intense rainfall that generates floods and flash floods, as the instrument can contribute to the retention and infiltration of the water from these rains, avoiding large volumes of water in a short space of time, overloading the drainage system, floodplain areas and the city's own hydrography.

The work shows that there is an urgent need to improve the information on the use of the instrument, especially the disclosure of data on the buildings that have been built using the Environmental Contribution instrument, as well as data on the maintenance of the architectural, landscaping, plant and construction solutions adopted. For example, the biannual reports provided for in article 84 of Municipal Law 16.402/16 were not found to exist. These reports should be published on the internet for broad public access.

The study also shows that the Environmental Contribution has only been applied to 4.21% of the projects approved between 2016 and 2023, which highlights the urgent need to expand the scope of this instrument. Looking ahead, it is suggested that the instrument be obligatorily applied to Social Interest Housing Projects (EHIS), Popular Market Housing Projects (EHMP) and Projects in Special Zones of Social Interest (EZEIS) and that it be applied to all new buildings on plots of land with an area of more than 250m², maintaining its incidence in cases of renovation with an increase in built area of more than 20%.

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Finally, we conclude that the Environmental Contribution is an instrument that should be improved and applied more forcefully in the municipality of São Paulo and even replicated in other municipalities, given its multiple functions or dimensions to contribute to improving the city's environmental quality. And it should be noted that adapting cities to the impact of climate change is not the result of a single action, a single instrument, but of a set of actions in the programmatic and regulatory field of state action. In this context, the Environmental Contribution is a powerful instrument, but it alone will not make São Paulo or any other city resilient to extreme events.

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