

TECHNICAL REPORT

Client: City Hall of São José dos Campos

Municipality: São José dos Campos - SP

Location: Roberto Burle Marx Municipal Park Avenida Olívio Gomes, 100, Santana
Place of Application: Lago Menor

PERIOD: APRIL / 2018 TO AUGUST / 2018



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1 Introduction

The City Park: Located on Avenida Olívio Gomes, 100, in the Santana neighborhood, 10 km from the City Center, the City Park, as it is popularly known, is the largest urban park in São José dos Campos. Occupying an area of 960.160,17m² receives about 800 visitors daily, and, on weekends this number grows to about 3,500 people looking for the tranquility of its facilities and direct contact with nature.



Image 1: Aerial view of City Park

The Park was officially opened to the population in 1996, named Roberto Burle Marx Park in honor of the idealizer of the gardens and all the landscaping of the park. In 2004, the park was considered an architectural and environmental patrimony by the Municipal Council for Preservation of Historic, Artistic, Landscape and Cultural Heritage of the Municipality of São José dos Campos (COMPHAC), the same year that it became "legally" public and owned by the City Hall.

It currently houses the Museum of Folklore, in the former residence Olivo Gomes, designed by the Italian architect Rino Levi. In addition, the park houses a butterfly room, dog room, fitness equipment and venues for events. The population can also enjoy the two lakes, the artificial island, and enjoy the nature and the conviviality with wild animals such as birds and capybaras.

1. Law of Innovation

On July 13, 2017 was passed Law No. 9563. The Law of Incentive to Scientific, Technological and Sustainable Innovation of São José dos Campos.

The law, proposed by the City Hall, unanimously approved by the City Council, under the coordination of the Secretariat of Innovation and Economic Development, aims to stimulate the creation of startups and innovative initiatives that increase the efficiency and quality of public works and services; promote the sustainable development of the municipality; and generate benefits for the population.

The Law provides for the selection and testing, at no cost to the municipality, of innovation projects presented by public bodies, public and private companies.

2. The technology – TWC

TWC Technology is formed of a group of micro trace elements mixed into waxes comprised of capillary tunnels inert to the water and that bio-stimulation of beneficial bacteria to the hydric body providing the equilibrium and depollution of the same.

Produced in Australia is imported into Brazil. It has patents registered in 11 countries.

Bio-stimulation is a remediation that does not use chemical elements that interact with water or exotic bacteria in the system, leaving it vulnerable to the action of elements outside the water body in question. The disruption of technology is precisely at this point, bringing environmental and financial benefits because the application and the design are better suited to the Brazilian reality.

Again an important point: There is no use of exotic bacteria in the medium, nor chemicals.

Additional information, publications, surveys and other applications are available on our website www.o2eco.com.br or through our team.

1. O Local



Imagem 2: Imagem Google Earth 30/09/2017 – 23°10'14.75''S 45°53'01.37''O

The Municipality of São José dos Campos defined as the appropriate place for the implementation of the project, the Lago Menor of the Roberto Burle Marx Park, located in the Santana neighborhood, in the North Zone of the city.

3. Purpose of the project

The city hall of the City, identified the need for action in Lake Menor, whose quality parameters should and could be improved.

13. The relevant parameters of this project are:

- A) Cyanobacteria;
- B) Biochemical Oxygen Demand (BOD);
- C) Chemical Oxygen Demand (COD);
- D) Ammonia Nitrogen;
- E) Turbidity;
- F) Total Suspended Solids;
- G) Total Phosphate;
- H) Total Density of Microorganisms.

1. Project and its Implementation

The Project was started in February / 2018 and is expected to be completed in 6 months. Partial monitoring and supervision reports were generated for the project, accompanied by due reports of water analysis.

The City Maintenance Secretariat hired Sabesp (São Paulo State Basic Sanitation Company) through the Paraíba Valley Sanitary Control Division (RVOC) to collect samples and issue test reports.

The monitoring of water quality was carried out through "Periodical Reports of Tests", by SABESP.



Image 3: Photography of O2eco Technology during its implantation in Lago Menor.

On 04/24/2018, O2eco Technology was implemented, according to previous design, using as premises:

- ☐ Characteristics with physical-chemical-biological parameters of the water body, prior to installation of the technology;
- ☐ Dimensions of the lake;
- ☐ Depth;
- ☐ Time of year, climate;
- ☐ Duration of the project;
- ☐ Compliance with environmental standards;

Considering the above conditions, the application of 45 kg in blocks of 5 kg each for the whole period (6 months), distributed in strategic positions was dimensioned.

The blocks were installed in the vertical position, supported by buoys and counterweight, fixed to the east, avoiding with this the damage to the local landscaping.

Samples of water samples were taken at project-determined times, in predetermined conditions and conditions, in order to obtain a comparative characterization between the analyzes.

In this implantation, civil society participated, through 30 Josephian students, with the objective of involving local society, especially young people, demonstrating the importance of being involved in the preservation and environmental conservation in an active way.



Image 4: Photograph of Lake Minor during the deployment of O2eco technology.

1. Standards and References

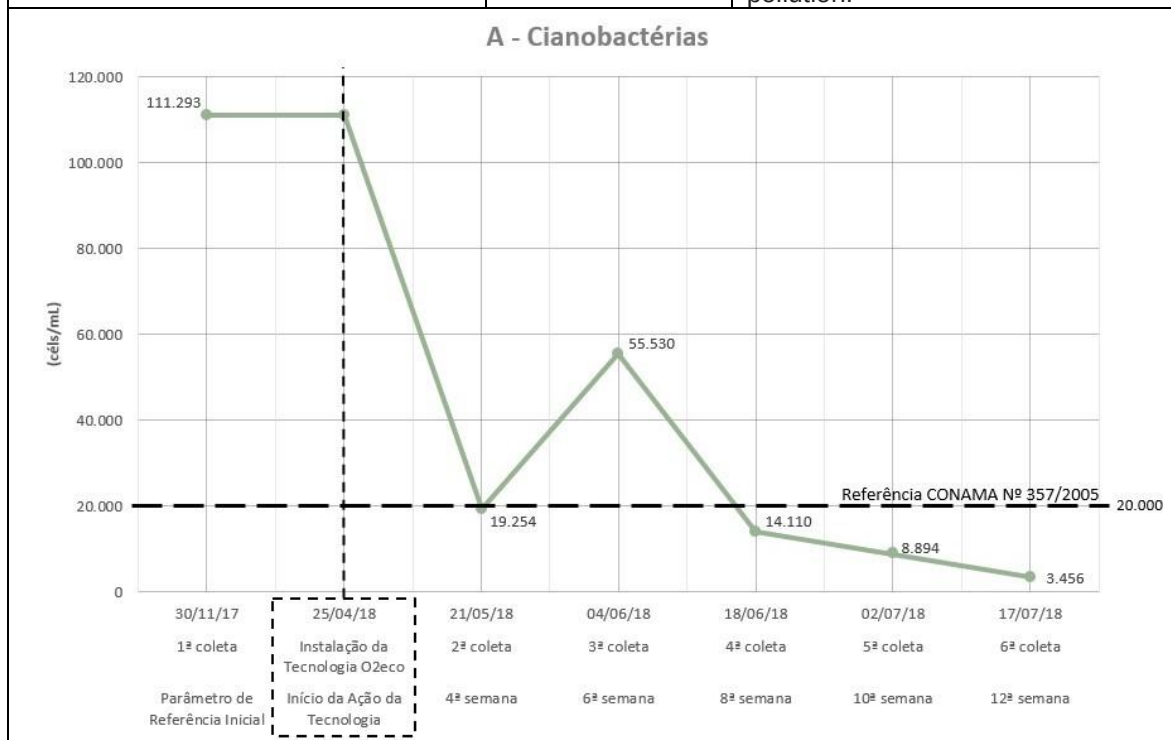
By means of State Decree No. 10,755 / 77 (SÃO PAULO, 1977), all water bodies in the State of São Paulo were classified according to classes of use (1, 2, 3 and 4), defined in the Regulation of Law No. 997 / 76 approved by State Decree No. 8.468 / 76 (SÃO PAULO, 1976). The smaller the class of framing of the body of water the better the quality expected, that is, the lower the degree of disturbance of anthropic origin should be.

In 2005, CONAMA Resolution No. 357/2005 established the quality standards expected for the different quality classes and their respective uses. Eventually water bodies do not meet these standards and the worse the quality of the body of water compared to the proposed use, the greater the efforts to manage the water resource in order to achieve the respective goals of its environment.

For the monitoring of water quality standards, the Resolution of the National Council for the Environment - CONAMA No. 357 of May 2005, and its amendments - Resolution No. 370/2006, Resolution No. 397/2008, Resolution No. 410 / 2009 and Resolution No. 430/2011, as well as to NBR 13969: 1997.

1. Gráficos e Resultados

Cliente: Secretaria de Manutenção da Cidade Prefeitura Municipal de São José dos Campos		Período Analisado Início: 30/11/2017 Término: 17/07/2018	
Local: Parque Municipal Roberto Burle Marx	Local de Aplicação: Lago Menor	Coordenadas Geográficas: 23°10'10.53"S / 45°52'59.84"O	
Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Cyanobacteria pollution.	



Analysis:

After the installation of the technology, the Cyanobacteria index presented a reduction of more than 82% in the period of 4 weeks.

It is noted that after the 8th week, the Cyanobacteria index remains below the CONAMA Resolution reference number 357/2005 (20,000 cells / mL), reaching a level of 3,456 cells / mL in the last measurement, which is considerable.

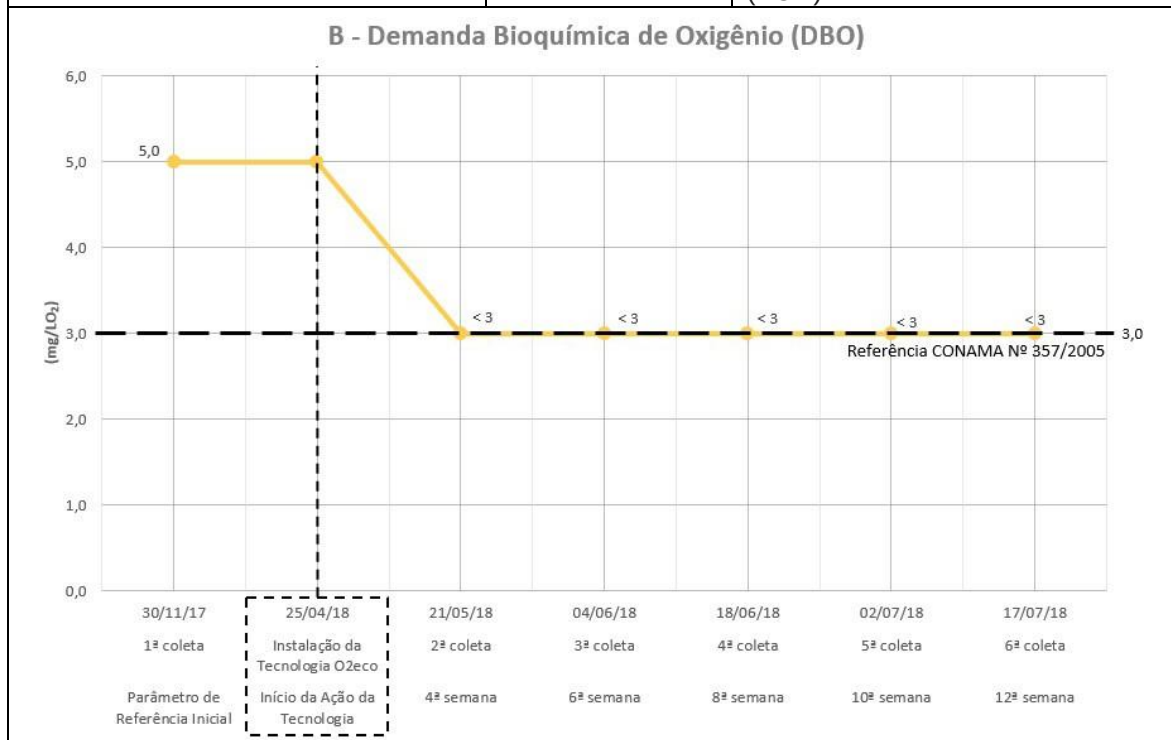
After the 8th week, with the use of technology, the parameter Cyanobacteria tends to be maintained and gradually reduced according to the norms.

We suggest the continuous monitoring of the parameters under analysis with effective use of technology to control cyanobacteria levels.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-101
- ☐ RVOC 16726/18-101
- ☐ RVOC 18211/18-101
- ☐ RVOC 20790/18-101
- ☐ RVOC 21676/18-101
- ☐ RVOC 24127/18-101

Cliente: Secretaria de Manutenção da Cidade Prefeitura Municipal de São José dos Campos		Período Analisado	
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Local: Parque Municipal Roberto Burle Marx	Local de Aplicação: Lago Menor	Coordenadas Geográficas: 23°10'10.53"S / 45°52'59.84"O	
Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Biochemical Oxygen Demand (BOD)	



Analysis:

After the installation of the technology, the Biochemical Oxygen Demand (BOD) index presented a reduction of 40% in the period of 4 weeks.

Note that after the 8th week the average BOD index reaches <3,0 mg / L O₂ and remains below the reference of the CONAMA resolution nº 357/2005 (3,0 mg / L O₂).

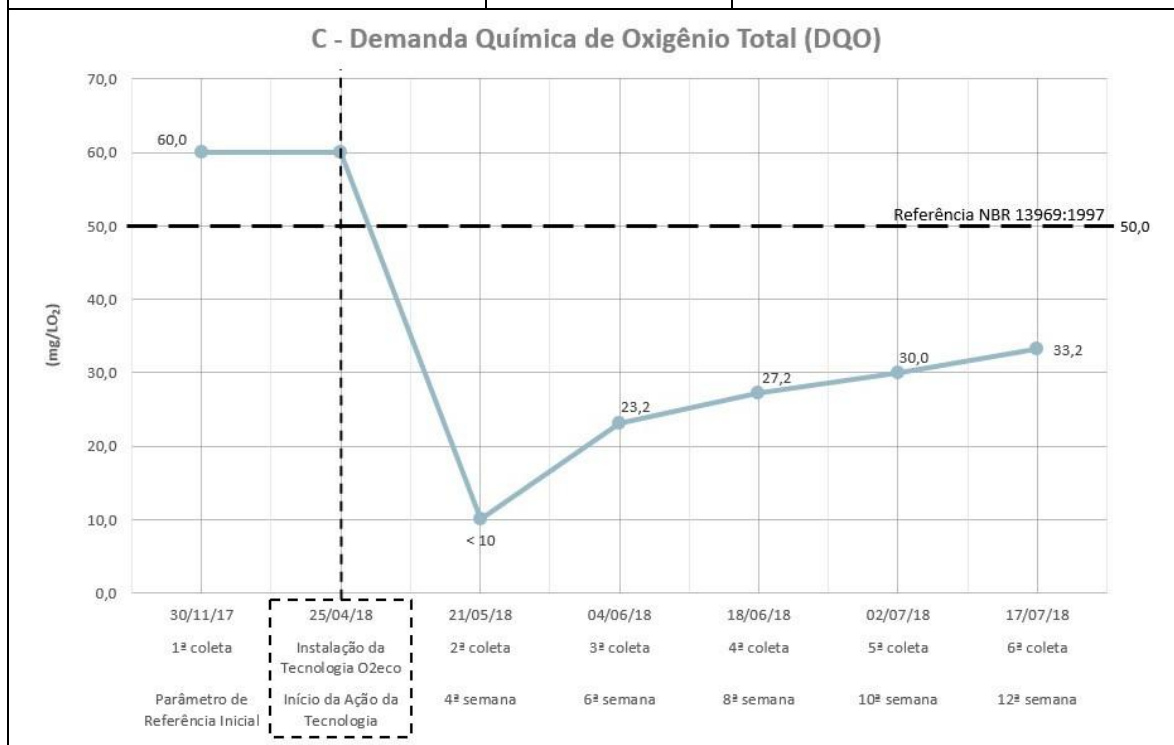
After the 8th week, with the use of technology, the parameter DBO tends to remain stable, meeting the norms.

We suggest the continuous monitoring of the parameters under analysis with effective technology to control BOD levels.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-101
- ☐ RVOC 16726/18-101
- ☐ RVOC 18211/18-101
- ☐ RVOC 20790/18-101
- ☐ RVOC 21676/18-101
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Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Chemical Oxygen Demand (COD)	



Analysis:

After the installation of the technology, the Chemical Oxygen Demand (COD) index presented a reduction of more than 83.0% in the period of 4 weeks.

It is noted that after the 8th week the average COD content reaches 30.13 mg / L O₂ and stays below the reference of norm NBR nº 13969/1997 (50,0 mg / L O₂).

After the 8th week, using the technology, the parameter DQO tends to remain below the limit, according to the norms.

We suggest the continuous monitoring of the parameters under analysis with effective use of technology to control COD levels.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-0213-A
- ☐ RVOC 16726/18-0213-A
- ☐ RVOC 18211/18-0213-A
- ☐ RVOC 20790/18-0213-A
- ☐ RVOC 21676/18-0213-A
- ☐ RVOC 24127/18-0213-A

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Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Ammonia Nitrogen	

D - Nitrogênio Amoniacal

Data	30/11/17	25/04/18	21/05/18	04/06/18	18/06/18	02/07/18	17/07/18
1ª coleta	< 0,2	0,2	< 0,2	0,23	< 0,2	< 0,2	< 0,2
Parâmetro de Referência Inicial							
4ª semana							
6ª semana							
8ª semana							
10ª semana							
12ª semana							

Analysis:

After the installation of the technology the Ammonia Nitrogen index remained stable, in the period of 4 weeks.

Note that during the period the average Ammoniacal Nitrogen content remained stable <0.2 mg / L NH3-N, below the reference of the CONAMA resolution nº 357/2005 (0,5 mg / L NH3-N), meeting the standards.

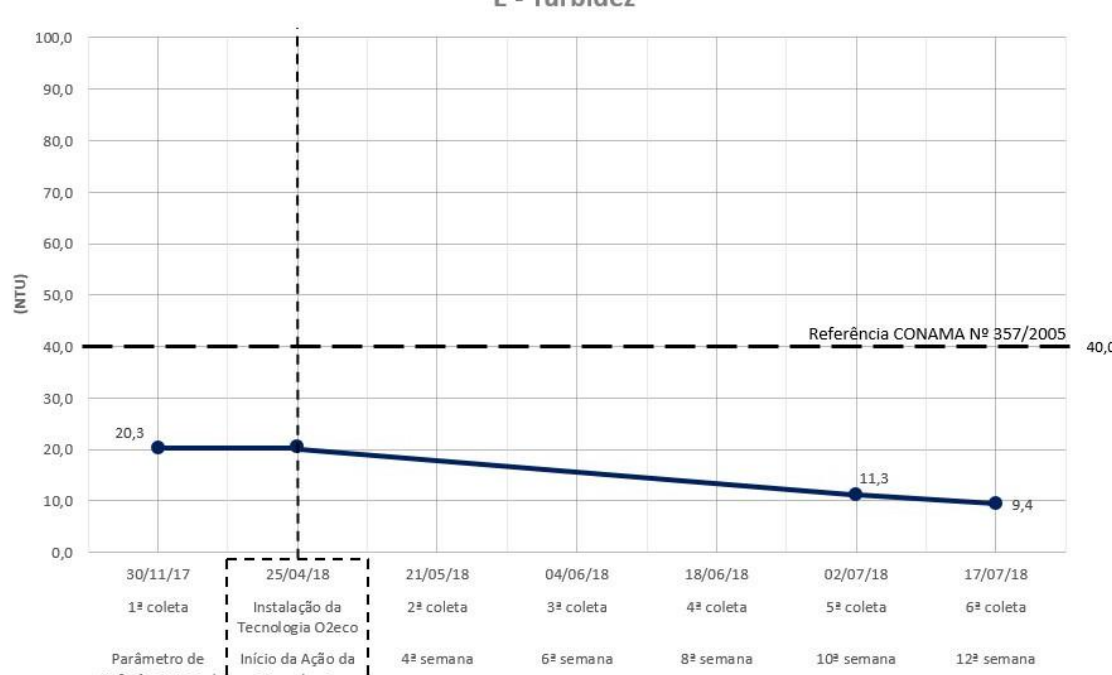
We suggest the continuous monitoring of the parameters under analysis with effective use of technology to control Ammonia Nitrogen levels.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-0213-A
- ☐ RVOC 16726/18-0213-A
- ☐ RVOC 18211/18-0213-A
- ☐ RVOC 20790/18-0213-A
- ☐ RVOC 21676/18-0213-A
- ☐ RVOC 24127/18-0213-A

Cliente: Secretaria de Manutenção da Cidade Prefeitura Municipal de São José dos Campos		Período Analisado	
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Local: Parque Municipal Roberto Burle Marx	Local de Aplicação: Lago Menor	Coordenadas Geográficas: 23°10'10.53"S / 45°52'59.84"O	
Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Turbidity	

E - Turbidez



Data	Turbidity (NTU)	Event / Week
30/11/17	20,3	1ª coleta
25/04/18	20,3	Instalação da Tecnologia O2eco
21/05/18	18,5	2ª coleta
04/06/18	16,5	3ª coleta
18/06/18	14,5	4ª coleta
02/07/18	11,3	5ª coleta
17/07/18	9,4	6ª coleta

Analysis:

After the installation of the technology, the Turbidity index presented a reduction of more than 44.0% over the 4-week period.

It is noted that after the 8th week the average Turbidity index reaches 10.35 NTU and remains below the reference of CONAMA resolution nº 357/2005 (40,0 NTU).

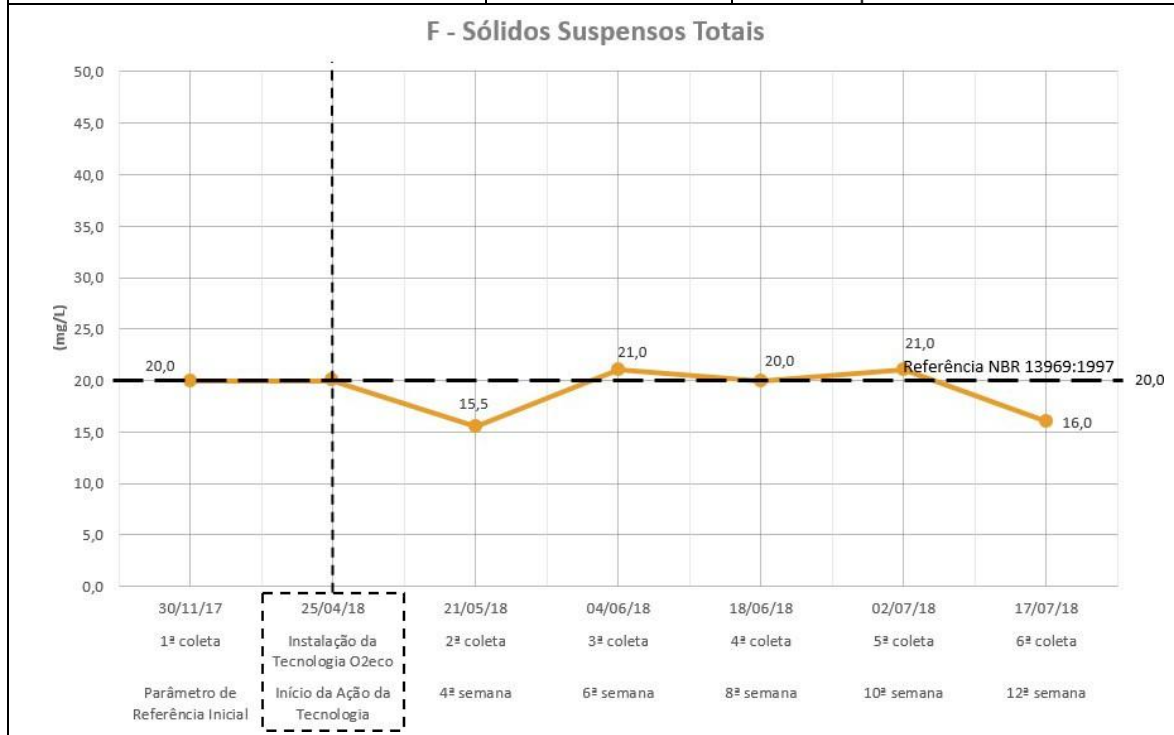
After the 8th week, with the use of technology, the parameter Turbidity tends to be maintained and reduced gradually, according to the norms.

We suggest the continuous monitoring of the parameters under analysis with effective technology to control Turbidity levels.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-0168-A
- ☐ RVOC 21676/18-0168-A
- ☐ RVOC 24127/18-0168-A

Cliente: Secretaria de Manutenção da Cidade Prefeitura Municipal de São José dos Campos		Período Analisado	
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Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Total Suspended Solids	



Analysis:

After the installation of the technology, the Total Suspended Solids index presented a reduction of more than 22.5% in the 4-week period.

It is noted that after the 8th week the average Total Suspended Solids index reaches 19.0 mg / L and remains below the reference of norm NBR no. 13969/1997 (20.0 mg / L).

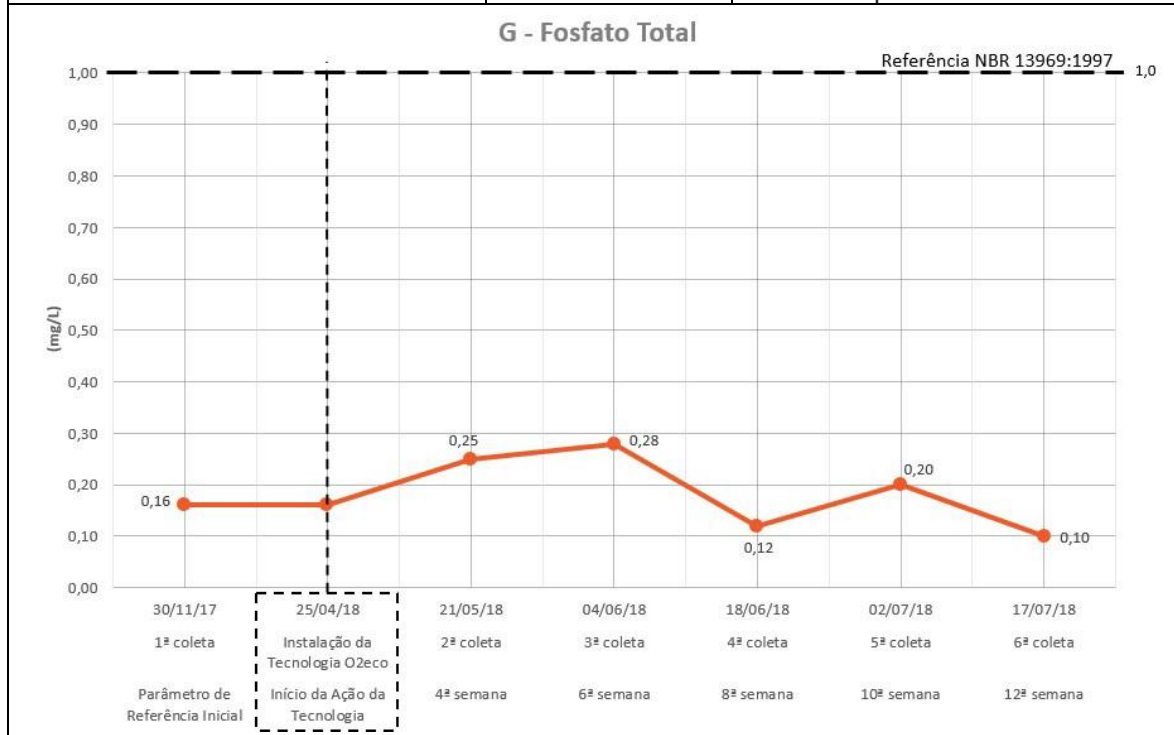
After the 8th week, using the technology, the Total Suspended Solids parameter tends to remain below the limit, according to the norms.

We suggest the continuous monitoring of the parameters under analysis with effective use of technology to control the levels of Total Suspended Solids.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-0213-A
- ☐ RVOC 16726/18-0213-A
- ☐ RVOC 18211/18-0213-A
- ☐ RVOC 20790/18-0213-A
- ☐ RVOC 21676/18-0213-A
- ☐ RVOC 24127/18-0213-A

Cliente: Secretaria de Manutenção da Cidade Prefeitura Municipal de São José dos Campos		Período Analisado	
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Local: Parque Municipal Roberto Burle Marx	Local de Aplicação: Lago Menor	Coordenadas Geográficas: 23°10'10.53"S / 45°52'59.84"O	
Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Total Phosphate	



Analysis:

After the installation of the technology, the Total Phosphate index increased by more than 56.0% in the 4-week period.

It is noted that after the 8th week the average Total Phosphate index reaches 0.14 mg / L and remains below the reference of standard NBR nº 13969/1997 (1.0 mg / L).

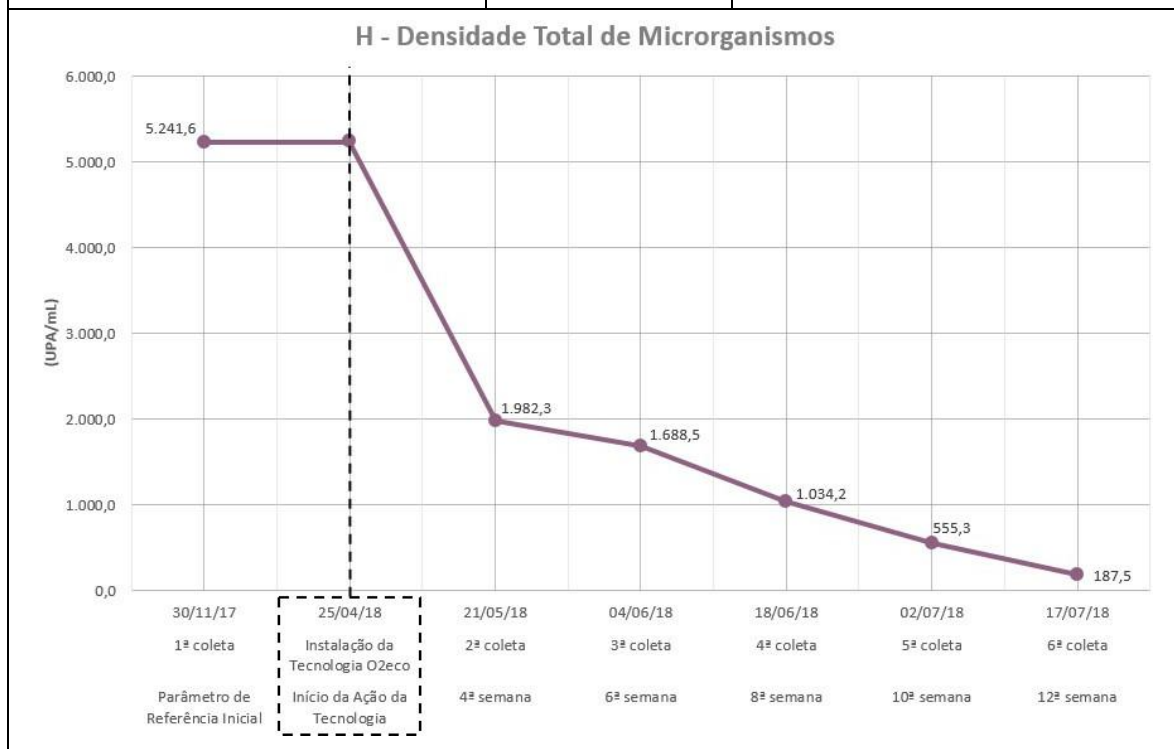
After the 8th week, with the use of technology, the Total Phosphate parameter tends to remain below the limit, according to the norms.

We suggest the continuous monitoring of the parameters under analysis with effective use of technology to control Total Phosphate levels.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-0213-A
- ☐ RVOC 16726/18-0213-A
- ☐ RVOC 18211/18-0213-A
- ☐ RVOC 20790/18-0213-A
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Município: São José dos Campos	Estado: São Paulo	Parameter Analyzed: Total Density of Microorganisms	



Analysis:

After the installation of the technology, the Total Density of Microorganisms index presented a reduction of more than 62% in the period of 4 weeks.

It is noted that after the 8th week the average Total Density of Microorganisms reaches 592.33 UPA / mL.

After the 8th week, using the technology, the parameter Total Density of Microorganisms tends to be maintained and reduced gradually.

It is necessary the continuous monitoring of the parameters under analysis with effective management

of the use of technology to control the levels of Total Density of Microorganisms.

Relatórios de Ensaio (Anexo I):

- ☐ RVOC 38764/17-101
- ☐ RVOC 16726/18-101
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- ☐ RVOC 20790/18-101
- ☐ RVOC 21676/18-101
- ☐ RVOC 24127/18-101

2. Conclusion

Based on the technical reports prepared by Sabesp, considering that the results express reliable values, it is concluded by the full and effective satisfactory result of the use of O2eco Technology, in the decontamination of the water body under analysis.

For conclusive analysis on the project period, we consider the parameter Cyanobacteria as critical. For this purpose, the mean time reference will be between the 4th and 12th week (05/21/2018 to 07/17/2018) for calculation of the evolution of the parameters, compared to the reference measurement (11/30/2017).

Therefore, the acclimatization period of the technology in this project was considered 4 weeks, which in water bodies of this nature is highly fast, and acceptable variation of some parameters between the 4th and 6th week after the application of the technology.

A) Cyanobacteria:

- ☐ Reduction in the first 4 weeks of 82%
- ☐ Average reduction of more than 92% - from 111,293 to 8,820 cells / mL in 10 weeks
- ☐ Last analysis with 96.7% reduction of cyanobacteria.
- ☐ meets the CONAMA resolution nº 357/2005 - <20,000 cells / mL

B) Biochemical Oxygen Demand (BOD):

- ☐ mean reduction of 40% - from 5.0 to <3.0 mg / L O₂ in 4 weeks.
- ☐ meets the CONAMA Resolution No. 357/2005 - 3.0 mg / L O₂.

C) Chemical Oxygen Demand (COD):

- ☐ mean reduction of more than 49.7% - from 60.0 to 30.13 mg / L O₂ in 4 weeks.
- ☐ meets NBR No. 13969/1997 - 50,0 mg / L O₂.

D) Ammonia Nitrogen:

- ☐ the condition remained stable during the analyzed period, remaining at <0.2 mg / L NH₃-N.
- ☐ meets CONAMA Resolution No. 357/2005 - 0.5 mg / L NH₃-N.

E) Turbidity:

- ☐ average reduction of more than 49% - from 20.3 to 10.35 NTU in 4 weeks.
- ☐ meets CONAMA Resolution No. 357/2005 - 40.0 NTU.

F) Total Suspended Solids:

- ☐ mean reduction of 5.0% - from 20.0 to 19.0 mg / L in 4 weeks.
- ☐ meets NBR No. 13969/1997 - 20.0 mg / L.

G) Total Phosphate:

- ☐ mean reduction of 12.5% - from 0.16 to 0.12 mg / L at 8 weeks.
- ☐ meets NBR No. 13969/1997 - 1.0 mg / L.

H) Total Density of Microorganisms:

- ☐ average reduction of more than 88.6% - from 5,241.6 to 592.33 UPA / mL over 10 weeks.

2. Recommendations

The O2eco Environmental technology obliges us to remember that we treat and promote the decontamination and rebalancing of water bodies through technology that bio-stimulates the present life and does not damage the local biota.

We recommend the constant and effective monitoring and management of applied technology and physical interventions such as plate replacement, reallocation of these, periodic analysis of parameters, that is, to maintain the effective technology applied during the use of this natural means of treatment and depollution.

2. Anexos

RELATÓRIOS DE ENSAIOS – SABESP - Divisão De Controle Sanitário Do Vale Do Paraíba

COLETAS	DATA DA COLETA	LAUDOS SABESP		
1ª Coleta (REFERÊNCIA)	30/11/17	RVOC 38764/17-101	RVOC 38764/17-0213-A	RVOC 38764/17-0168-A
2ª Coleta	21/05/18	RVOC 16726/18-101	RVOC 16726/18-0213-A	
3ª Coleta	04/06/18	RVOC 18211/18-101	RVOC 18211/18-0213-A	
4ª Coleta	18/06/18	RVOC 20790/18-101	RVOC 20790/18-0213-A	
5ª Coleta	02/07/18	RVOC 21676/18-101	RVOC 21676/18-0213-A	RVOC 21676/18-0168-A
6ª Coleta	17/07/18	RVOC 24127/18-101	RVOC 24127/18-0213-A	RVOC 24127/18-0168-A

Joel de Oliveira Junior

Diretor