

# Embasa (Joanes I) Reservoir, Salvador, Brazil.

Application dates: 6<sup>th</sup> January 2016, 18<sup>th</sup> May 2016 and 12<sup>th</sup> December 2016

## Summary

**Aim:** To bind the high concentrations of phosphorus released from lake sediments and in the water column in order to significantly reduce cyanobacteria blooms.

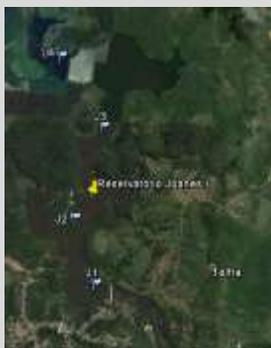
**Description:** Drinking water reservoir

**Size** (m<sup>2</sup>): 1 100 000 (110 ha)

**Average depth** (m): 3

**Dosage** (tonnes): 125 (over 3 applications)

## The Reservoir



Embasa (Joanes I) Reservoir is a drinking water reservoir located in Salvador, Brazil. Salvador is the largest city in the north eastern part of Brazil and has a population of almost 3 million. The reservoir supplies 40% of the urban population of Salvador city. Embasa Reservoir is heavily enriched with phosphorus which has led to a high incidence of cyanobacterial (blue green algal) blooms and prolific macrophyte growth.

Figure 1: Aerial photo of Embasa Reservoir (image from Google Earth, 2017).

## Background

The Reservoir, Joanes I, supplies approximately 40% of the water to Salvador city. Although it is located in an area of environmental protection, the disorderly growth of urban populations in the surrounding hydrographic basin has caused the increase of organic loads in the system. These pollution problems have caused an increase of phosphorus and cyanobacteria densities in the Reservoir water. To solve this eutrophication problem EMBASA decided to add Phoslock in order to bind the soluble phosphorus in the water column before it is taken up by algal cells or stored in the sediment for release in the future.



Figure 2: Water quality of Embasa Reservoir prior to the application of Phoslock (photo from Tiago Finkler NALMS presentation, 2016).

## The Treatment

Prior to the treatment of Embasa Reservoir, water and sediment samples were taken to determine the concentration of total and releasable phosphorus in the reservoir (Figure 3). Due to the size of the Embasa Reservoir, Phoslock was applied on three separate occasions. Phoslock Water Solution Ltd's Brazilian representatives, Hidroscience, applied Phoslock to the reservoir. The first application was conducted during January 2016, the second and third were performed on May and December 2016 respectively. In all, 125 tonnes of Phoslock were applied to the Reservoir during 2016.



Figure 3: Photos of sediment cores and the first Phoslock application to Embasa Reservoir (photo taken by Hidroscience).

# Embasa Reservoir

## Results

A detailed sampling program was undertaken prior to the application of Phoslock. Water and sediment samples were collected in order to provide detailed information on water/sediment chemistry and nutrient concentrations stored in the reservoir. Sediment samples were analysed and it was found that there was a very large amount of available phosphorus stored in the reservoirs sediments (500 mgP/kg to 2400 mgP/kg DW  $\cong$  2000 kg P in the top 5 cm).

Monitoring after the application of Phoslock included the collection of water samples at 4 sites with results for the Total Phosphorus (TP) concentration displayed in Figure 4. This data shows that the concentration of TP fell by 76% after the first Phoslock application and 86% after the second. Results from the third application are still being analysed but will be included in this communication once available.

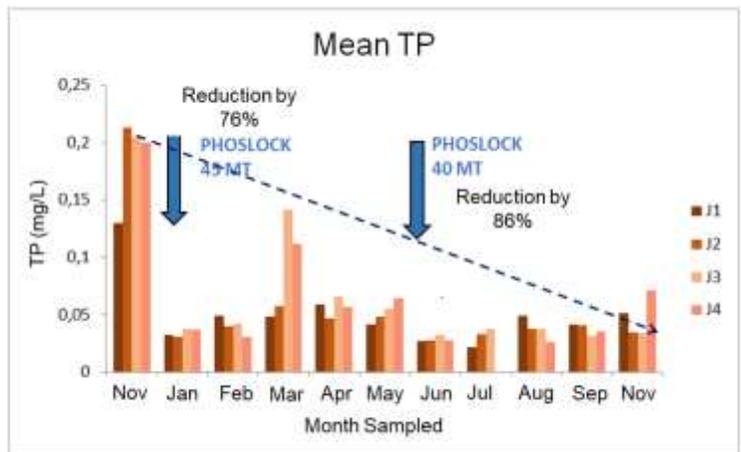


Figure 4: Mean Total Phosphorus (TP) monitoring from Embasa Reservoir. J1 to J4 are sample locations in the reservoir (data from Tiago Ferreira NALMS presentation, 2016).

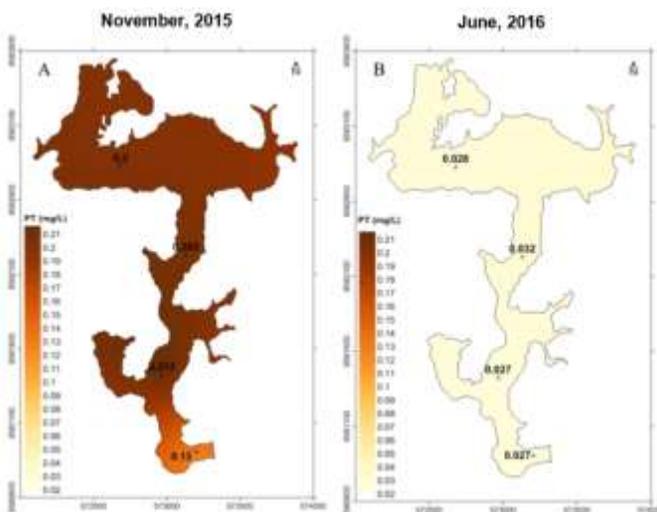


Figure 5: Change in the Total Phosphorus (TP) concentration over time from 4 monitoring sites in the Embasa Reservoir. J1 to J4 are sample locations in the reservoir (data from Tiago Ferreira presentation, 2016).

Figure 5 shows the significant reduction in Total Phosphorus (TP) over time. In 7 months the entire water body was affected by the application of Phoslock as observed from data collected from the 4 sampling sites. Post-treatment monitoring also showed that as well as the huge reduction in the concentration of TP, there was a significant reduction of over 95% in cyanobacteria density in the reservoir over time.

## Conclusion

Embasa Reservoir is a drinking water body located in Salvador, Brazil. Phoslock was applied to the reservoir over 3 applications in 2016. This was carried out to significantly reduce the concentration of Total Phosphorus (TP) and cyanobacteria.

The application was successful in meeting its aim. Results showed that Phoslock reduced the concentration of TP by 76% after the initial application and 86% after the second application. Further data is expected to show a similar trend as the water quality in the reservoir has been observed to improve since the applications of Phoslock.

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Additional information can be found on our website or can be provided on request.