

Brian Kling

From: Carlos Gonzalez CEO GIT <techsales@prtc.net>
Sent: Saturday, March 01, 2014 6:24 AM
To:
Cc: 'Brian Kling'; Robert L. Laing
Subject: RE: Data on Toa Vaca
Attachments: IMG_1070.JPG

There is a lot more relevant information that you must show in order to educate people regarding "The Real Costs of Lake Eutrophication"...investigate how much fresh water lakes make out of the total fresh water in planet earth!!..will be surprised

Here we go, hope you find it interesting:

Toa Vaca dam was built in 1972 for \$200M and a life expectancy of 350 years. As soon as 1983 the lake started to show serious signs of eutrophication. The residence time of the water is around 1.5 years, and since we are located in the Caribbean, the water has time enough to stratify, please note that in the tropics we seldom have the natural lake turnover like in USA.

Under these low vertical water movement and hot temperatures all the yearlong, blue green algae find the perfect habitat to grow. Without natural predators this million years old bug dominates the ecology of the lake, at this point, things start to complicate for the drinking water plants. Why?

Algae, grows and dies, little by little exhausting the dissolved oxygen inventory of the lake, specially at the bottom. Under anaerobic conditions, Mn, H₂S, P and ammonia migrate to the water column, keeping the lake on an eternal nutrient recycling mode.

When Mn is present on the raw water going to the drinking water plants, plant operators are forced to increase the dosage of chlorine and lime in order to oxidize the Mn. The problem is that by doing this, trihalomethanes are formed and these compounds are carcinogenic.

El Embalse de Toa Vaca



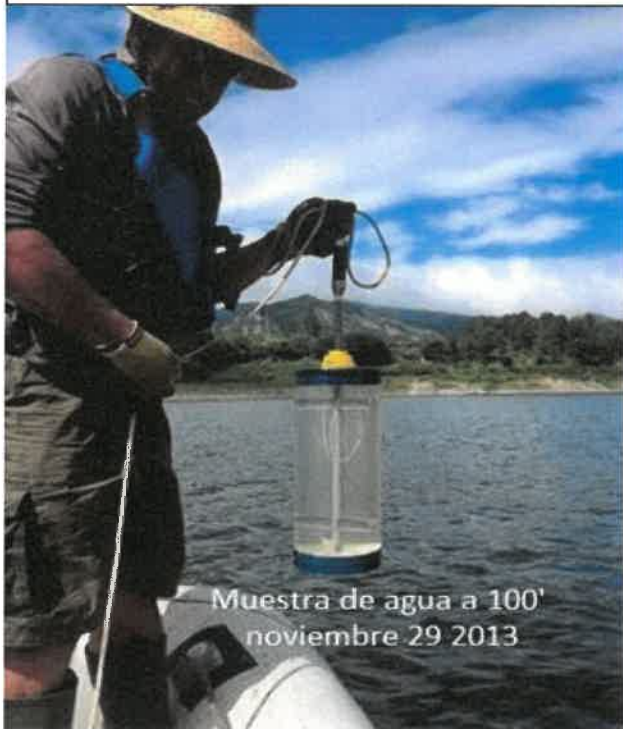
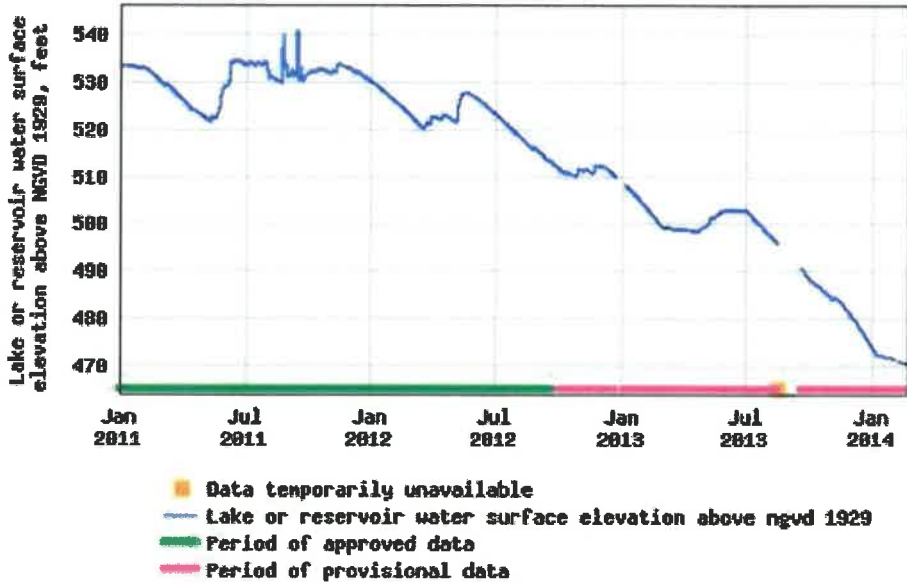
- 1972 : Año de Construcción: seis compuertas, 1-6 de abajo hacia arriba, 36 MGD, expectativa de vida útil de 300 años
- 1983 : Lago Eutrófico (CAAM), oxígeno disuelto bajo
- 1994 : El agua de la compuerta #2 era ya intratable se comenzó a utilizar agua de la compuerta #3
- 1995 : Compuerta #3 comienza a dar problemas con calidad de agua
 - ✓ Se comienza a utilizar lago Cerrillos por problemas de calidad del agua del Lago Toa Vaca
- 1998 - 2007
 - ✓ Compuerta #5, buena Calidad de Agua
 - ✓ Compuerta #4, problemas de cumplimiento en las plantas y se comienzan a duplicar costos en consumo de productos químicos
 - ✓ Compuerta #3, se dejó de utilizar
- 2008 - 2009
 - ✓ Compuerta #5, problemas de cumplimiento y producción en las plantas
 - ✓ Aumento en costos y consumo de productos químicos
 - ✓ Compuerta #4, el tener que abrir esta compuerta significaba: tener que bajar la producción en las plantas, las plantas de Ponce conectarse al lago Cerrillos, además de considerar cambios en productos químicos (más costosos) para poder estar en cumplimiento, aumento de producción y manejo de lodos, aumento de Mn en agua cruda, aumento de TOC/DOC,DBP's, agua servida con mal olor y sabor

Toa Vaca lake eutrophication has been specially challenging for plant operators, in 2009 (27 years after construction, less than 15% of the life expectancy) only two of six gates ,33% of dam capacity, was available for use, since water below gate 4 was untreatable. Puerto Rico is a very small island(100x35 miles) we do not have plenty of space for new dams.

When we started the project, there was oxygen only down to 10feet,today the level is around 470 ft, so 70 ft has been lost due to draught...but still the water is good for treating thanks to the aeration system installed,...also, Toa Vaca lake is the ONLY water source for the treatment plant in Villalba.....pelicans were 5,now 28..eagles 2,now 10



USGS 50111210 LAGO TOA VACA AT DAMSITE NR VILLALBA, PR



Water treatment costs has cut down 60%, ROI is around 3 years, water to plants has an stable consistency and Mn is under control. Customers are starting to express their satisfaction for the better taste and odor of the water on the tap, they do not have to buy water bottles anymore!

Villalba Raw Water Dissolved Oxygen and Mn

