Wastewater Treatment Plant Upgrade Project (WWTP)

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Introduction

A common challenge for breweries is meeting current wastewater discharge standards while accommodating growth and anticipating more stringent discharge regulations in the future. Cervecería de Puerto Rico wastewater treatment system had been in operation for a long time, but years of service and increased hydraulic and organic loadings had made it difficult to meet treatment objectives.

For years Cervecería de Puerto Rico wastewater treatment plant was affecting the image of the company and had become a priority for the future of the company.
Potential Issues

- Regulatory Compliance of Waste Water Discharge
- Possible surcharges
- Controls were mostly manual, there were no instrumentation automated monitoring parameters of waste water treatment process
- Operation of Return Activated Sludge Systems (RAS) was inconsistent due to past retrofits and obsolete equipment
- Operation and maintenance of the treatment systems rotating biological contactors had become a very high total operational costs
- Increased hydraulic and organic loadings
- Bad odor generation at the treatment plant
- Bad image of the company
Before Process Diagram of WWTP

Equalization Tank

Pista-Grit

Blocked discharge connections to/from reactor

Reactor

Pump #1

Pump #2

Digester/Thickener

Pressed if needed

Clarifier
Previous Rotating Biological Contactors
Previous Rotating Biological Contactors
Previous Clarifier
<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>DOWNLOAD LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD (mg/L)</td>
<td>250</td>
</tr>
<tr>
<td>TSS (mg/L)</td>
<td>250</td>
</tr>
</tbody>
</table>
Before - Graph of BOD

Biochemical Oxygen Demand

Month/Year

BOD (g/ml)
Challenges

- Regulatory compliance with the permit.
- Reduce the environmental footprint of the plant
- Cost effective technologies
- Limited budget of 1.3M
- Space construction limited
- Withstand large changes in demand while maintaining efficient
- Reduce odors
- Make changes without stopping operation
- Reduce total operating costs
CERVECERA DE PUERTO RICO PILOT STUDY

MOVING BED BIOREACTOR (MBBR) TECHNOLOGY
Paramecium

Vorticella

Epistilys

Vorticella
The Engineering Department along with EH&S evaluated different treatment alternatives to determine the viability of upgrading the existing facilities to achieve permit parameters.

- Moving Bed Biofilm Reactor (MBBR)
- Tank Dissolved Air Flotation (DAF), system without air saturation
## MBBR Design Basis

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNITS</th>
<th>INFLUENT</th>
<th>EFFLUENT</th>
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<tbody>
<tr>
<td>Flow</td>
<td>MGD</td>
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<td>0.15</td>
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<tr>
<td>BOD₅ (Soluble)</td>
<td>MG/L</td>
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<tr>
<td>TSS</td>
<td>MG/L</td>
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<tr>
<td>COD (Soluble)</td>
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<tr>
<td>P</td>
<td>MG/L</td>
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<tr>
<td>Temperature</td>
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## Project Scope

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Original Scope</th>
<th>Currently Achieved</th>
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<tbody>
<tr>
<td>Reactor Tank Retrofit</td>
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<tr>
<td>Blowers Replacement</td>
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<tr>
<td>DAF Installation</td>
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<td>Acid Dosing Station Automation</td>
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<td>Caustic Soda Station Automation</td>
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<tr>
<td>Caustic Soda Receiving Station Automation</td>
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<td>pH/Temp Monitoring EQ Tank</td>
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<td>pH/Temp/DO Monitoring Reactor Tank</td>
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<td>Influent Flow Metering</td>
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<td>Influent Temperature Monitoring</td>
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<td>Central process overview</td>
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<td>Tank Levels</td>
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<td>Belt Press automation</td>
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<td>Electrical Utilities</td>
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<td>Air Utilities</td>
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<td>Water Utilities</td>
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<td>Pads/Dikes/Civil Work</td>
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<td>Aesthetical Improvement</td>
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<td>Waste Water Lift Station Upgrade</td>
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<tr>
<td>New Laboratory Furniture</td>
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</tbody>
</table>
PROJECY BUDGET

- Project Budget $1,394,036

- Discharge Overcharges $98,069
  - Negotiated PRASA Limits
    - BOD - 5,633 mg/L
    - TSS - 2,628 mg/L

- Currently consumed $1,358,641
Actual Process Diagram of WWTP

Equalization Tank
292,000 gals

Moving Bed Biofilm Bioreactor
(315,000 gals)

Digester
89,000 gals

Belt Filter Press & Container

Lift Station

Screens

Blowers

Utilities
Brew House
Cold Block
Packing Lines

DAF

PRASA

Utilities

Belt Filter Press & Container
• A stand-alone biological treatment system with no need for media backwashing

• Wastewater treatment plants of this type operate as fixed-film processes without activated sludge recycle between the bioreactor and clarification units

• Aeration supplied provides oxygen, essential for microbial growth, and the energy required to disperse the carriers completely throughout the system
Moving Bed Biofilm Reactor (MBBR)
Moving Bed Biofilm Reactor (MBBR)

Process uses 25 mm-diameter cylindrical plastic carriers that provides environments in which bacteria and protozoa can grow effectively.
Moving Bed Biofilm Reactor (MBBR)
Dissolved Air Flotation Operation (DAF)

Separates and optimizes solids prior to dewatering
Dissolved Air Flotation Operation (DAF)
Dissolved Air Flotation Operation (DAF)
WWTP RETROFIT
Belt Press
Now - Graph of TSS

Total Suspended Solids Efficiency

TSS (g/ml) vs Month/Year

- Actual TSS
- Before TSS
- Limit
Biochemical Oxygen Demand Removal Efficiency

- Actual BOD
- Before BOD
- Limit

BOD (g/ml)

Month/Year
Summary Savings

- Maintenance Costs 70%
- Chemicals 50%
- Generation of H2O
- Power Cost 35%
- Odor reduction
- Regulatory compliance without overcharges 100%