Sustainable Water Reuse:

Design Build Delivery of Water Recovery and Reuse Facility at Frito-Lay

Casa Grande, AZ

July 2015

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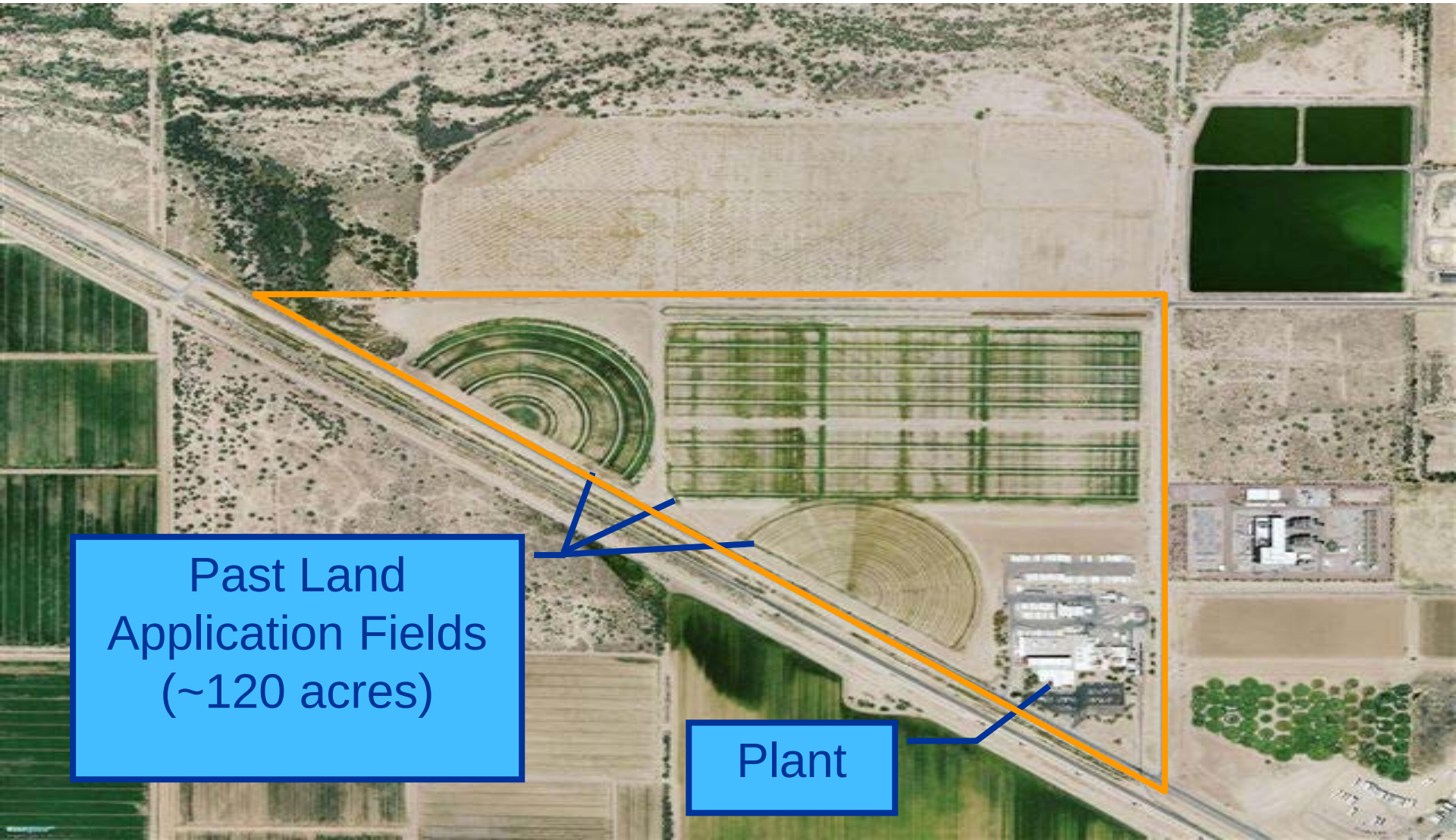
WATEREUSE ARIZONA

Agenda

- Site
- Project Overview and Objectives
- Process Water Treatment and Recycling Plant (PWTRP)
- Renewable Energy

Pre-2008 Casa Grande Plant & Land Application Fields



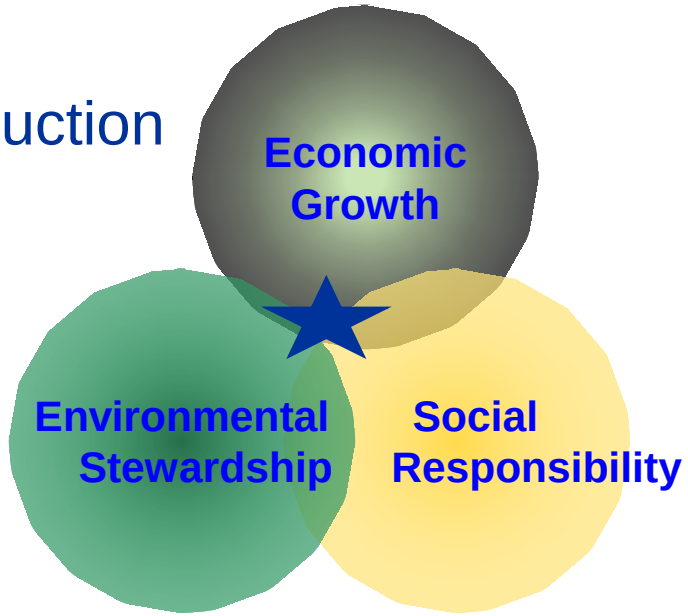
Current Site

Property Boundary | Solar Panels | Water Treatment and Recycling | Biomass Boiler

CDM Smith

Project Overview & Objectives: Sustainability

- Water
  - Process Wastewater Recovery for Reuse
- Energy
  - Solar Panels
  - Biomass Boiler for Natural Gas Production
- Facilities
  - LEED Certified Main Facilities
- Economics
  - Cost Effective Design
  - Reliable Performance

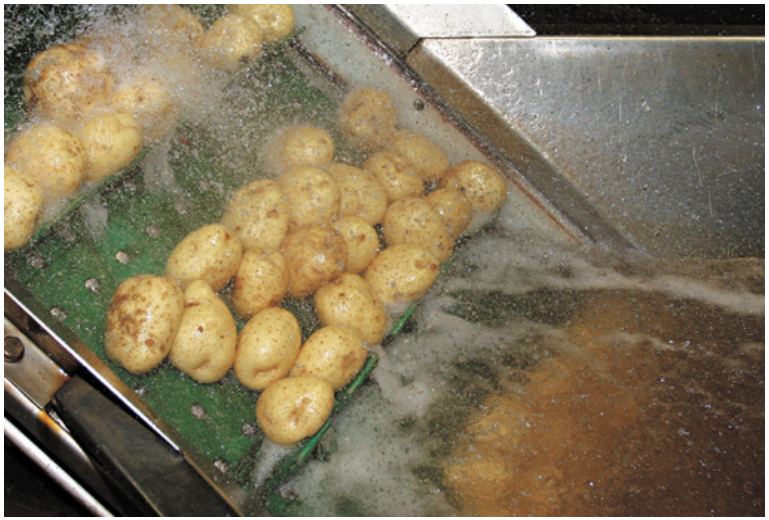


Project Overview & Objectives

- Flagship Project for Frito-Lay, Pepsico & CDM Smith
- High profile/example project for other food industries
- Achieves sustainable goal for “Near Net Zero” facility
- Integrates production procedures with treatment & reuse
- Aesthetically pleasing to showcase for visitors
- Produce Sun Chips and other products at Casa Grande facility using solar power
- Area used for waste process water land application converted to solar fields
- A treatment plant to recycle process waste water

Project Overview & Objectives: Process Wastewater

- To align with their sustainability goals, Frito Lay selected to treat waste process water to be reused.
  - Washing
  - Cleaning
  - Move Food Products
  - Sanitize Equipment



- Finished Water Quality: Meets EPA Primary & Secondary Drinking Water Standards

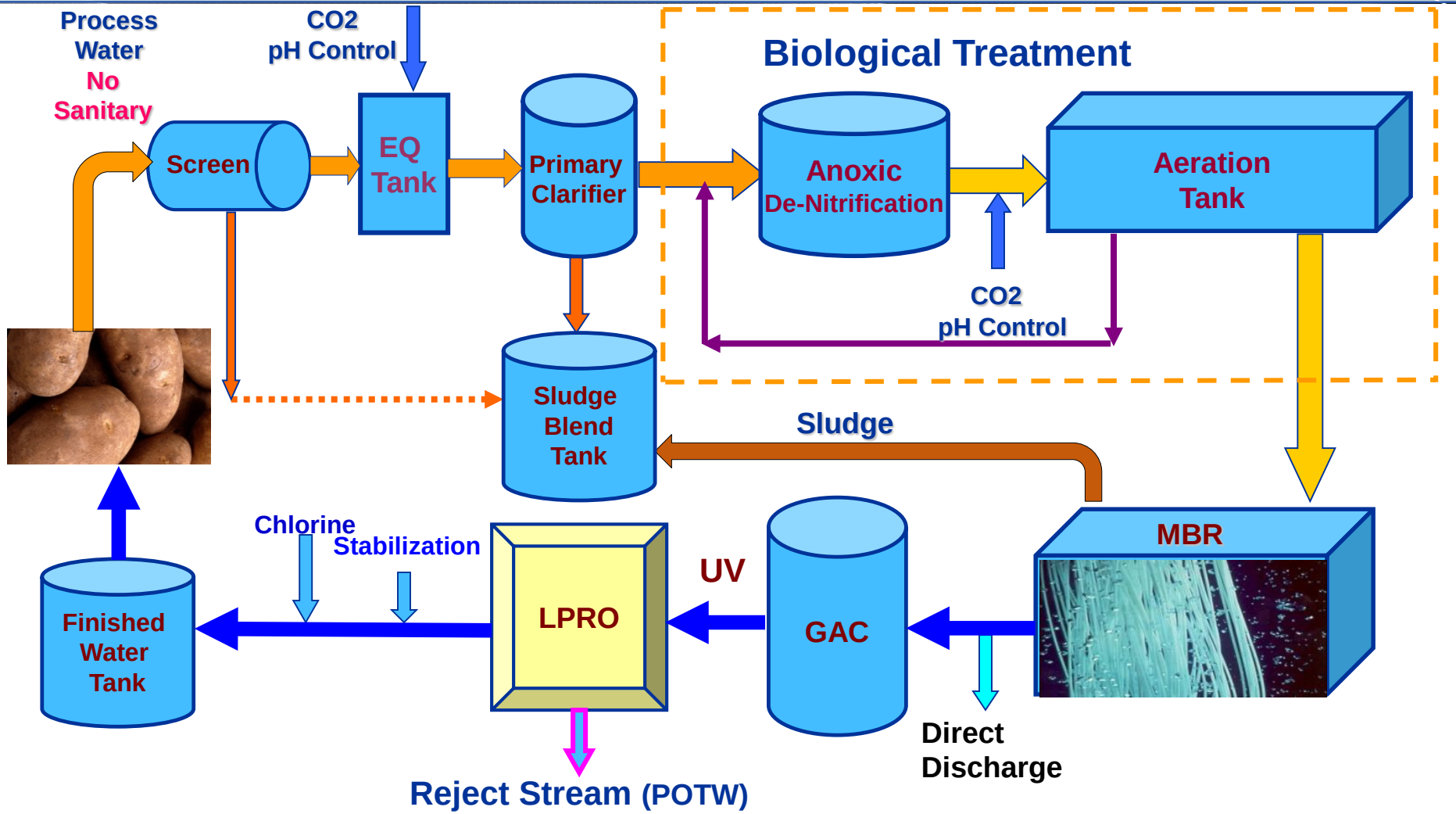
Process Water Treatment and Recycling Plant Basis of Design

- Design Flow: 645,000 GPD (450 GPM)
  + Future Expansion

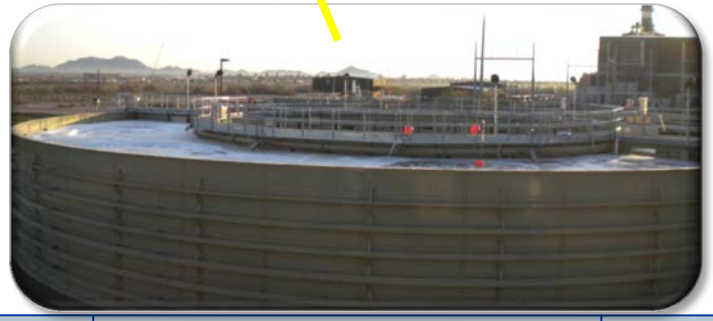
- Water Recovery & Reuse: 75 - 80%

- City Water: 20 – 25%

Process Water Treatment and Recycling Plant Process Flow Diagram



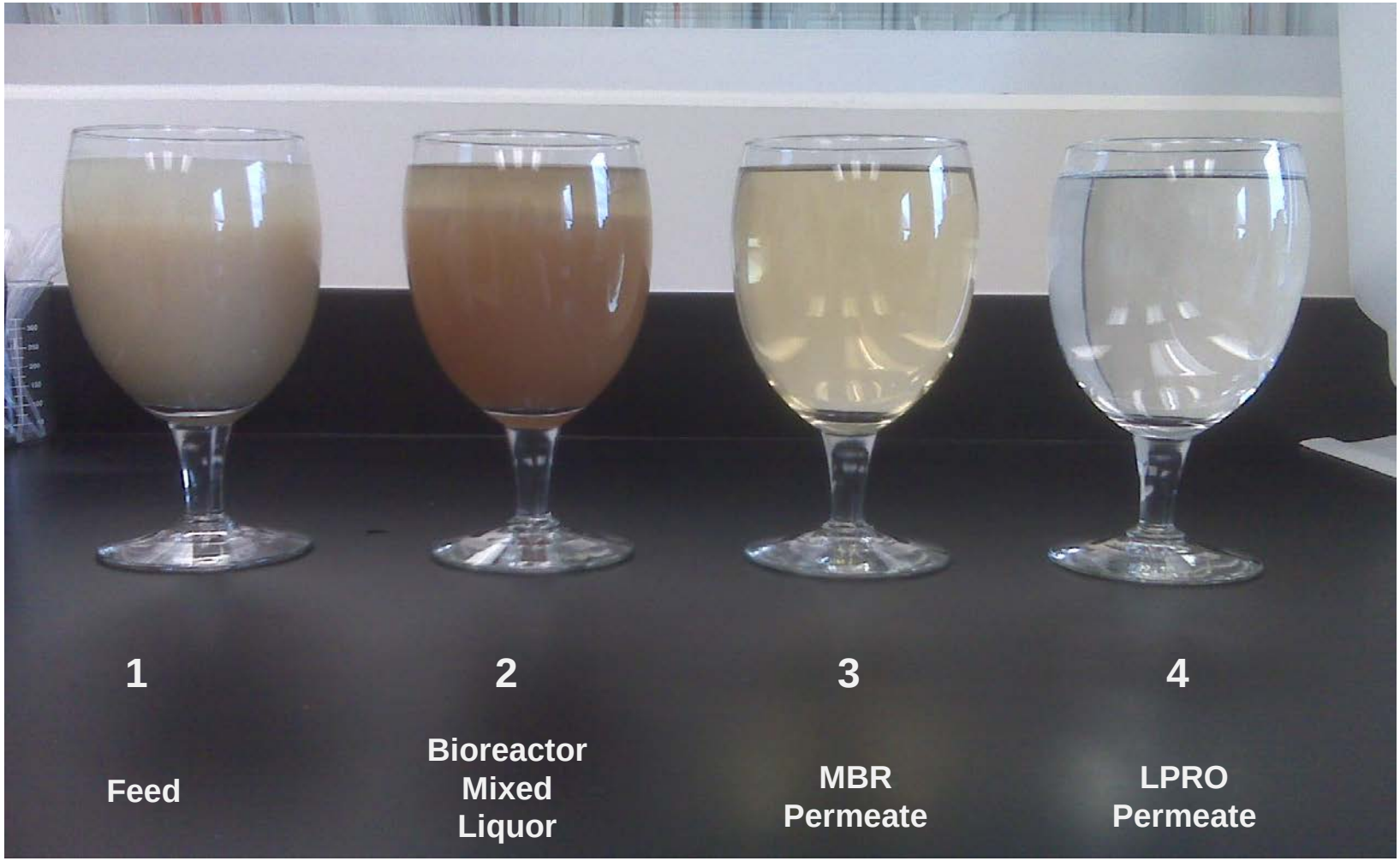
Process Water Treatment and Recycling Plant Site Layout



Process Water Treatment and Recycling Plant Solids Handling Building

- Rotary Drum Screens
- Solids Blending Tank
- Centrifuges
- Centrate Recovery Tank

Process Water Treatment and Recycling Plant
Process Wastewater



Process Water Treatment & Recycling Plant 15 Steps!

Step 1. Plant Process Sump:

Process Water Treatment & Recycling Plant

Step 2. Primary Screens:

Blend Tank

Centrifuge

CDM Smith

Process Water Treatment & Recycling Plant

Step 3. Equalization Tank

CO2 System

Step 4. pH Control System

Process Water Treatment & Recycling Plant

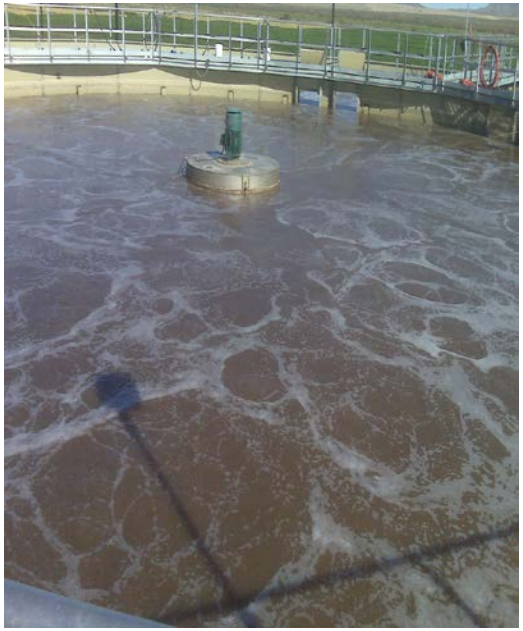
Step 5. Primary Clarifier

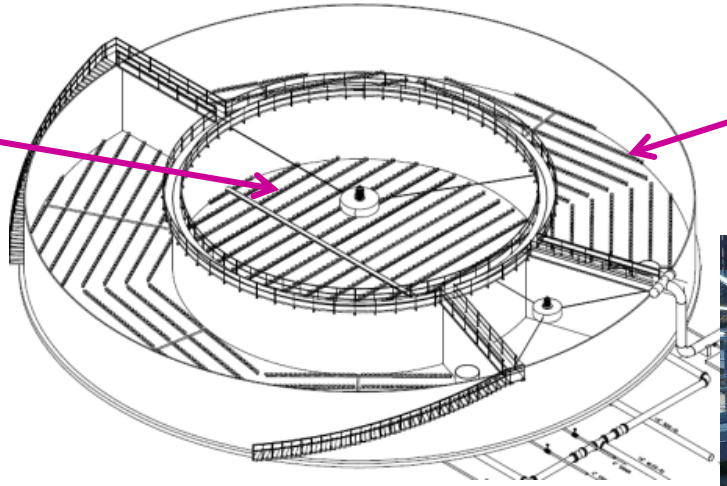
Influent:
BOD = 2,200 mg/L
TSS = 420 mg/L
TKN = 78 mg/L

Process Water Treatment & Recycling Plant

Unique Design Houses Bioreactors in 1 Concentric Tank

Step 6. Anoxic Tank





Step 7. Aeration Tanks

MLSS = 8,000 – 10,000 mg/L

Process Water Treatment & Recycling Plant

Step 8. MBR Tanks

(Direct Discharge)

BOD & TSS = ND-10 mg/L
TN = 2 – 9 mg/L
NO3 = ND- 2mg/L

Step 9. Back Pulse Tank

Process Water Treatment & Recycling Plant

Step 10. Activated Carbon

Step 11. UV Disinfection

Process Water Treatment & Recycling Plant

Step 12. LPRO System

Permeate Meets EPA Drinking Water Quality

Permeate

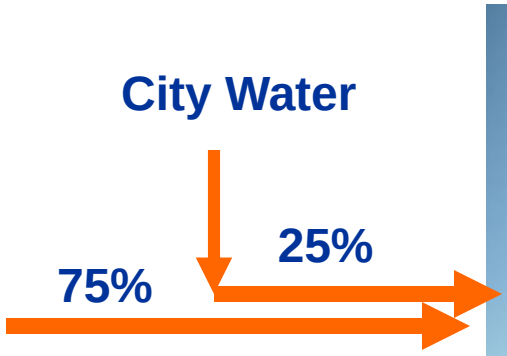
Reject Water

Process Water Treatment & Recycling Plant

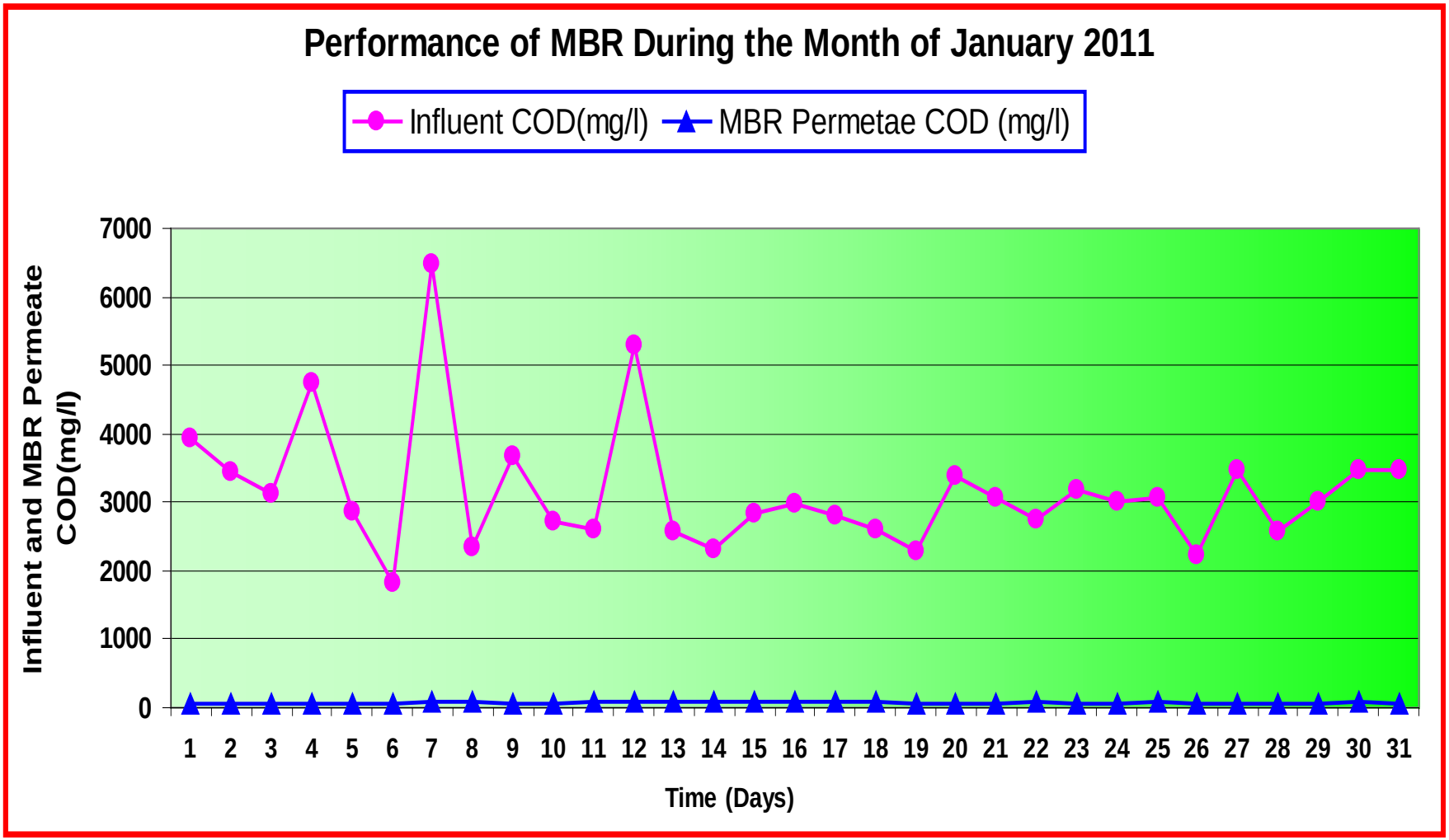
Step 13. Water Stabilization

Step 14. Chlorination

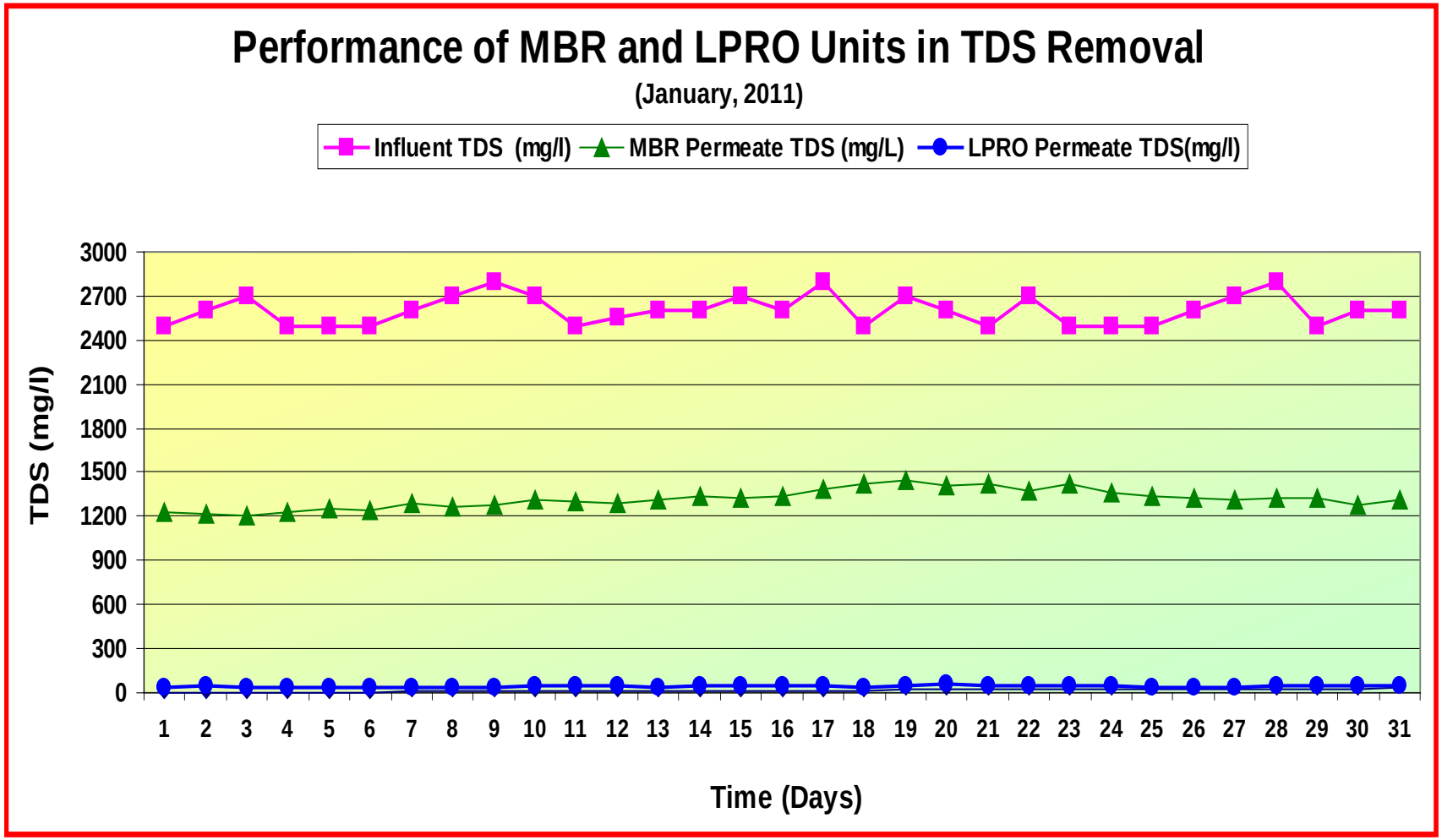
Step 15. Water Storage Tank



Process Water Treatment & Recycling Plant

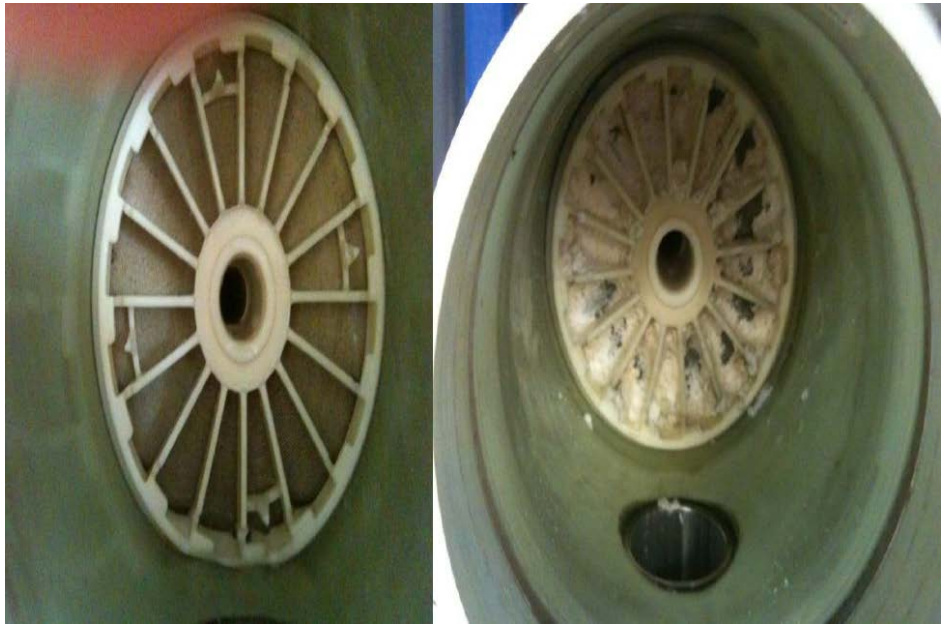


Process Water Treatment & Recycling Plant



Process Water Treatment & Recycling Plant

- Fouling of LRPO Membranes
- Membrane Autopsy Performed
- Organic Foulant Constituents
  - Proteins
  - Carbohydrates
  - Polysaccharides



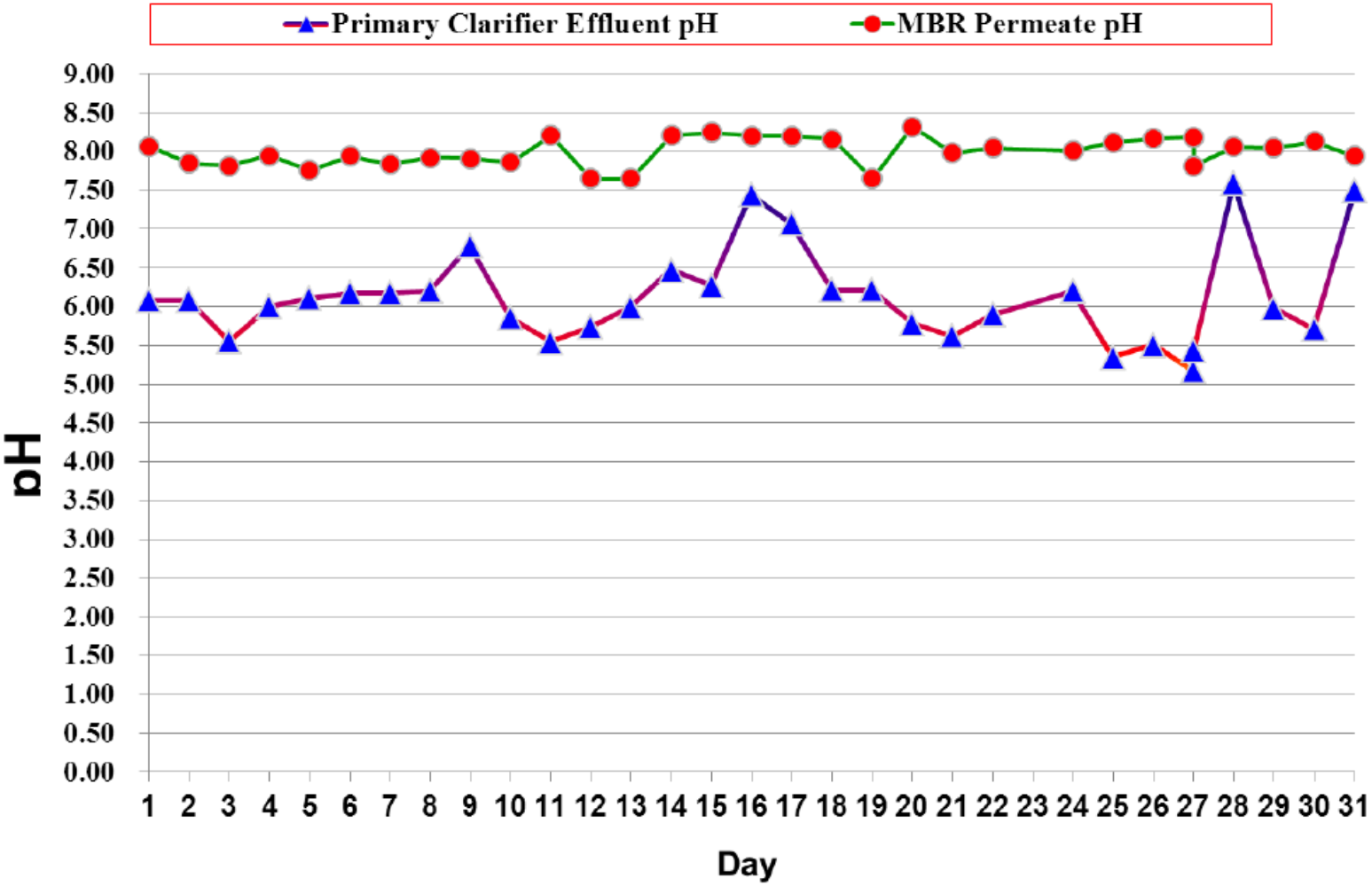
Fouled LPRO Membrane Due to High pH

New LPRO Membranes (DOW/FilmTech)

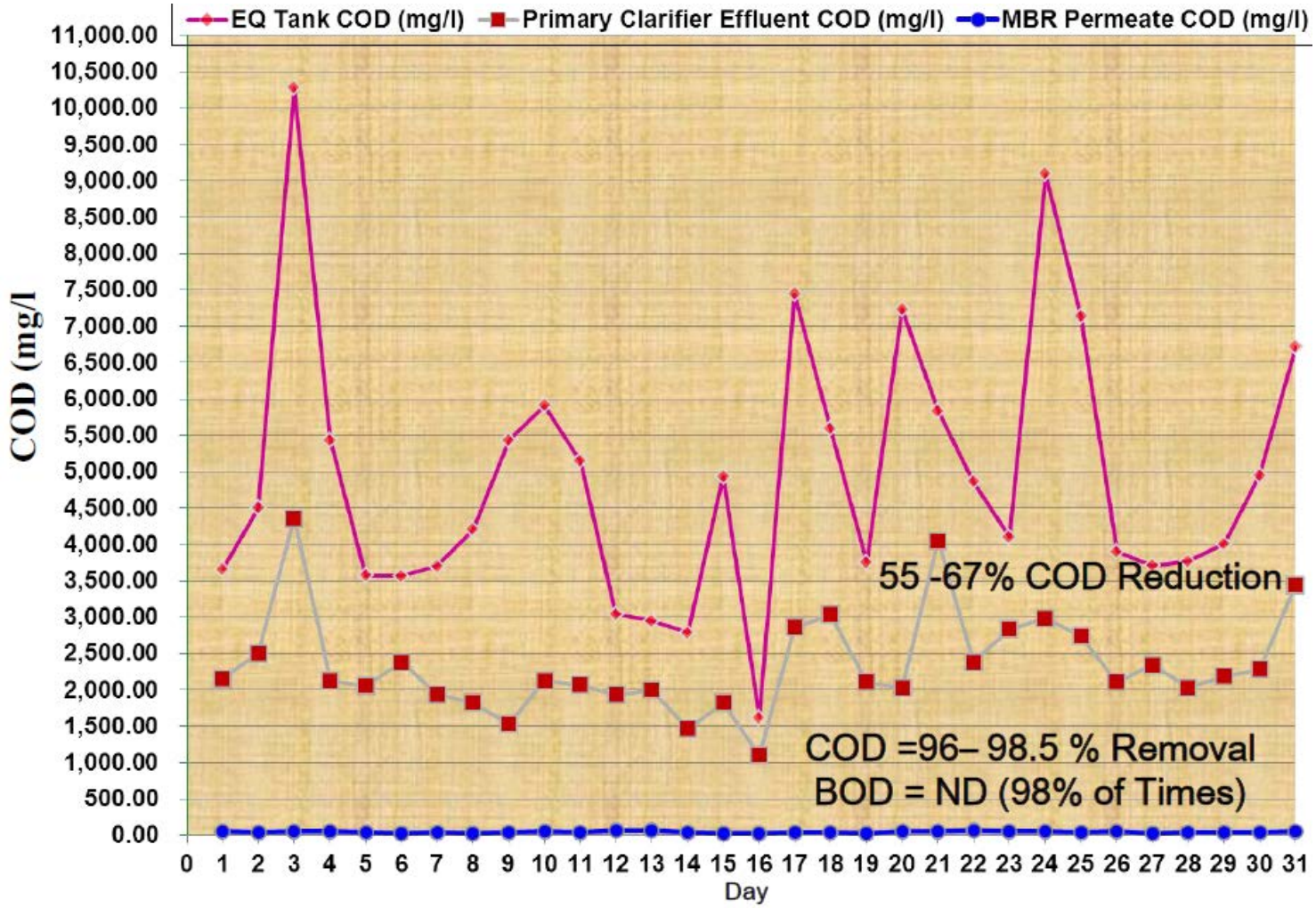
MBR Permeate Before & After GAC Tanks

Comparison of New Filter Cartridge With Dirty Filter Cartridges

Primary Clarifier Effluent pH and MBR Permeate pH



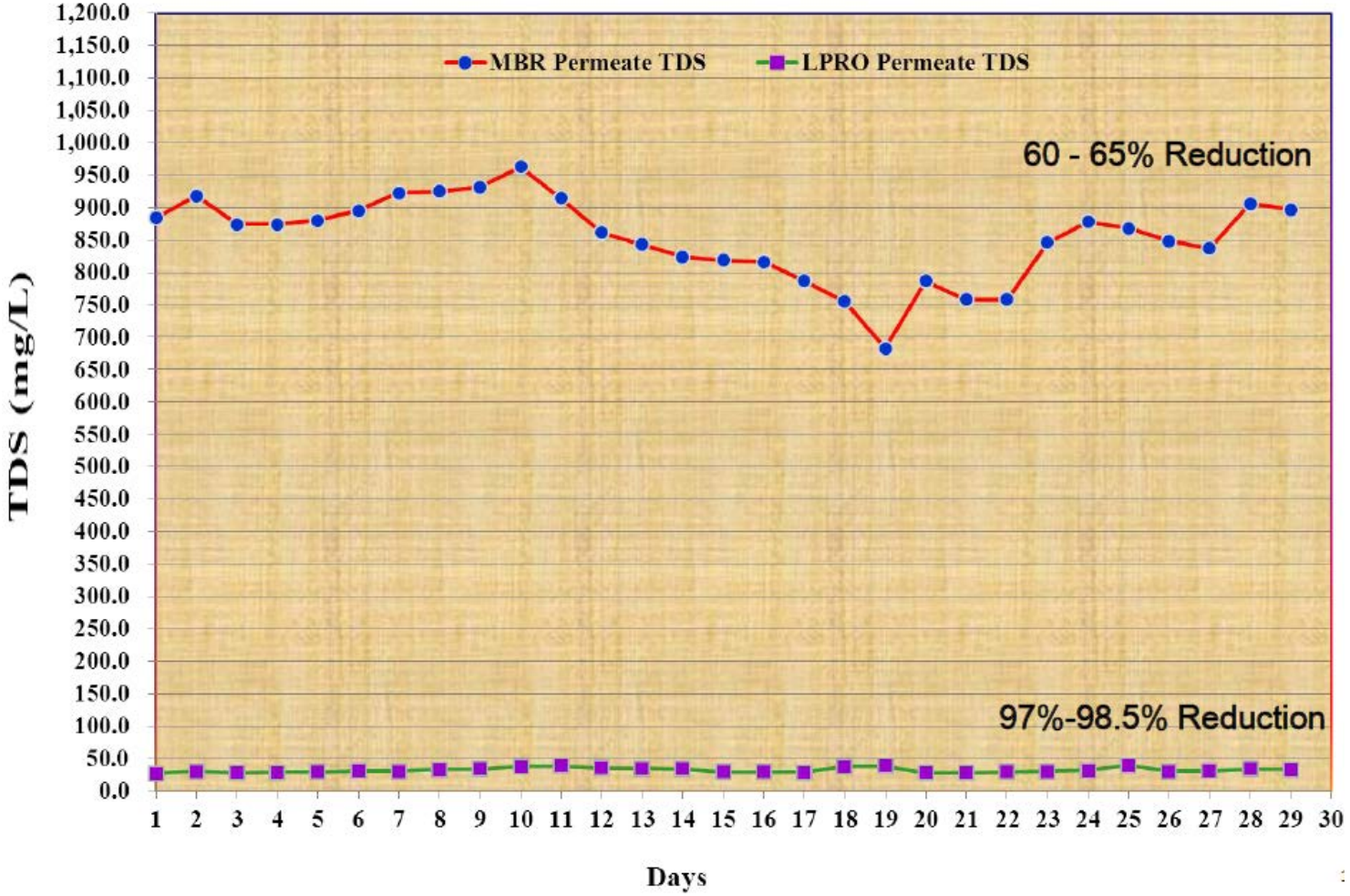
COD Removal Efficiency by Primary Clarifier and MBR (January 2012)



TDS Removal Efficiency by MBR & LPRO

(Raw Process Water TDS 2,200 mg/l - 2,800 mg/l)

February 2012



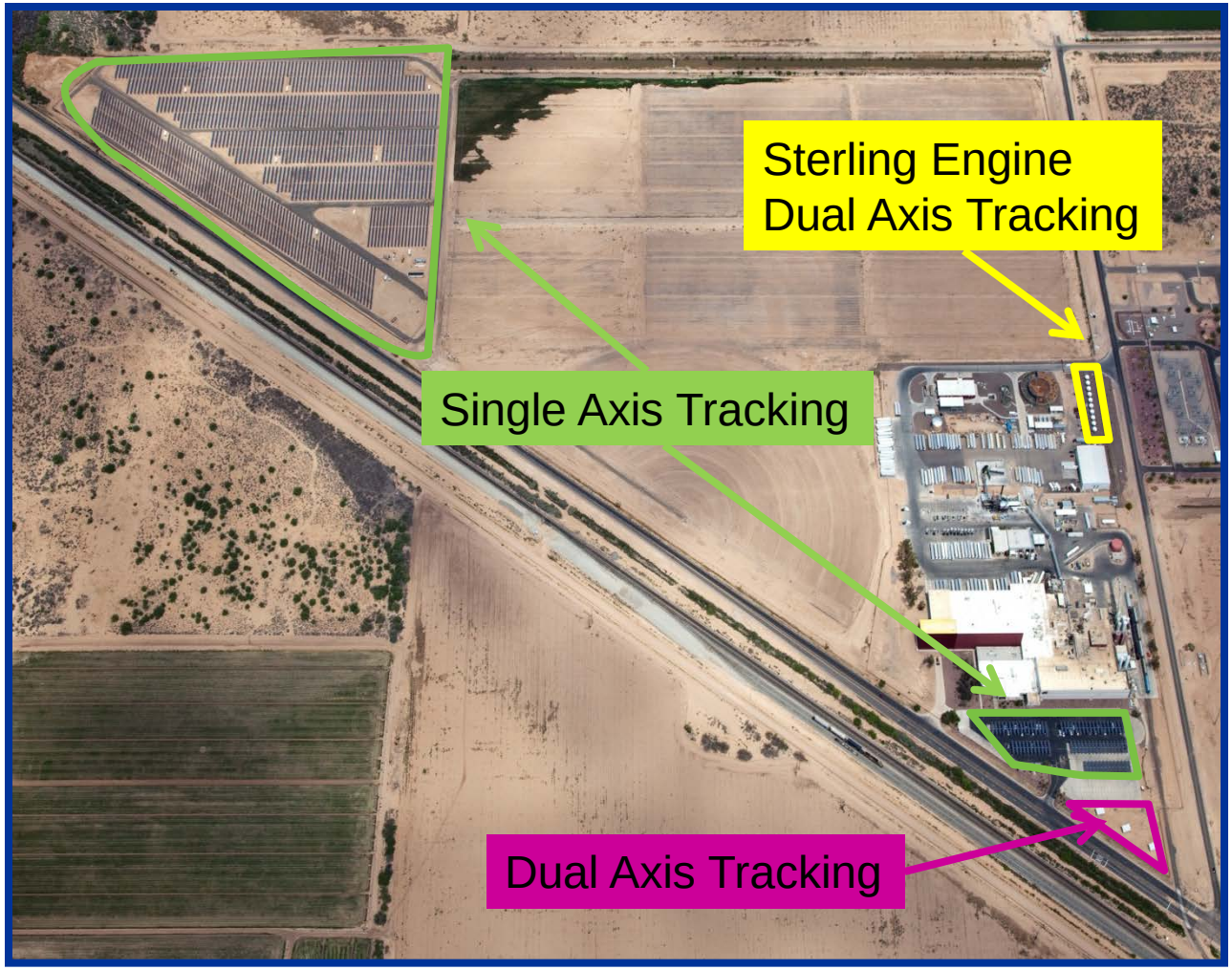
Process Water Treatment & Recycling Plant Finished Water Quality

- BOD = ND
- TSS = ND
- TN = ND
- NO3 = ND
- Color = 0 CU
- NO Microbes
- NO Sugar
- NO Protein
- Low TDS

➢ Meets EPA Drinking Water Standards!

Renewable Energy

- 4 Locations on Site
- 3 Types of Solar Panels
- Produce ~5MWt ~50% of Site's Annual Load



Renewable Energy

- Single Axis Tracking Photovoltaic:
  - Proven Technology
  - 18,000 Solar Panels
  - 36 Acres
  - Covered Parking & Field
- Dual Axis Tracking Photovoltaic:
  - SolFocus PV Panels
  - 10 Stirling Engines

Project Achievements

- 75 - 80% Water Reuse Achieved
- <1% of Waste to Landfill
- 67% of Energy Generated from Renewable Sources
- Collective Actions Reduced Greenhouse Gas Production by 50%

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The New York Times

National

THURSDAY, NOVEMBER 15, 2007

In Eco-Friendly Factory, Low-Guilt Potato Chips

By ANDREW MARTIN

CASA GRANDE, ARIZ.

At Frito-Lay's factory here, more than 500,000 pounds of potatoes arrive every day from New Mexico to be washed, sliced, fried, seasoned and portioned into bags of Lay's and Ruffles chips. The process devours enormous amounts of energy, and creates vast amounts of wastewater, starch and potato peelings.

Now, Frito-Lay is embarking on an ambitious plan to change the way this factory operates, and in the process, create a new type of snack: the environmentally benign chip.

Its goal is to take the Casa Grande plant off the power grid, or nearly so, and run it almost entirely on renewable fuels and recycled water. Net zero, as the con-

PETER DaSILVA FOR THE NEW YORK TIMES


Questions?
NET-ZERO PROJECT TEAM
CASA GRANDE, ARIZONA
Frito Lay
CDM Smith