Kubota MBR Systems

Damone Supica, PE
Product Engineer

(425) 248 - 7897
Damone.Supica@kubota.com

Kubota Corporation

For Earth, For Life
Kubota

Company Name	Kubota Corporation
HQ	2-47, Shikitsuhigashi, 1-Chome, Naniwa-ku, Osaka 556-8601, Japan
Founded	1890
Turnover	USD 19,200 M (as of Dec, 2019)
Operating profit	USD 2,017 M (as of Dec 2019)
Employees	41 027 (consolidated) 11,396 (non-consolidated) (as of Dec 2019)

Farm & Industrial Machinery Domain

For Earth, For Life
Kubota

Tractor

Residential Commercial Mower

Combine

Construction Equipment

Utility Vehicle

Corporate History

- ***Ductile iron pipes***
- ***Steel castings***
- ***Valves***
- ***Waste water treatment tanks***
- ***Pumps***
- ***Sewage treatment / water purification plants***

- *Vending machines*
- ***Weighing / measuring equipment***
- ***Engines***
- ***Agricultural / construction machinery.***
- ***Air-conditioning equipment***

1893

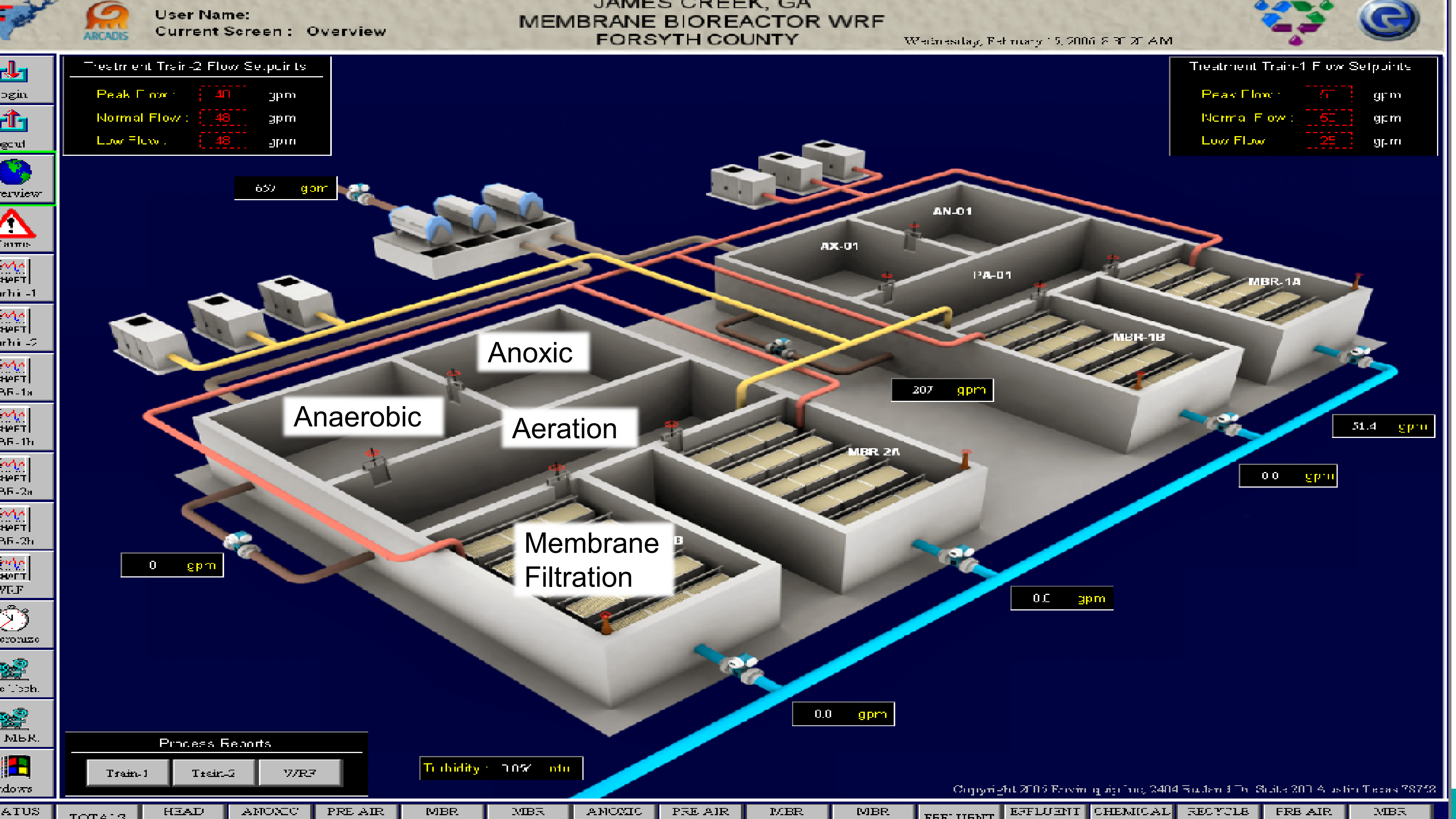
Started production of cast Iron pipes

1st US Installation – Bandon Dunes, OR ---2002

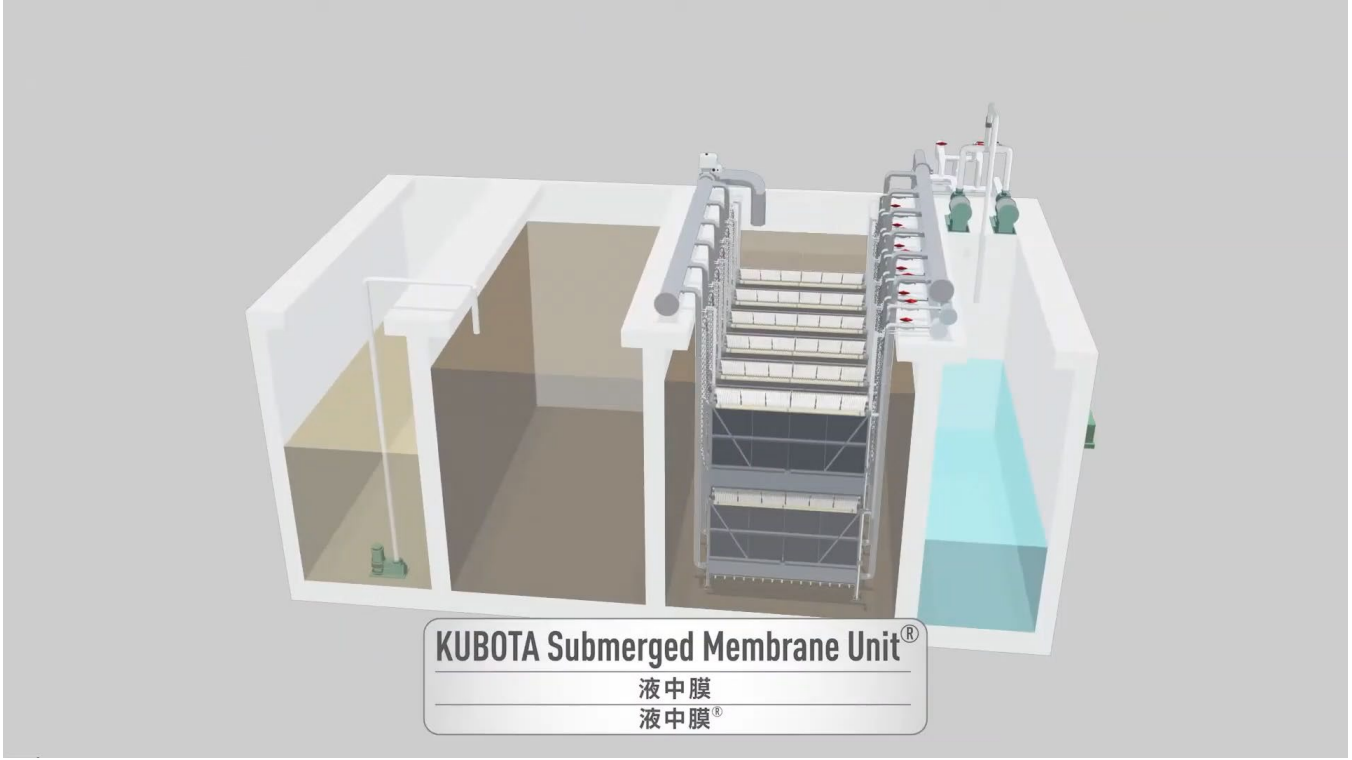
- The U.S. journey began
- in 2002 with **Bandon Dunes**

#1 in MBR Installations World Wide

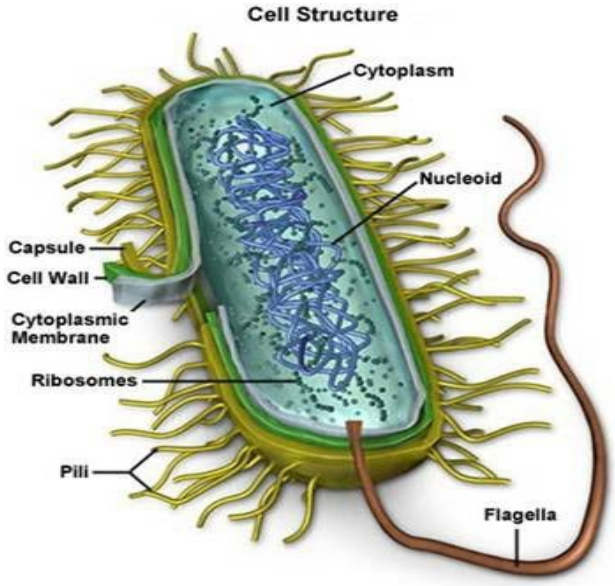
Fundamentals of MBR

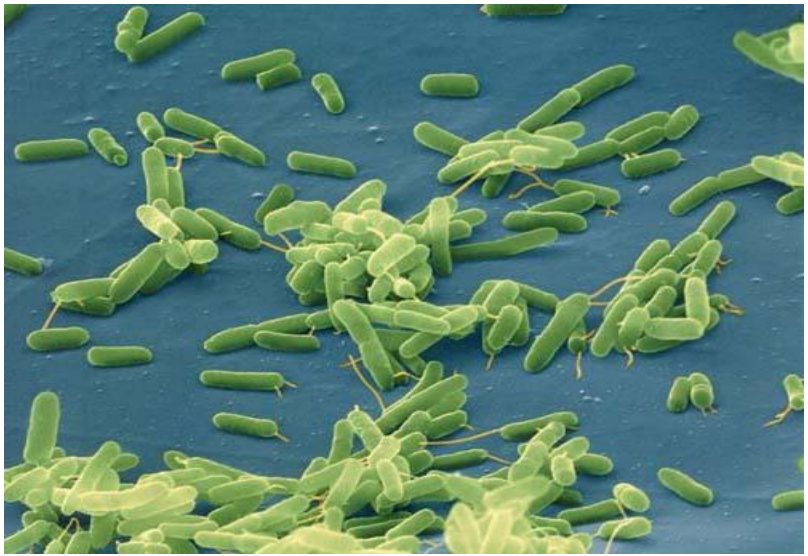

User Name:
Current Screen : Overview
MEMBRANE BIOREACTOR WRF
FORSYTH COUNTY
Normal Flow :
48
gpm
Peak Flow :
Low Flow
AN-01
AX-01
PA-01
MBR-1A
MBR-1B
MBR 2A
Anoxic
Anaerobic
Aeration
Membrane
Filtration
207 gpm
51.4 gpm
0.0 gpm
0 gpm
Process Reports
Train-1
Train-2
Turbidity
ntu
HEAD
PRE AIR
MBR
ANOXIC
EFFLUENT
CHEMICAL
RECYCLE

MBR Process Overview

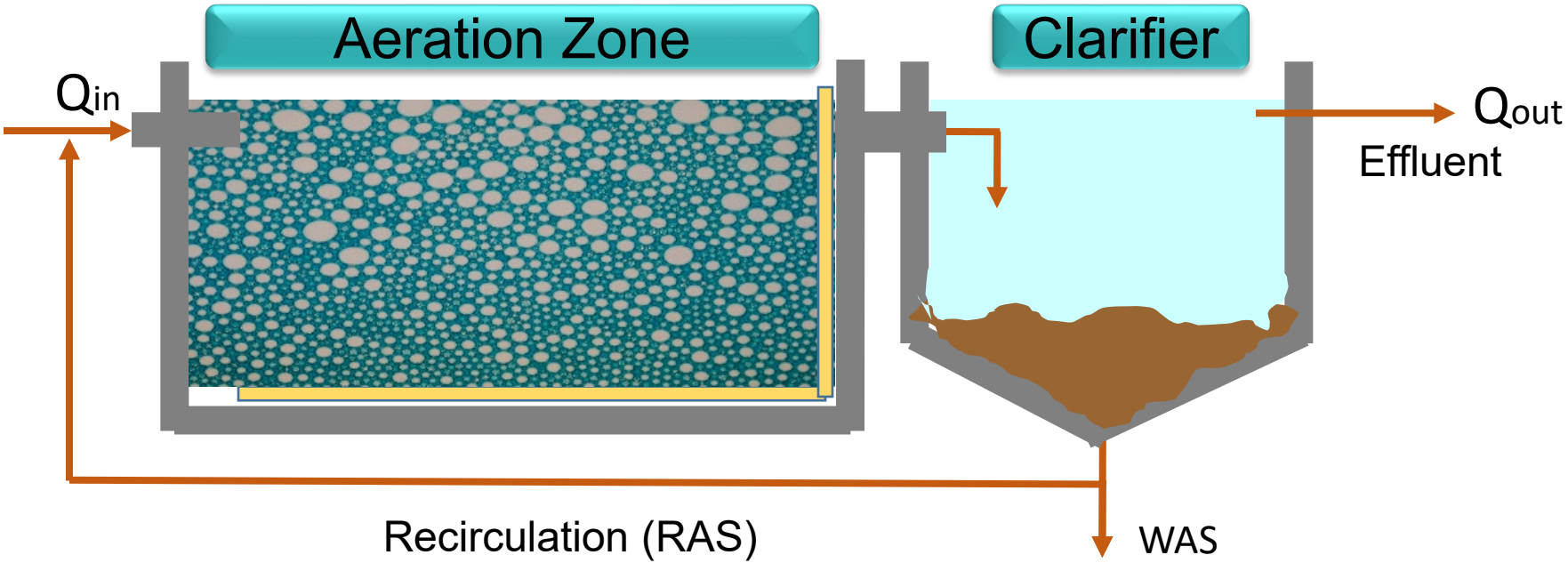


Biological Treatment

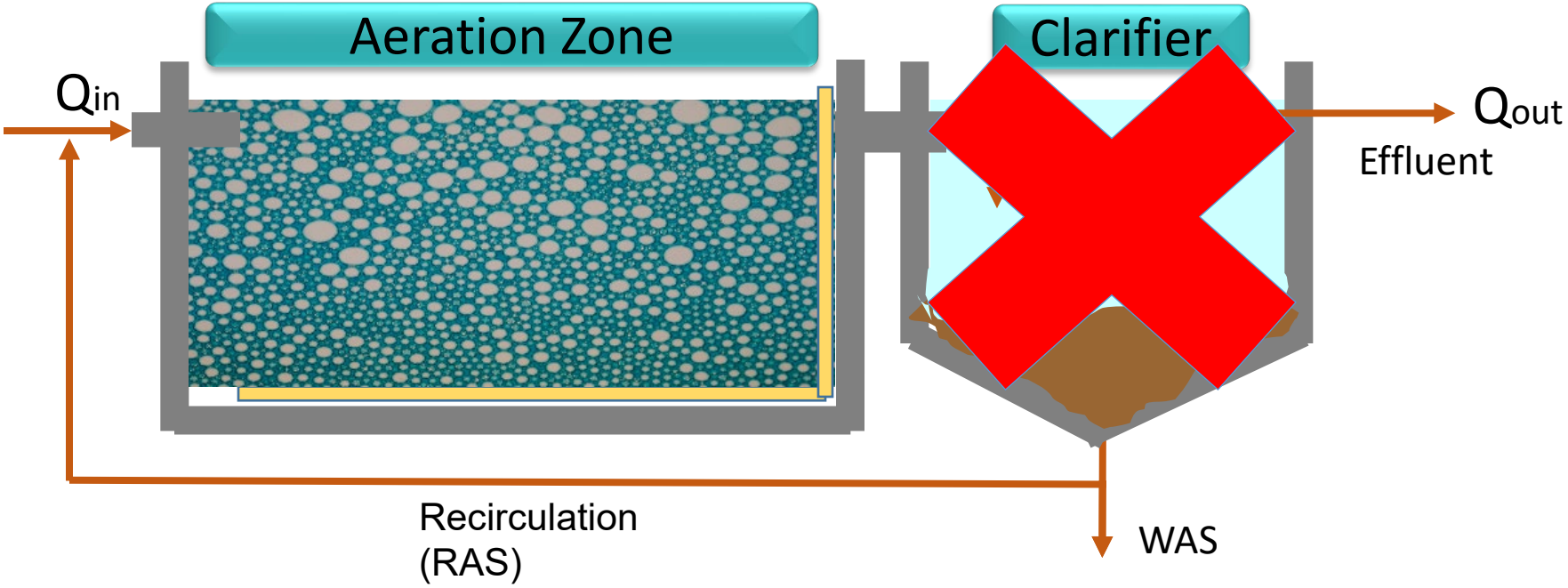




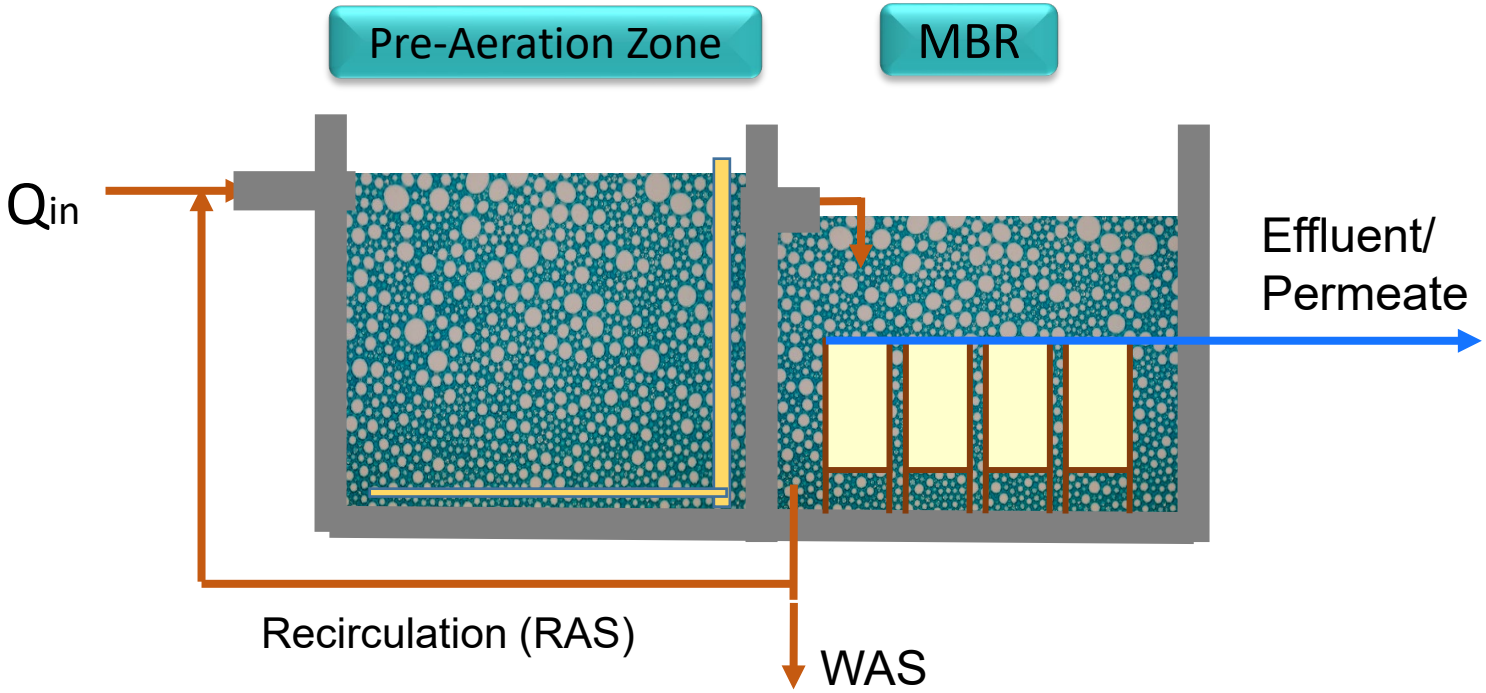
Liquid-Solids Separation



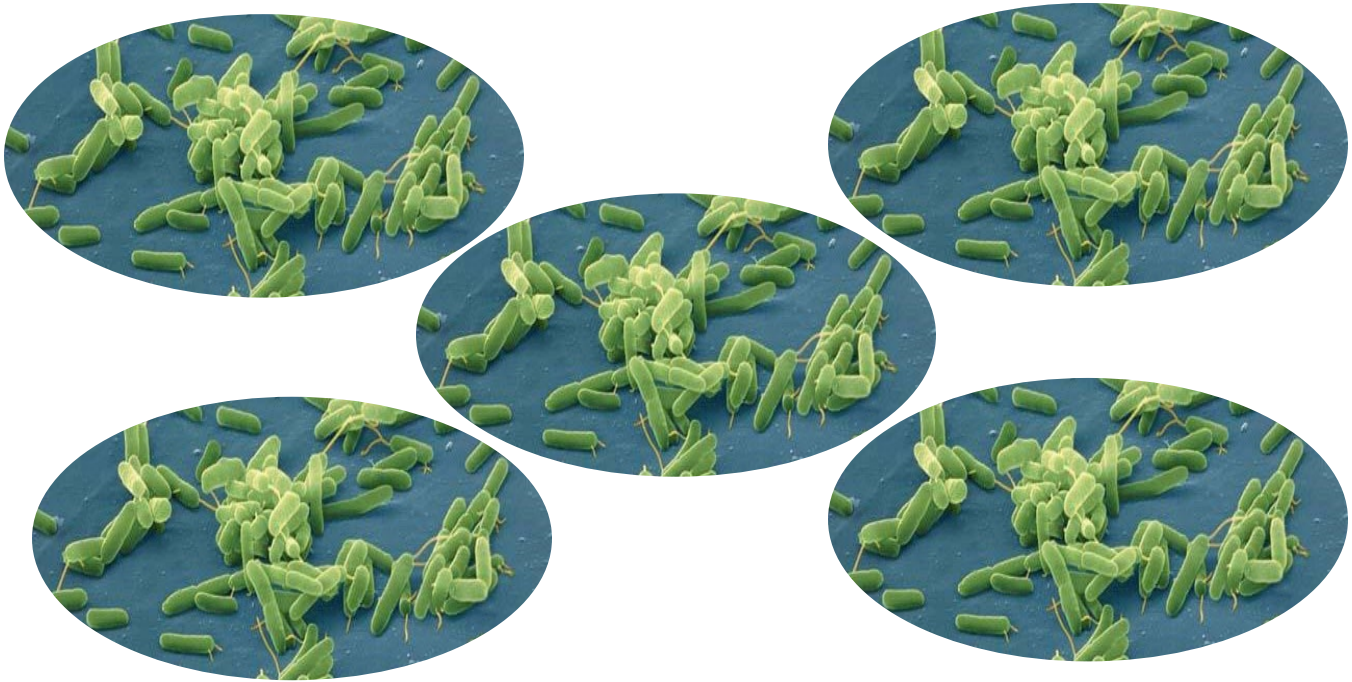
Liquid-Solids Separation



Liquid-Solids Separation

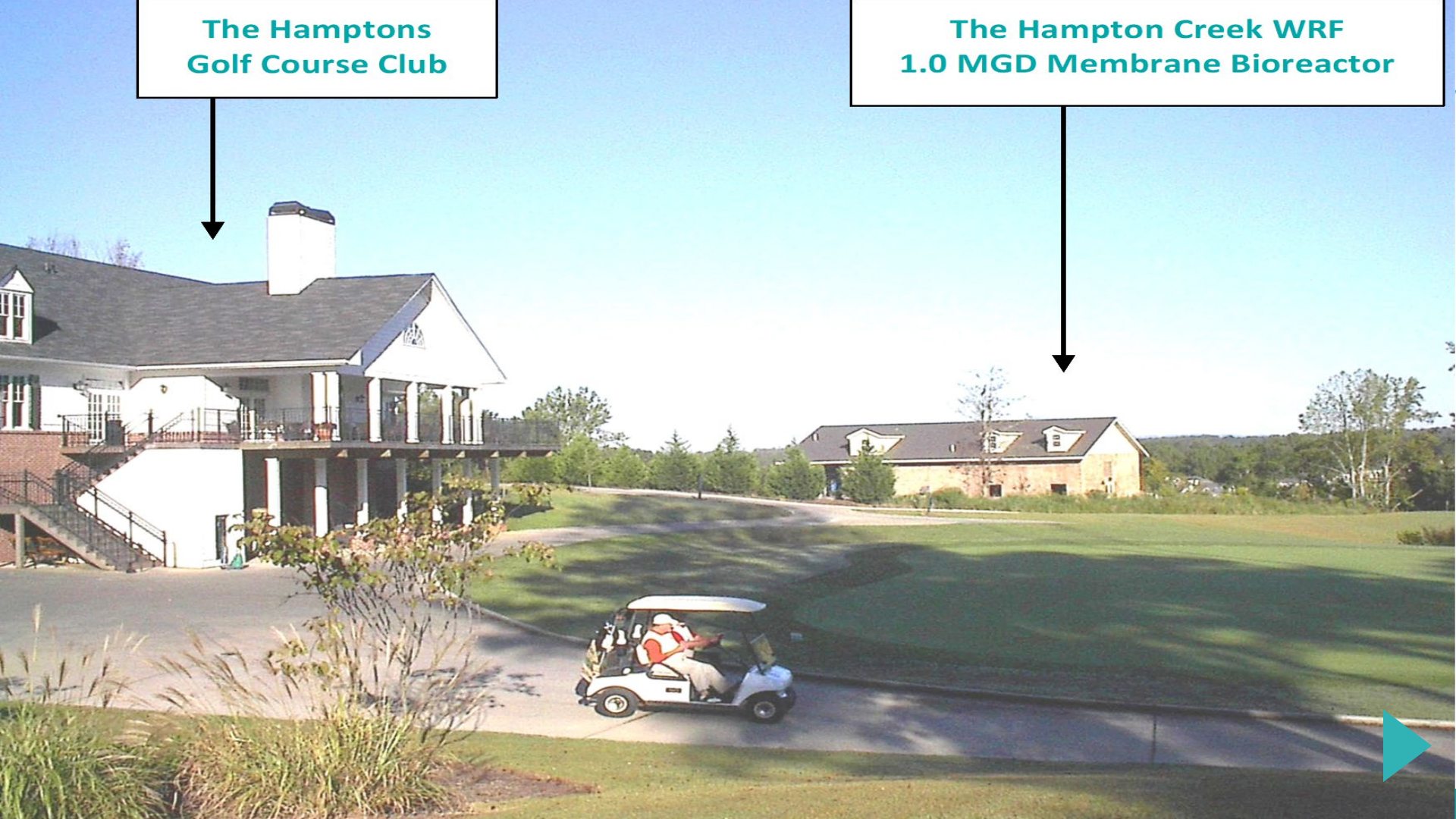


Wastewater Bacteria



MBR has 4X to 5X the bacteria concentration

Hidden in Plain Site


The Hamptons
Golf Course Club
The Hampton Creek WRF
1.0 MGD Membrane Bioreactor

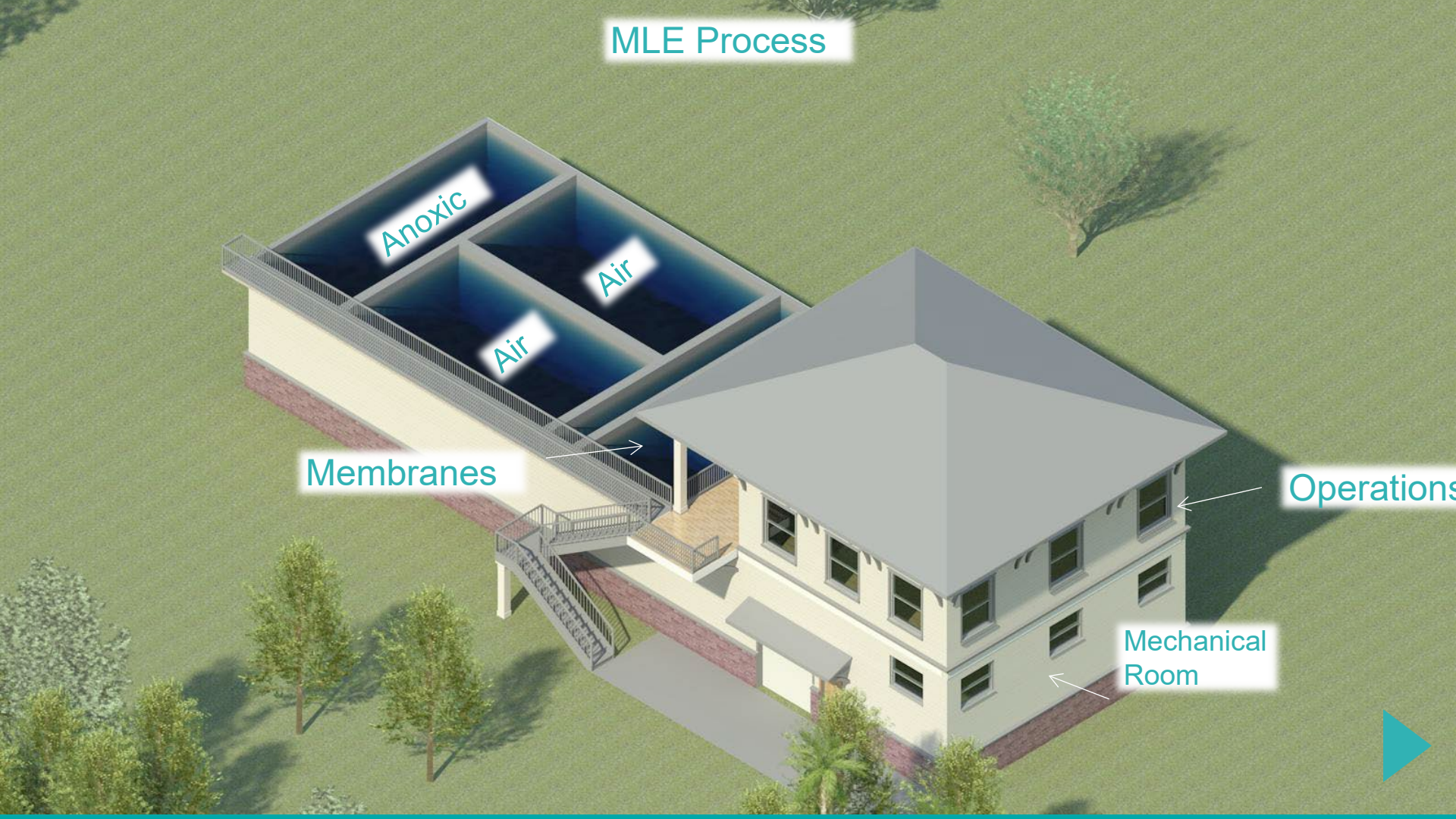

Anoxic
Membranes
Fine Screens

250,000 gpd MBR

Isle of Palms, SC

700,000 gpd

MLE Process




EXIT
AERZEN
Delta Blower
Delta Blower


200,000 gpd Conventional package plant
700,000 gpd MBR

Isle of Palms Part2 ---The Expansion!

Heart of the MBR System

History of Kubota SMU

1990 1995 2000 2005 2010 2015

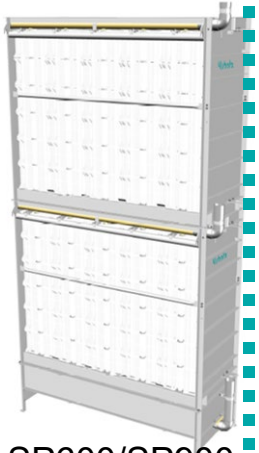
A100

ES200

EK400

RW400

SP400



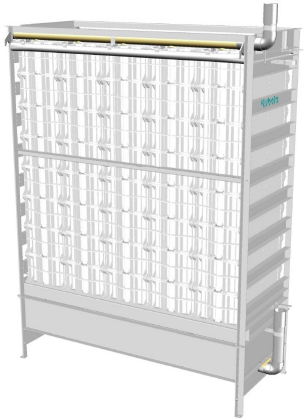
SP600/SP900

Same Membrane Sheet for last 30 years

Optimization that maintains Kubota Stengths

Kubota SP Series

SP450 – 11” SWD

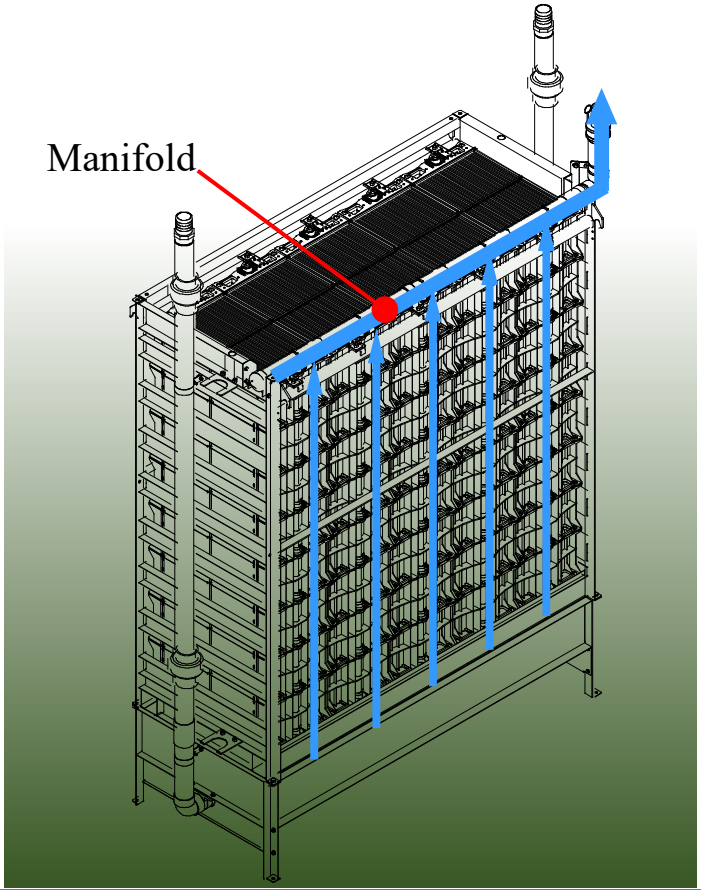


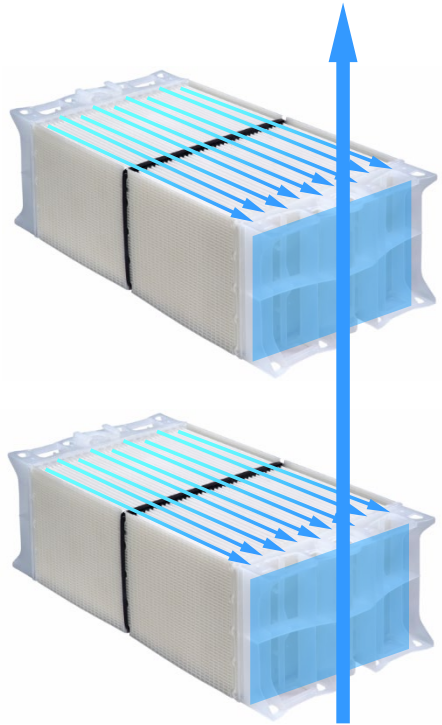
SP675 – 15’ SWD

SP900 – 19’ SWD

Models are identical except in the depth.

Permeate Collection

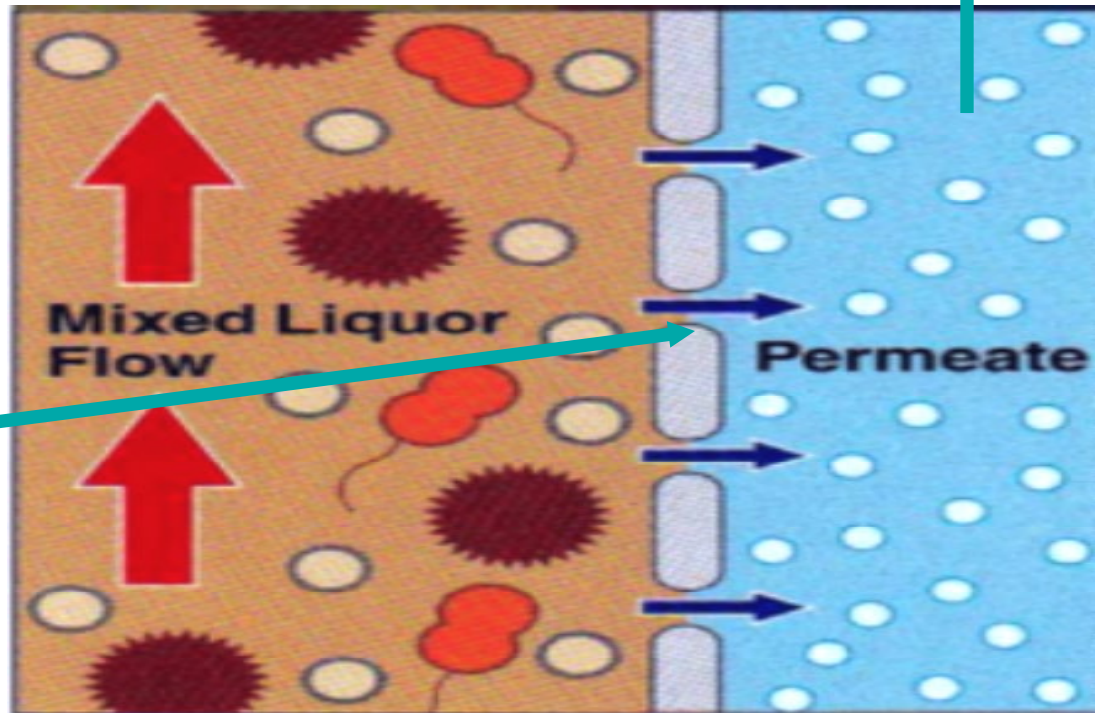




Membrane Performance

Membrane Pore Size

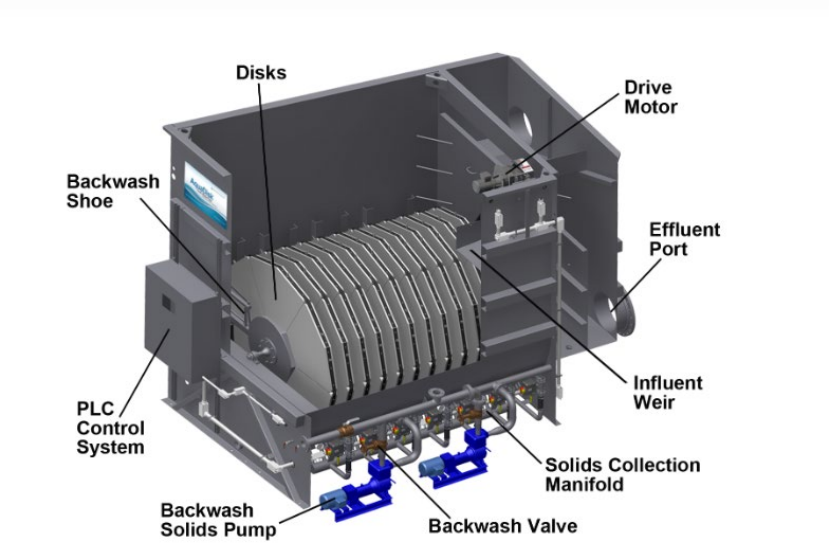
Typical 1 psi TMP



Avg. pore size 0.20 micron

Two Types of Filters

Disk Filter



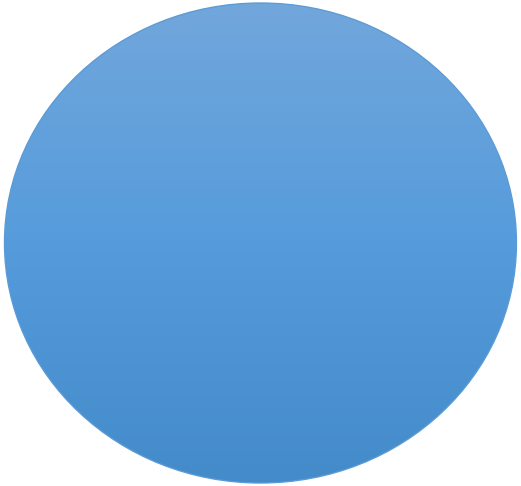
Tertiary Filter--Up to 20 mg/l

Kubota Membrane

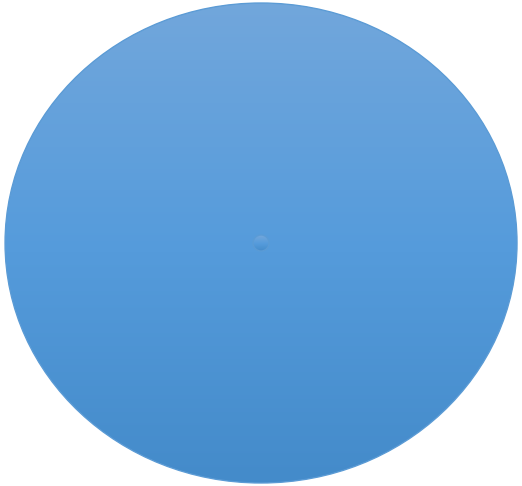
Barrier-
Filters 40,000 mg/l TSS

Pore Size

Sand or Cloth Filter - 10 micron

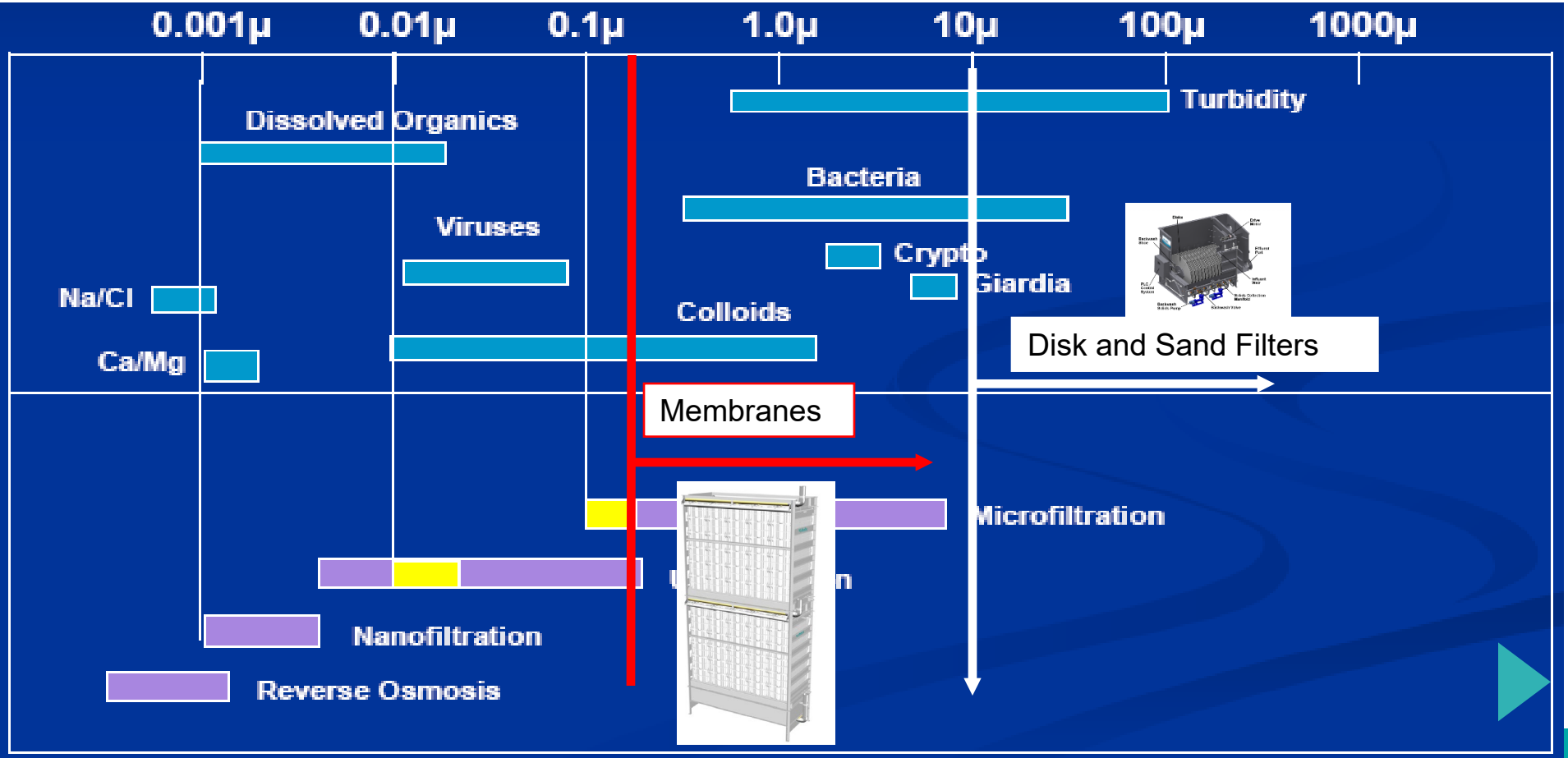


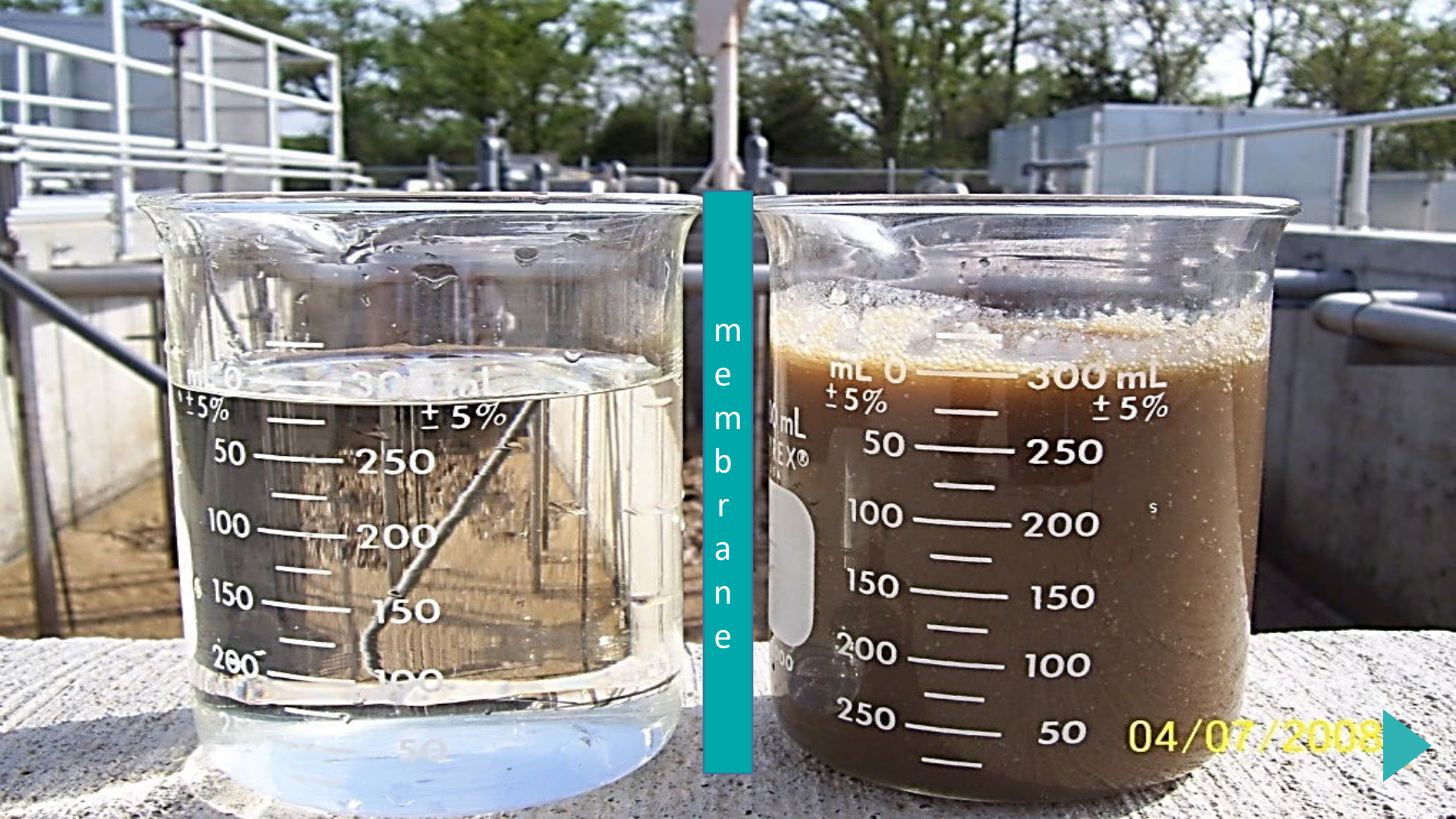
Membrane - 0.20 micron



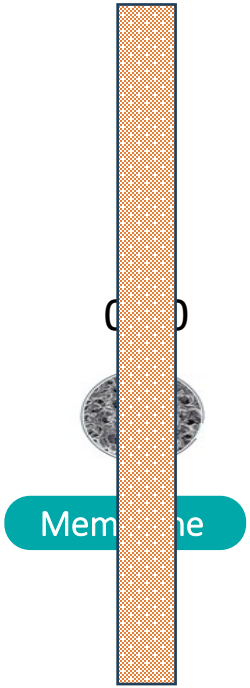
50 Times Smaller Opening Compared to Conventional Filter

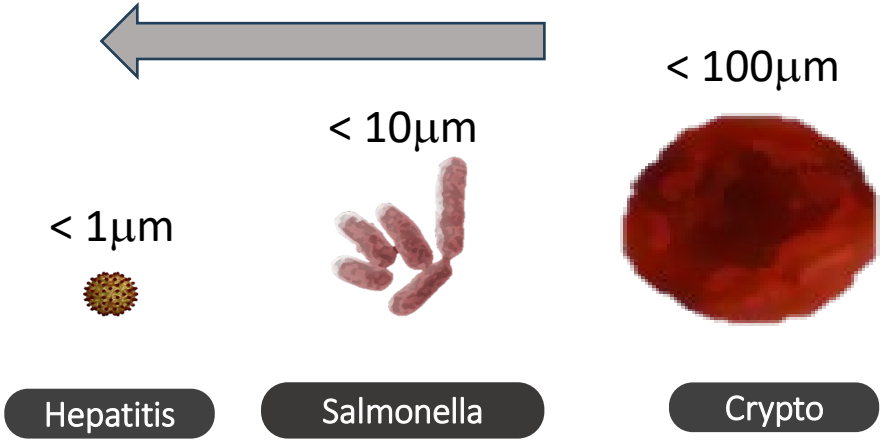
Contaminant Rejection




membrane
300 mL
± 5%
250
200
150
100
50
04/07/2008

Fecal Coliform





MBR Effluent = Non-Detect on Fecal Coliform (PRIOR TO DISINFECTION)


Town of Davie, FL (4 MGD)
MBR

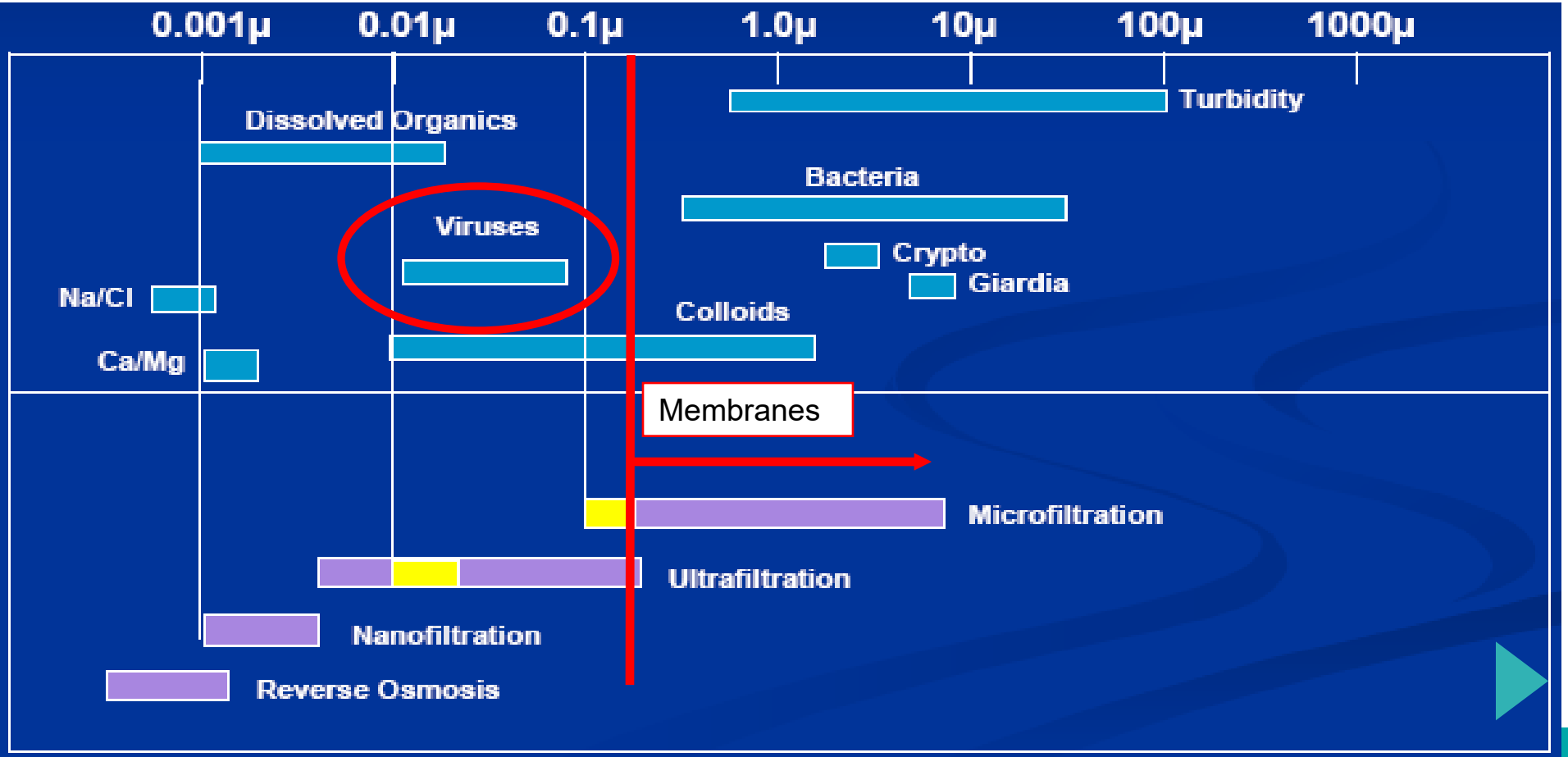
Town of Davie, FL

7 Year Old Membrane

Membrane Performance Data

	Effluent TSS			Effluent Fecal		
	MONTHLY	3-MO. AVG.	12-MO. AVG.	MONTHLY	3-MO. AVG.	12-MO. AVG.
Jul-2019	1.00	1.00	1.00	1.00	1.00	1.04
Aug-2019	1.00	1.00	1.00	1.00	1.00	1.04
Sep-2019	1.00	1.00	1.00	1.00	1.00	1.04
Oct-2019	1.00	1.00	1.00	1.00	1.00	1.04
Nov-2019	1.00	1.00	1.00	1.00	1.00	1.02
Dec-2019	1.00	1.00	1.00	1.00	1.00	1.00
Jan-2020	1.00	1.00	1.00	1.00	1.00	1.00
Feb-2020	1.00	1.00	1.00	1.00	1.00	1.00
Mar-2020	1.00	1.00	1.00	1.00	1.00	1.00
Apr-2020	1.00	1.00	1.00	1.00	1.00	1.00
May-2020	1.00	1.00	1.00	1.00	1.00	1.00
Jun-2020	1.20	1.07	1.02	1.00	1.00	1.00
Jul-2020	1.00	1.07	1.02	1.00	1.00	1.00

What about Virus Removal by Membranes?



Protozoa & Viruses

- ***Protozoa***

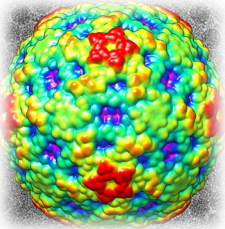
Giardia

5-18 µm

Cryptosporidium

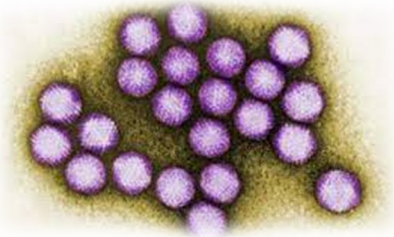
0.5-5 µm

- ***Viruses***



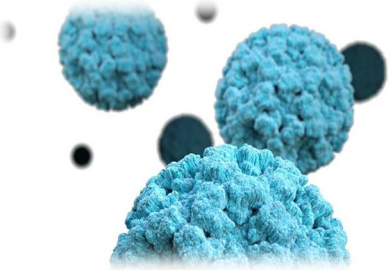
Enterovirus

0.020-0.030 µm



Adenovirus

0.090-0.100 µm



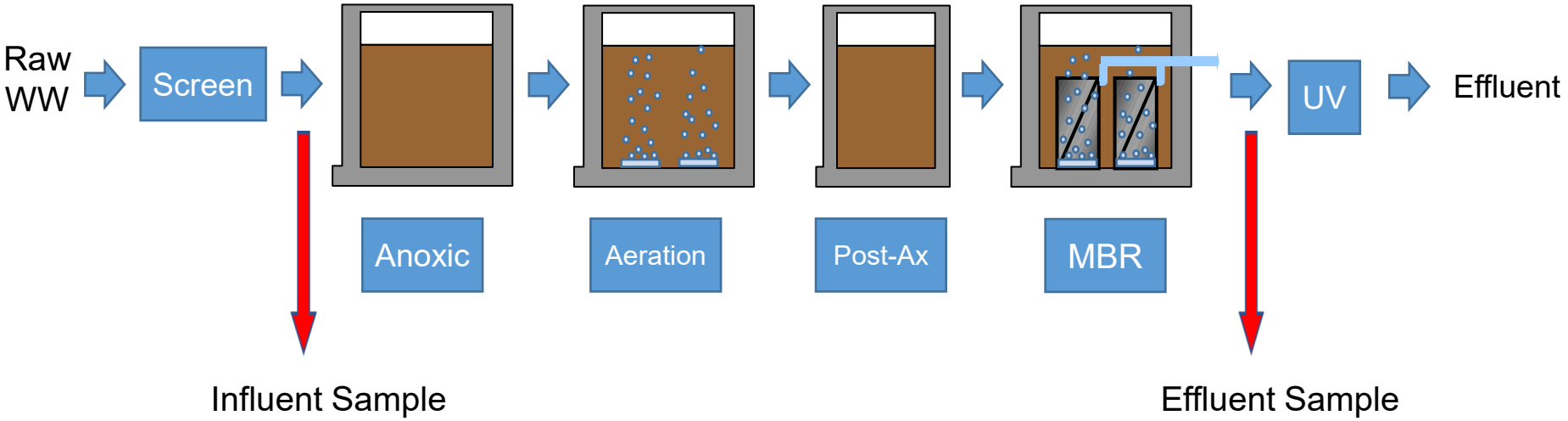
Norovirus

0.023-0.040 µm

Lake of the Pines WWTP, CA

Membranes are 10 years old.

Lake of the Pines WWTP, CA



Virus Removal Result Summary

Pathogen Name	Size (μm)	Average LRV
Giardia	6～8 x 8～14	**5.64**
Cryptosporidium	1～3 x 6～8	**3.55**
Clostridium perfringens	0.9～1.3 x 3～9	3.28
Coliphage (Male Specific)	0.022～0.026	4.17
Coliphage (Somatic)	0.022～0.026	3.57
Adenovirus	0.090～0.100	2.60
Enterovirus	0.020～0.030	**3.96**
Norovirus (GIA)	0.023～0.040	**4.11**
Norovirus (GIB)	0.023～0.040	**3.99**
Norovirus (GII)	0.023～0.040	2.11

Virus Removal ranged from 99% to 99.99%

But would you drink it?

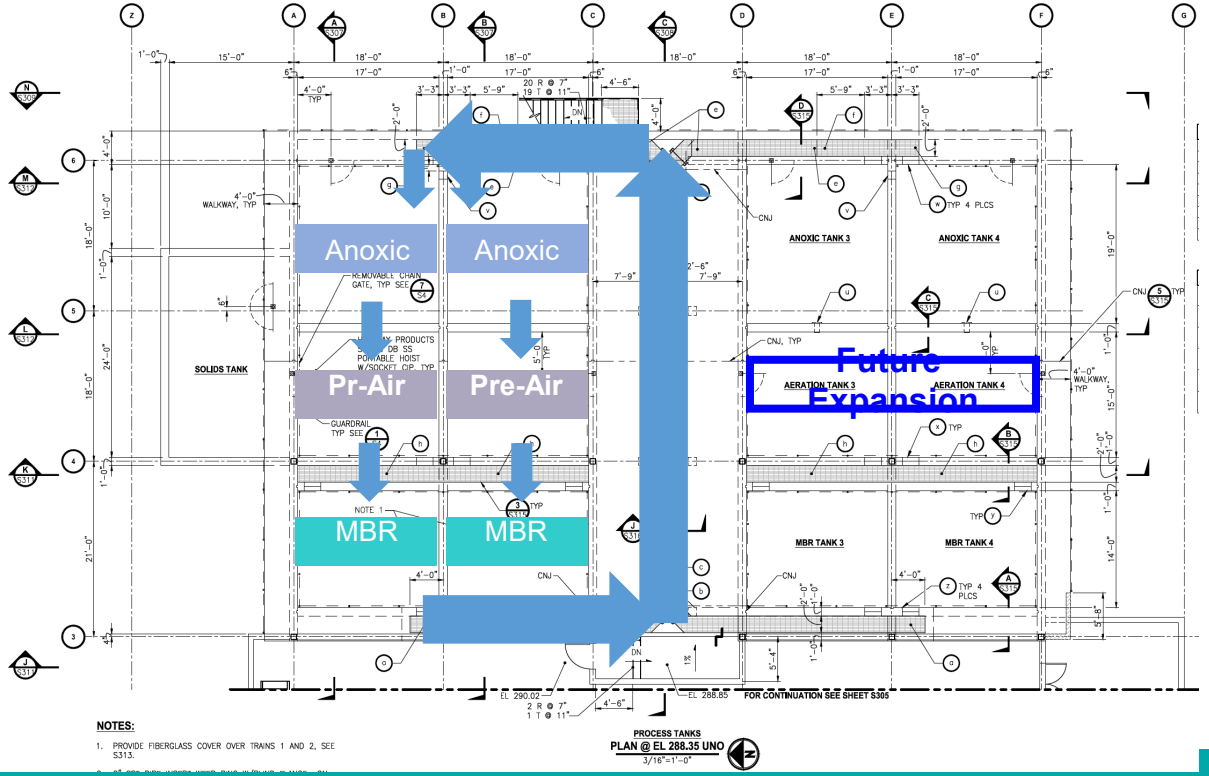
Steve Majors – Dyer Partnership Engineer
Designed First US Kubota MBR in 2002 (Bandon Dunes, OR)


Cowlitz Indian Tribe

Some Project Drivers

- Class V Underground Injection Control System – EPA Region 10
- Federal Primary Drinking Water Standards
- Water Reclamation Facility Ability to Meet Primary DW Standards Prior to Injection
- Vertical Wells Were Selected for Vadose Zone Injection

Some Project Drivers



Construction

Construction

Construction

Completed MBR System

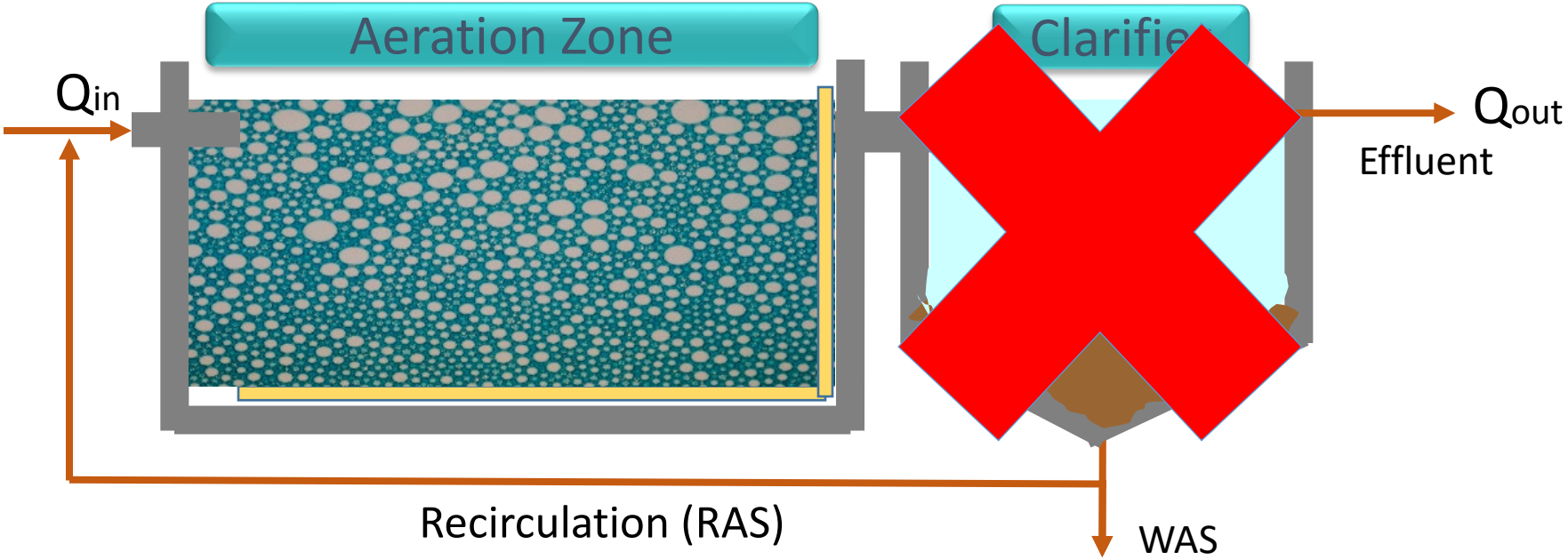
Permeate Collection

Blower Room

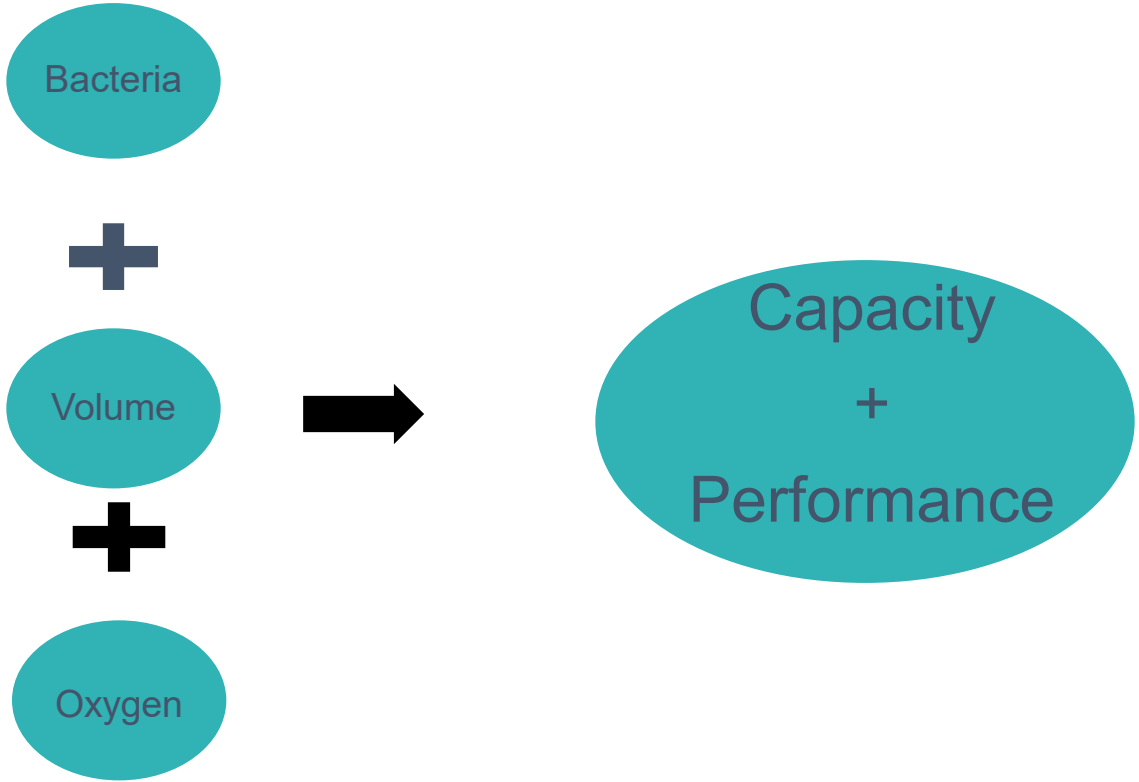
More Capacity & Better Treatment

Converting To MBR

MBR Retrofits

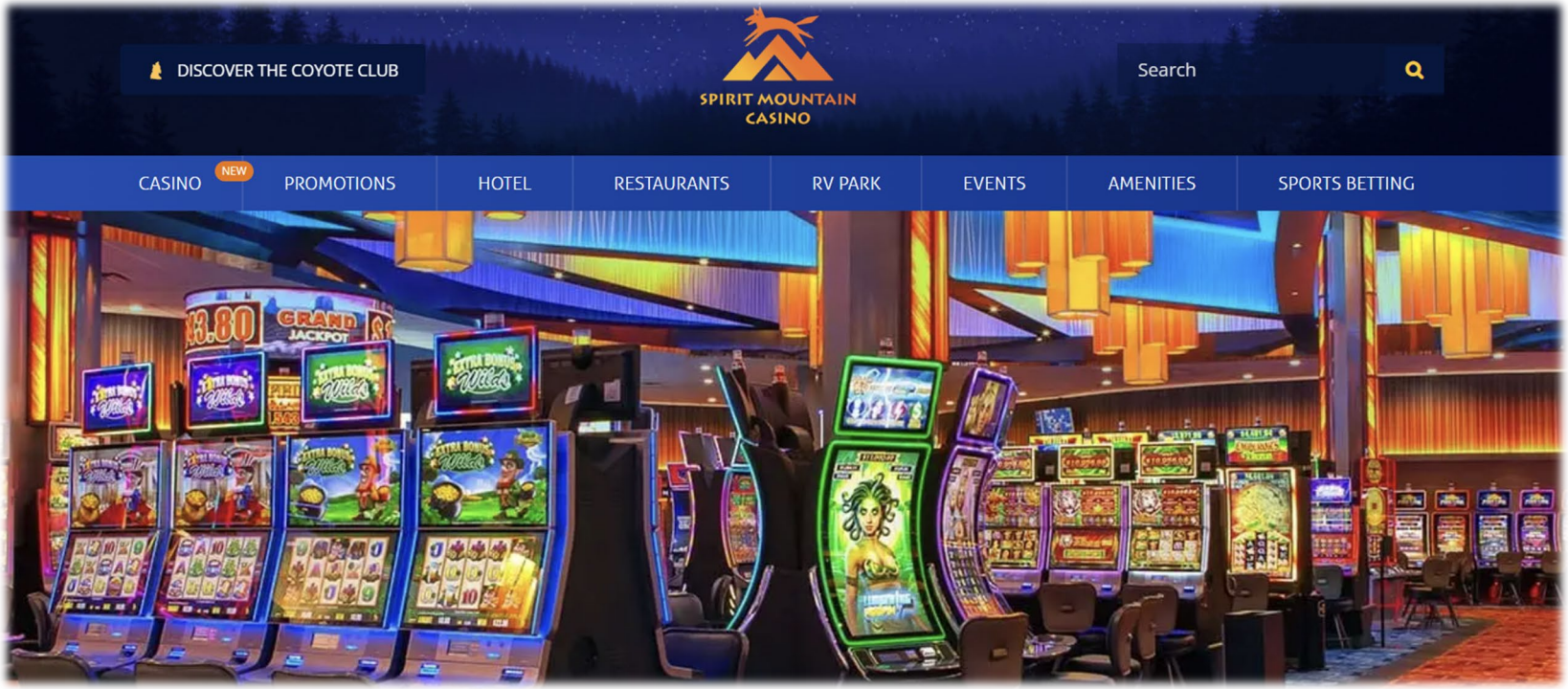


MBR Retrofit




Welcome to
Confederated Tribes of Grand Ronde
Our Story
Umpqua • Molalla • Rogue River • Kalapuya • Chasta

Spirit Mountain Casino



Project Objectives

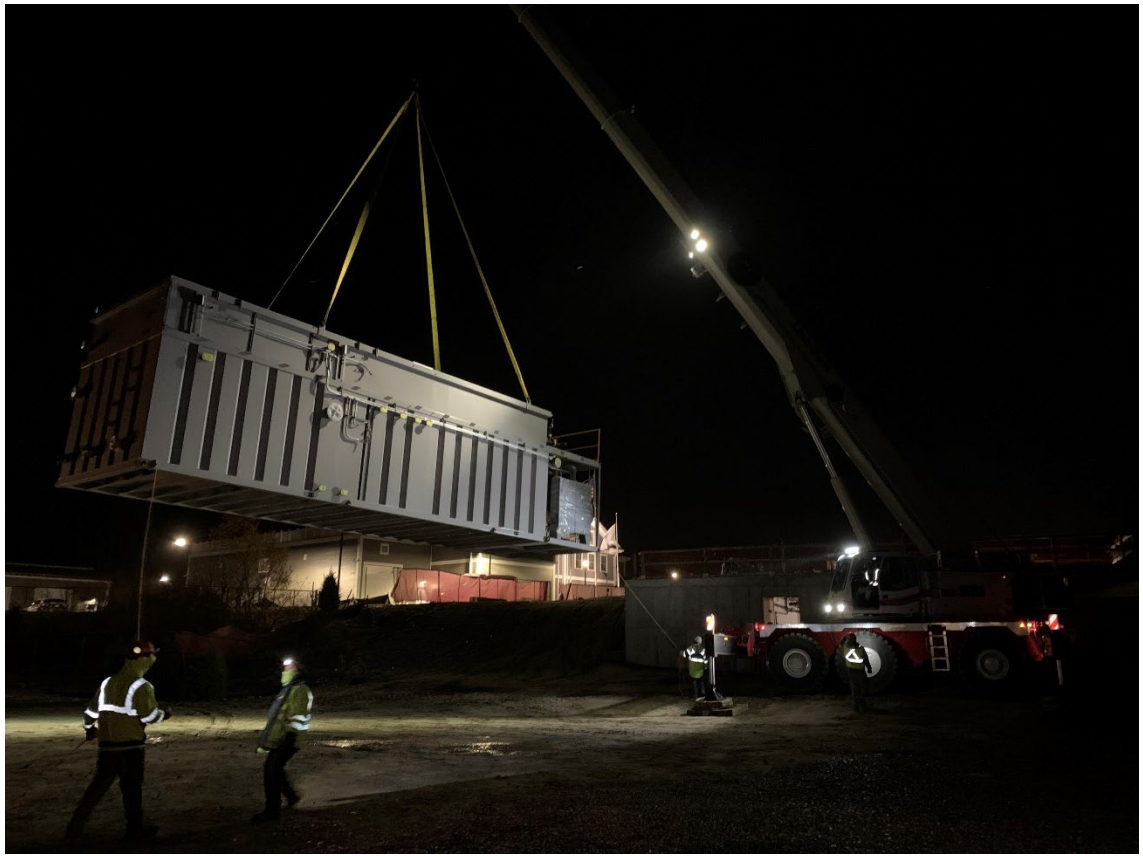
- Increase Capacity by 3X (Future Flow)
- Better Performance
- Limited Space Available

Tripled Existing Plant Capacity

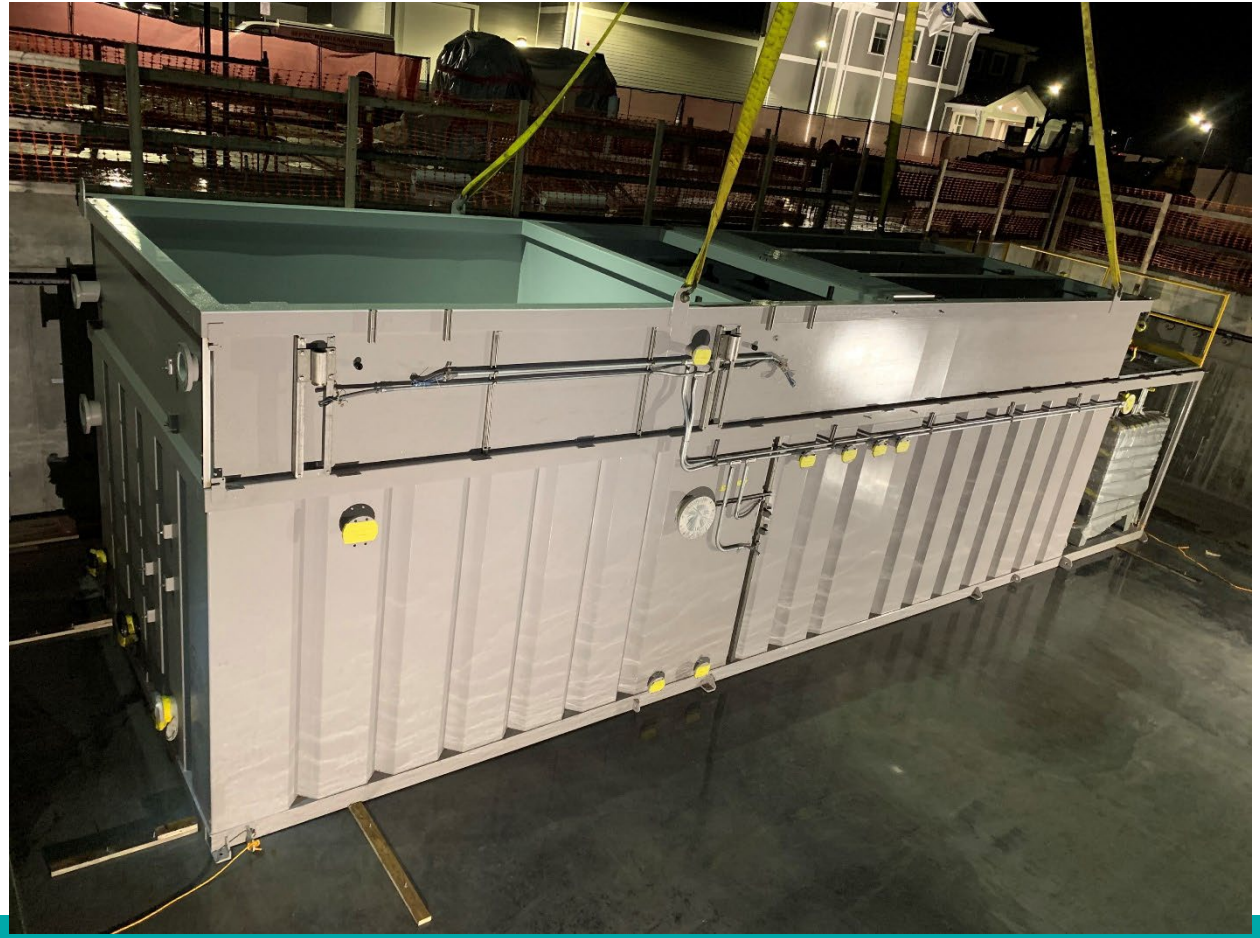

Gravity Permeate Collection

Package MBR Systems

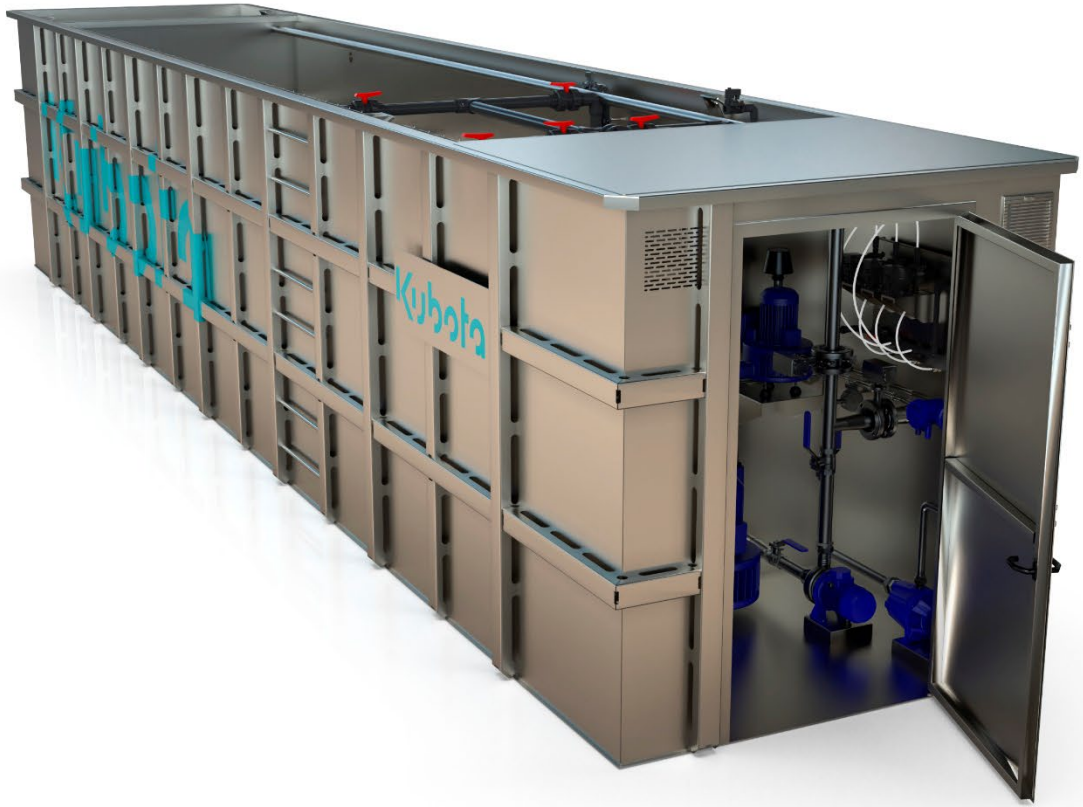
Bourne (Delivery)



Bourne (Installation)



Package MBR Systems

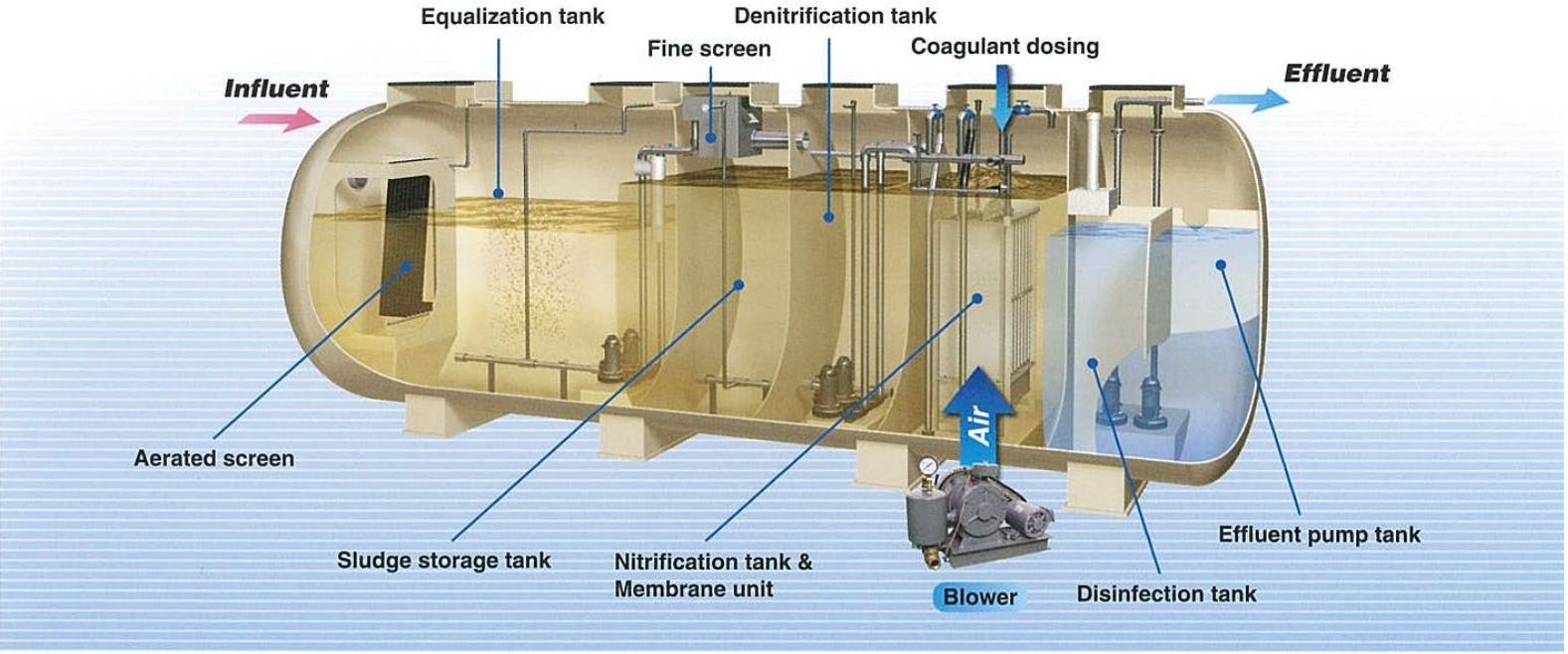

Kubota

MBR Package Plant

MBR Package Plant

Control Panel

What is Johkasou?



Examples

Examples

Keeping the Membranes Clean

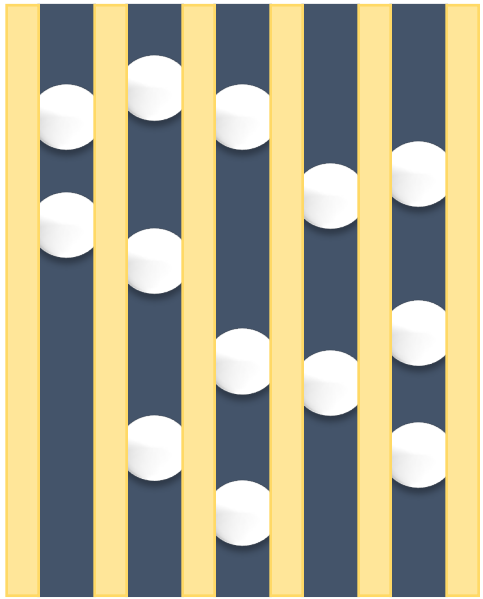
Types of Membrane Cleaning

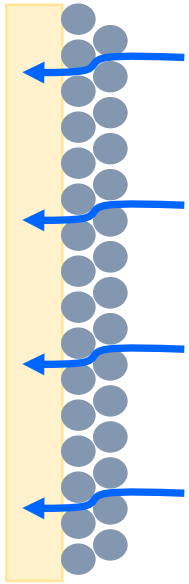
Physical

Chemical

Kubota Air Scour (Physical)

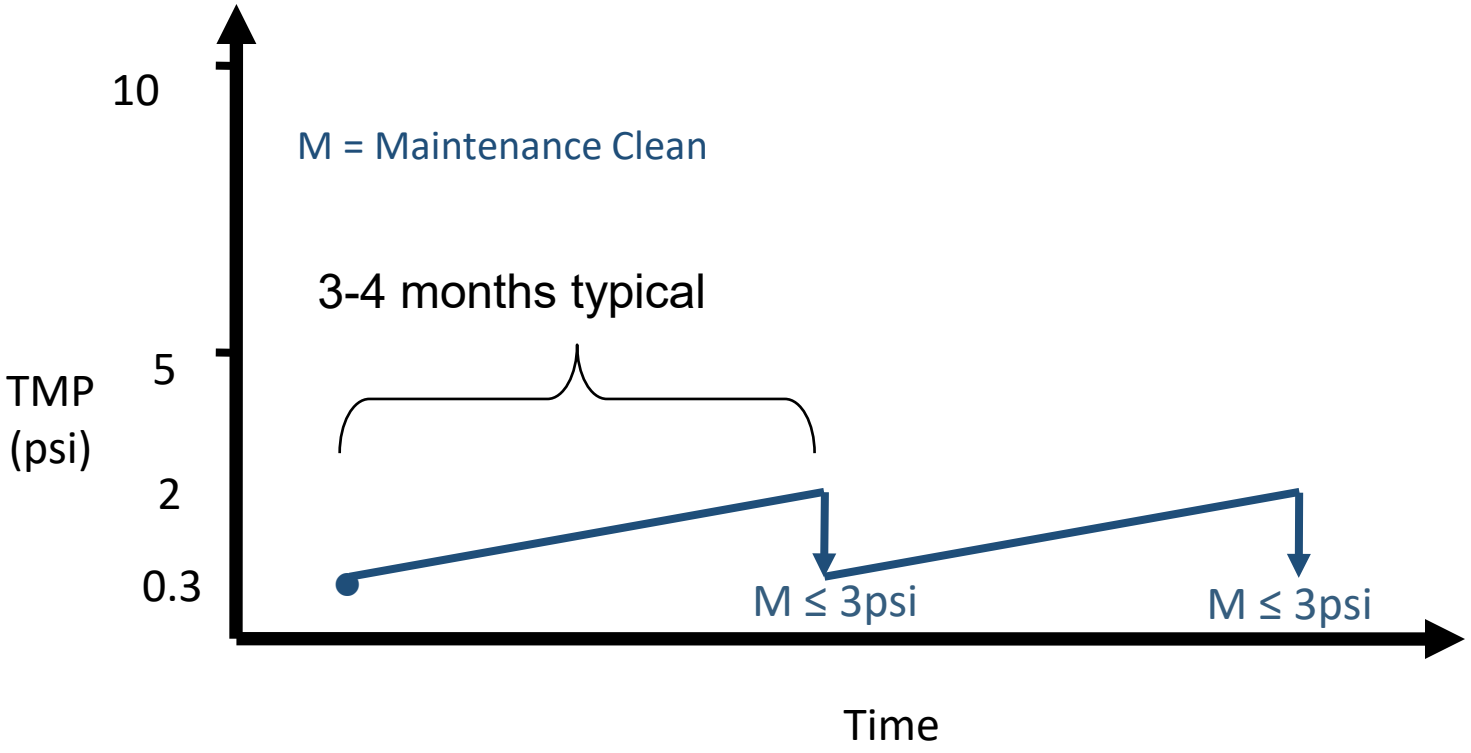
Why Membrane Geometry is Key



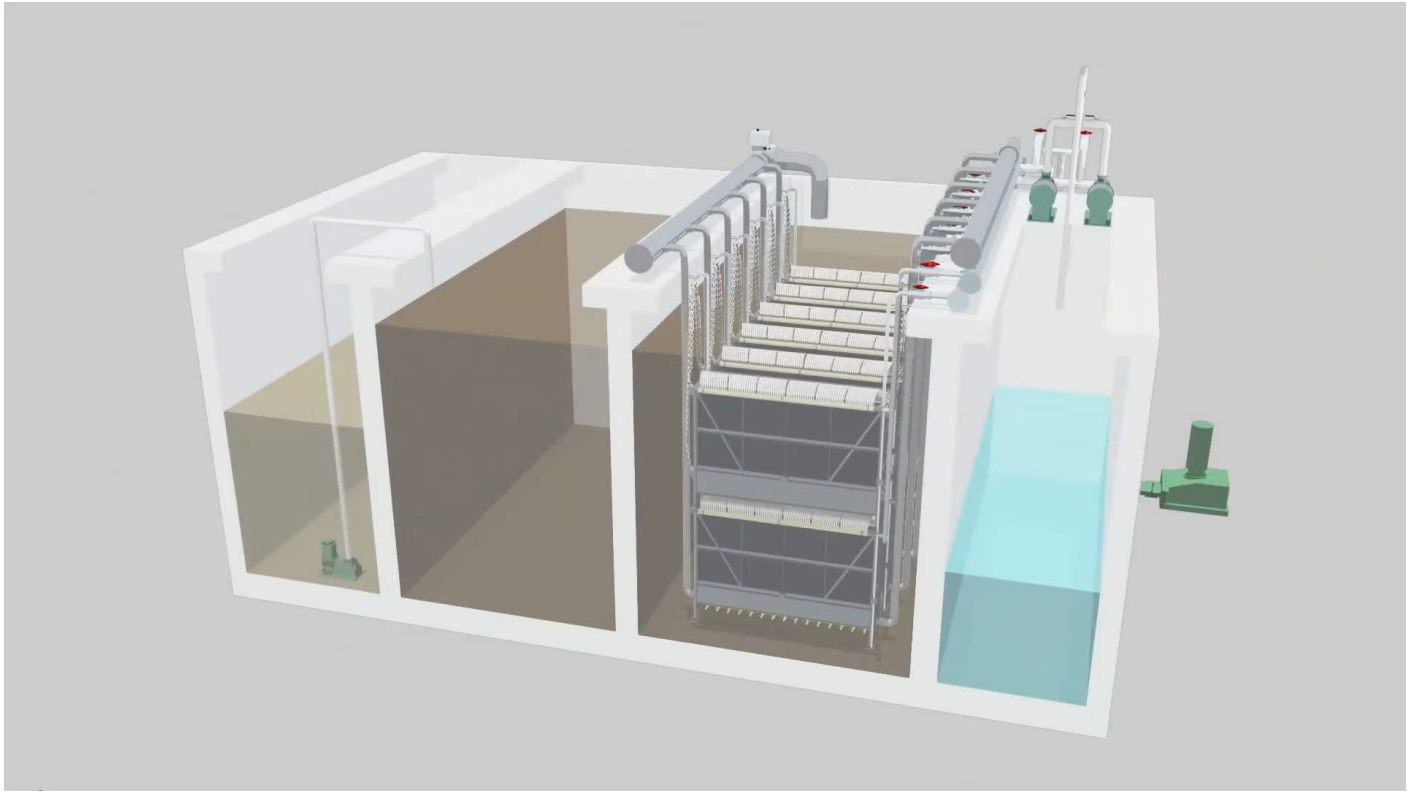


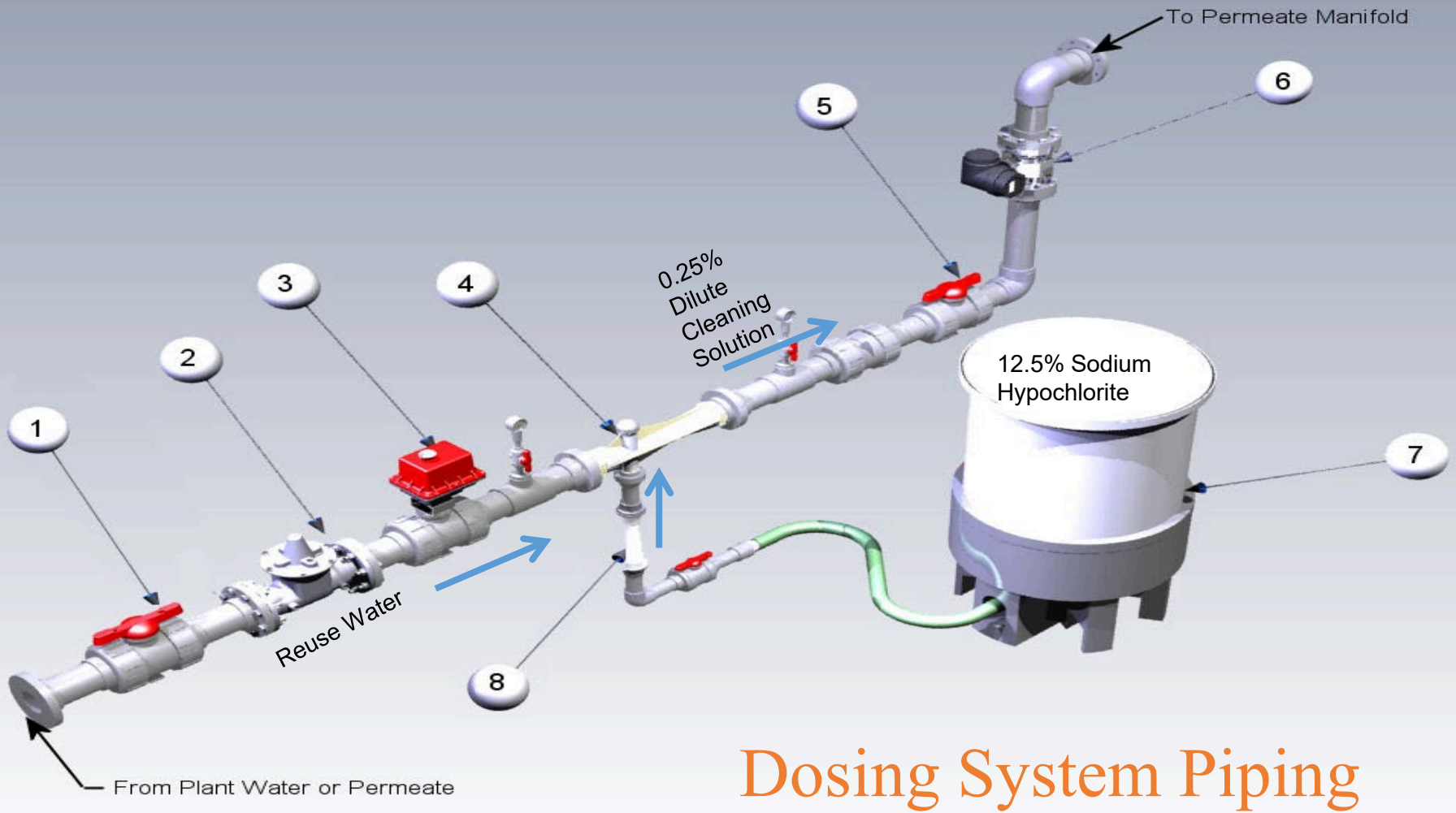
Scour Efficiency is VERY high for us due to geometry of flat plate.

Kubota Chemical Cleaning - CIP



Kubota Chemical Cleaning - CIP

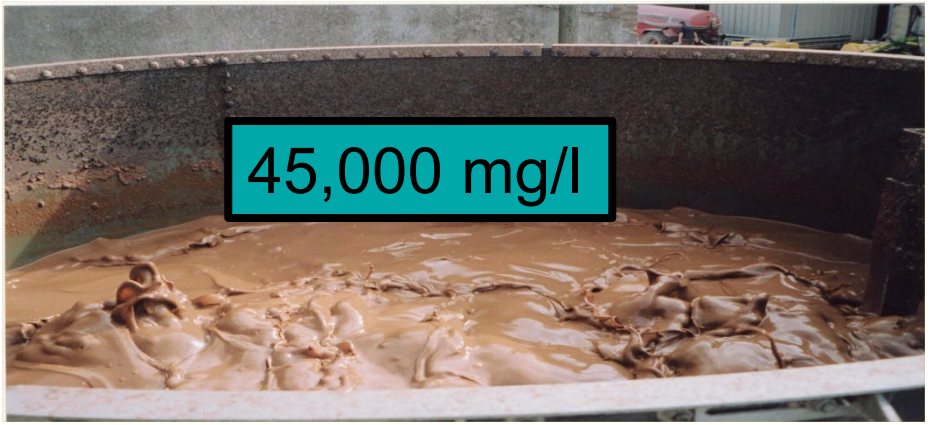


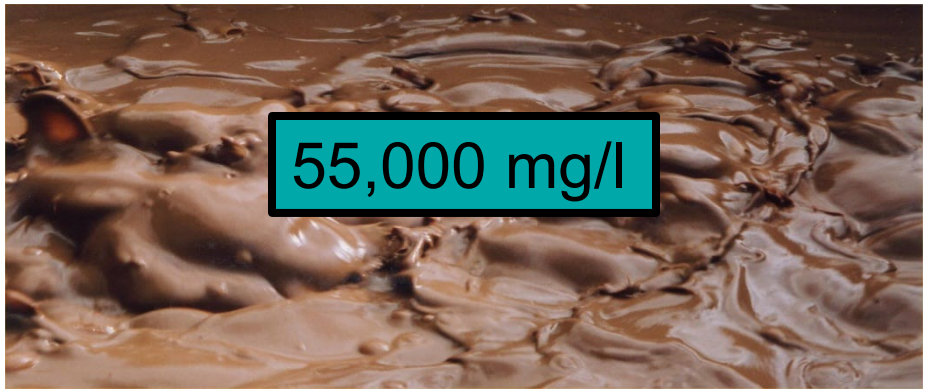


Dosing System Piping

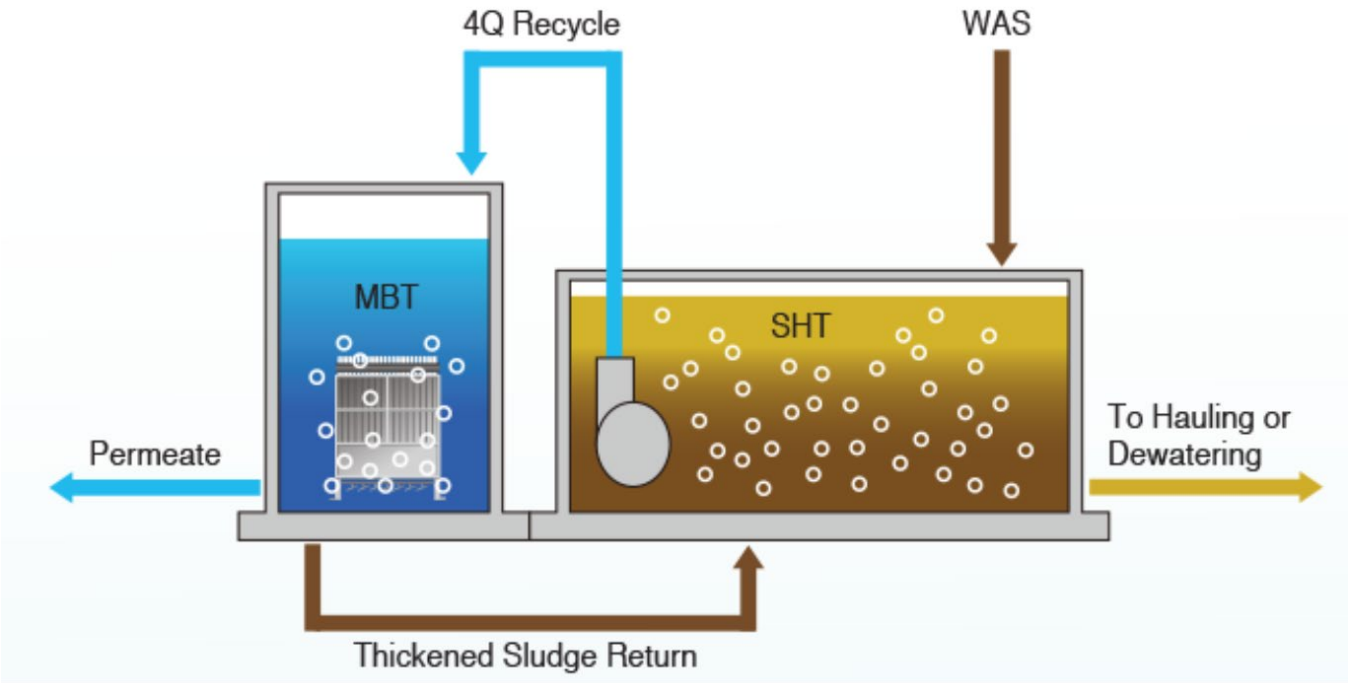
Class B Biosolids

Membrane Thickening of WAS



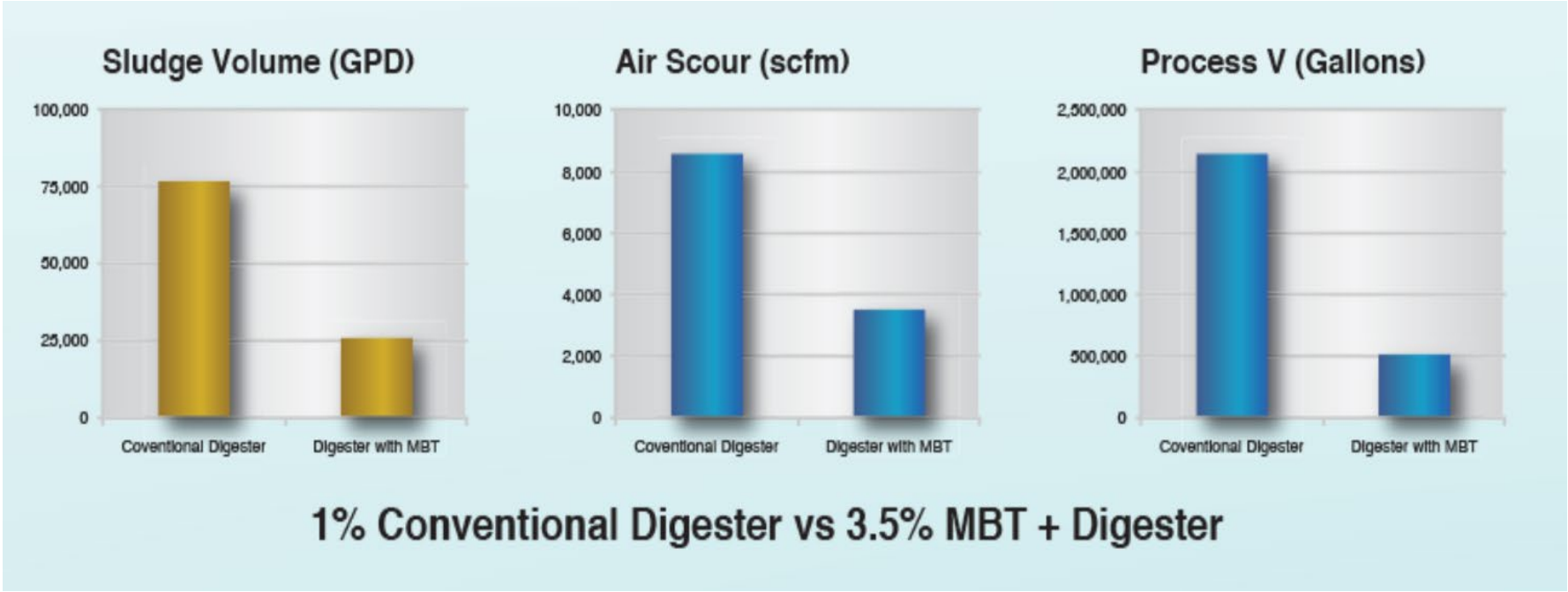


Thickener/Digestion Layout



Sludge Concentration up to 4%

Digester Volume Requirements



Questions

Biological Nutrient Removal

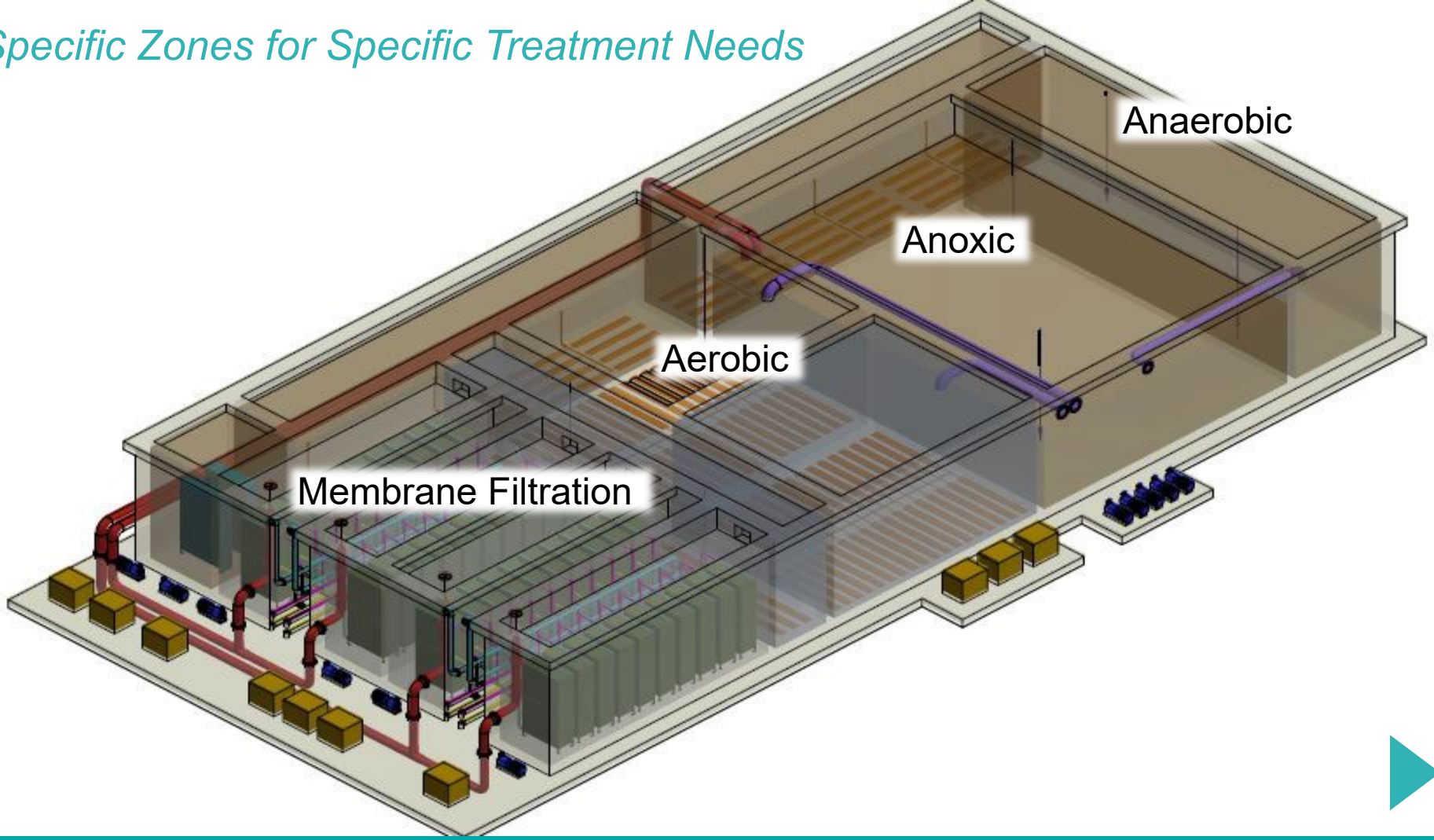
Biological Treatment Zones

Anaerobic – Bio-P Removal

Anoxic – Total Nitrogen Removal

Aerobic – BOD/NH3-N Removal

Specific Zones for Specific Treatment Needs



Total Phosphorus Removal

Bio-P Removal

Chemical P Removal