# fluence

Global Water, Wastewater & Reuse Treatment Solutions

MABR Smart Product Solutions aspiral Subre

-Confidential-

June 2021

### **Evolution of Wastewater Aeration Processes**

(total energy consumed in kWh per treated volume)





### Fluence MABR Membrane Aerated Biofilm Reactor

- Air is supplied to a spirally wound, semi permeable membrane
- The MABR spiral is submerged in the mixed liquor





- An air spacer inside the sleeve allows low pressure air flow
- A water spacer defines the water volume in contact with the membrane



- Intermittent mixing causes wastewaterto circulate through the spiral
- An aerobic nitrifying biofilm develops on the surface of the membrane



### A Unique Biofilm to support SND

Simultaneous Nitrification and Denitrification



https://www.youtube.com/watch?v=gYMpkna22eU -ConfidentialAutotrophic biofilm develops at low BOD conditions, nitrifies ammonia using oxygen from the membrane

Heterotrophic suspended biomass denitrifies the nitrate at **anoxic** conditions

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### Membrane Aerated Biofilm Reactors ("MABR") Technology

"Unlike conventional biofilms, in the MABR the DO is highest at the attachment surface (Figure b) and drops to low levels in the bulk liquid. In this situation, NB are exposed to high DO levels, leading to higher nitrification rates. At the same time, the outer biofilm and bulk liquid are anoxic, allowing HB to reduce NO3 - with influent BOD as an electron donor. As a result, MBfRs can achieve BOD removal, nitrification, and denitrification within a single biofilm (Timberlake, Strand et al. 1988; Yamagiwa, Ohkawa et al. 1994; Hibiya, Terada et al. 2003; Semmens, Dahm et al. 2003; Terada, Hibiya et al. 2003; Satoh, Ono et al. 2004)."



### Filter vs. Biofilm

**Membrane Filtration Process** 



#### **Membrane Biofilm Process**



#### **Filter Fouling Damages The Process and Flow**

Physical barrier that separates solids:

- **Membrane clogging**: need for chemical maintenance on a regular basis.
- Membrane Replacement: every 3-7 years
- Membrane fouling :reduce effluent capacity and increase energy demand
- Very high OPEX: high energy demand, maintenance and chemicals



#### **Biofilm Provides Consistent Reliable Results**

Biological process that treats sewage:

- Aerobic biofilm constantly removes contaminants from the wastewater
- Biofilm thickness is **well controlled**
- No need for maintenance or cleaning of the membrane
- **Durable materials** with 20+ years lifespan



### **Fluence MABR- Competitive Advantages**

Parameter	Fluence MABR	AAO (CAS)	MBBR MBR		
Energy Consumption	Very Low	Moderate	Moderate	Very High	
TN Removal	High	Medium	High	High	
O&M Complexity Low		Medium	Medium	High	
Effluent Quality High		Good	Good	Outstanding	
Operating Costs Low		Moderate	Moderate	High	
Odor Problems No Odors		Odor Problem	Odor Problem	Odor Problem	
Required Area	Small	Large	Large	Small	
Equipment Life	Over 20 years	Over 20 years	Over 20 years	3-7 years	

### SUBRE Retrofit, Mayan Zvi, Israel

Customer	Mayanot Ha-Amakim Water Authority									
Project	The WWTP was designed to treat 9,000 m <sup>3</sup> /day of municipal sewage in a conventional A2O process with two parallel reactor basins and clarifiers. The plant is expected to increase its capacity by 16% to 10,500 m <sup>3</sup> /day and reach the required effluent standards.									
Capacity	10,500 n	n³/day								
Solution Overview	Design & installation of MABR modules to increase the plant's treatment capacity while maintaining the same effluent quality. The upgrade will reduce the specific energy consumption while adding 20% to the plant's nitrogen removal capacity. The upgrade eliminates the excess scum in the clarifiers which is created by denitrification									
Results	<ul> <li>1 month basin preparation work</li> <li>1 week for installation</li> <li>Results exceeding the required effluent quality:</li> </ul>									
Parameters (mg/l	_)	ТР	NH4	TN	TSS	BOD	COD			
Influent		11	60	82	500	400	900			
Effluent requirem	ients	5	10	25	10	10	100			
Effluent qualit	:y	3	3	4	9	8	38			
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Conndential

### Thousands Trails RV Resort – La Pine, Oregon, USA

Customer	Orenco (Equity Life Style)
Project	Integrate MABR modules into Orenco's FRP tanks in order to reduce the size of a I-fast based process and meet the stringent TN requirements at minimum energy and capital costs.
Capacity	18,000 GPD (Peak – 42,000 GPD)
Solution Overview	Install 4 x MABR, 2 MABR modules into Orenco's FRP tanks and design the biological process as well as specify the auxiliary equipment supplied by Orenco and provide a PPG.
Results	<ul> <li>Integration of MABR modules took 2 days.</li> <li>Installation time was reduced to less than a week</li> <li>Expected process results (commissioned Oct. 2019):</li> <li>BOD &lt; 10 mg/l</li> <li>TSS &lt; 10 mg/l</li> <li>TN &lt; 10 mg/l</li> <li>E. Coli - &lt; 10 CFU</li> </ul>





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### **Fluence MABR Validation**

### **Global Partnerships**



### "One of the Top 10 Water Tech Inventions of the Decade"

	Breakthrough technology	Developer	Description
1	Nereda	Royal HaskoningDHV	Aerobic granular sludge technology which saves 50% on energy costs while removing nitrogen and phosphorus. It has become a global success for its licencees.
2	Nanocomposite membranes	NanoH20/LG Nano	High-performance nano-engineered thin film reverse osmosis membranes. The takeover by LG Nano represented the highest exit valuation of any water technology during the 2010s.
3	Thermal hydrolysis	Cambi, Veolia, Eliquo, Suster, and others	High-pressure boiling and decompression as a pretreatment for sludge digestion. It is rapidly
4	Membrane-aerated biofilm reactor	Fluence, OxyMem/ DuPont, Suez WTS	A modular aerobic wastewater treatment system where the biofilm grows on the membranes which provide the aeration. Fluence has done extremely well with it in China.

"The three vendors of the technology...have each achieved important milestones in the last 18 months...interest from utilities remains high, with myriad commercial demonstrations being conducted all around the world"



-GWI April 2019 Article

### **Accelerating Shift to Decentralized Systems**

Estimated \$13 billion global market for decentralised systems utilising pre-engineered water and wastewater treatment products\*



- ★ Costly to build and operate
- Infrastructure heavy two-thirds of CAPEX before the plant (piping, pumping)
- Overdesigned for growth = lower ROI
- ★ Take years to deploy
- ★ Mainly for well developed urban areas
- Legacy plants require efficiency improvements



- ✓ Require minimal infrastructure
- $\checkmark$  Improved use of existing water reuse saves drinking water
- ✓ Lower, just-in-time CAPEX
- ✓ Easy and low cost to operate and maintain
- ✓ Can be deployed in rural areas with minimal existing infrastructure
- ✓ Modular and easily upgradable



\*Sources: The Global Water Market in 2018, Global Water Intelligence

### **Fluence MABR Configurations**

MABR Configurations

 Aspiral Micro

 On-site sewage treatment

 MABR Modules

 Integrated in existing solutions

Aspiral Smart Packaged plants

Aspiral Plant End-to-end solution

SUBRE Plant Using MABR to build new concrete WWTPs

> SUBRE Upgrade Retrofitting existing WWTPs using MABR













### aspiral



Treats wastewater for communities from one household to 35,000

- Pre-engineered MABR wastewater packaged solution
- Fast deployment ideal for small towns, residential communities, resorts, hotels and commercial complete
- Capacity of 20 5,000m<sup>3</sup>/day

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Upgrades central wastewater treatment plants for larger communities

- MABR wastewater solution that can be applied to existing plants or new plants, and therefore eliminates or delays the need for costly new builds
- Up to 30% capacity increase
- Capacity 2,000 100,000m<sup>3</sup>/day



### **Fluence MABR Configurations**



### **SUBRE Products**



### Upgrade and expansion of WWTP with highly efficient nutrient removal

- Ideal for CAS/AxO plants
- Improves effluent quality
- Increases wastewater treatment plant capacity
- Enhanced nitrogen removal
- Enhanced Bio Phosphorous removal
- Robust attached growth biofilm treatment





New build wastewater treatment plant based on Fluence MABR technology

- Tailormade process design
- End-to-end solution for wastewater treatment
- High effluent quality
- Highly efficient nitrogen removal
- Intensify Bio Phosphorous removal
- Robust attached growth biofilm treatment



### SUBRE MABR WWTP2, Sihanoukville Port, Cambodia

Project	Sihanoukville Port WWTP is a Cambodia national investment project. It is the first modern municipal wastewater treatment plant in Sihanoukville. The plant treats municipal and commercial wastewater from various districts of the city. The treated water is discharged to the sea. The WWTP design capacity is 7,200 m <sup>3</sup> /d, because of the land limitation, this plant located along the storm drainage channel of Sihanoukville. It's a challenge for compact layout and structure design. <b>Fluence MABR technology was used to meet local government effluent quality with very compact land using.</b>								
Design Parameters	<ul> <li>Flow: 7,200 m<sup>3</sup>/day (1.90 MGD)</li> <li>Wastewater minimum temperature: 25°C (77°F)</li> </ul>								
Wastewater Influent Characteristics	<ul> <li>BOD: 170 mg/l</li> <li>TSS: 200 mg/l</li> <li>Ammonia: 40 mg/l</li> <li>Effluent Requirements</li> <li>BOD: &lt;20 mg/l</li> <li>TSS: &lt;20 mg/l</li> <li>Ammonia: &lt;8 mg/l</li> <li>TN: &lt;20 mg/l</li> </ul>								
Solution	<ul> <li>Pre-treatment using fine screen</li> <li>Secondary treatment consisting of biological treatment using twenty (20) MABR modules submerged inside a concrete basin</li> <li>Secondary clarifier</li> <li>Lamellar clarifier</li> <li>UV disinfection</li> </ul>								
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets local government requested effluent standards</li> </ul>								





### SUBRE MABR WWTP2, Sihanoukville Port, Cambodia







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### **Treatment Results for COD**



- COD is removed upon mixing of RAS with the influent
- This is known as **biosorption** (commonly used for selection against filamentous bacteria)
- In the absence of dissolved COD an aerobic autotrophic nitrifying biofilm develops on the oxygen transfer membranes
- Anoxic conditions in the COD loaded mixed liquor enables denitrification
- The nitrification and denitrification occur at the same time in the same volume



### **Treatment Results for NH<sub>4</sub> and NO<sub>3</sub>**



- Nitrification is gradual and measurable along the reactor
- Nitrification rate decreases with decreasing concentration
- Stage 1 is operating at the highest nitrification rate but produces zero nitrate – it is all denitrified by the suspended biomass
- Effluent ammonia concentration (out of stage 4) is less than 5 mg/l and TN is less than 10 mg/l



### **Treatment Results for TP and ORP**



- Up to 80% Bio-P removal without a dedicated anaerobic process stage
- Quantitative phosphorous release is seen in stage 1, followed by enhanced uptake in downstream stages
- Stage 1 ORP was in the range (-330) to (-230) mV, and in average (-280) mV as shown
- These conditions prevail together with SND process in the same reactor

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## **Case Studies**



### Aspiral Wastewater Treatment System, Hubei China

Customer	Hubei Communication Investment Intelligent Detection Co., Ltd. (Hubei ITEST)						
Project	Replacement of existing WWTP with highly compact Aspiral <sup>™</sup> systems powered by MABR technology for Xiaogan highway service area in China. The location of the service area required a compact, fast and easy to install WWTP solution that can meet effluent requirements of China's Class 1A standards						
Design Parameters	<ul> <li>Flow: 200 m<sup>3</sup>/day (53,000 gpd)</li> <li>Wastewater minimum temperature: 12.5°C (54°F)</li> </ul>						
Solution	<ul> <li>Pretreatment: fine screen and selector tank</li> <li>Secondary treatment: 2 Aspiral L4 packaged systems and a secondary clarifier</li> <li>Tertiary treatment: media filters, disinfection units</li> </ul>						
Results	<ul> <li>Meets stringent effluent requirements of China's Class 1A standards</li> <li>Lower energy consumption</li> <li>Simplified operations &amp; maintenance</li> <li>Small physical footprint – Net 240 m<sup>2</sup> (2600 sq. ft), Gross 850 m<sup>2</sup> (9200 sq. ft)</li> <li>Low noise and odor free</li> </ul>						

Parameters (mg/L)	рН	NH <sub>4</sub> -N	COD	TN	ТР	TSS	BOD
Influent	6~9	50	350	70	6	250	130
Effluent requirements	6~9	< 5	< 50	< 15	< 0.5	< 10	< 10
Effluent quality	6.81	0.206	16	2.18	0.04	8	4.4



### SUBRE MABR WWTP, Zhejiang Province

Customer	Tiandi Environmental Protection Technology Co., Ltd. ("Tiandi")								
Project	In Outang a Village in Zhejiang province, wastewater were discharged to the ground and to the local river affecting the villagers main water source for irrigation and local domestic usage and their natural environment. A <b>wastewater treatment solution that can provide effluent quality according to the strict standard</b> was needed.								
Design Parameters	<ul> <li>Flow: 600 m<sup>3</sup>/day (158,500 gpd)</li> <li>Wastewater minimum temperature: 12.5°C (54°F)</li> </ul>								
Wastewater Influent Characteristics	<ul> <li>BOD: 200 mg/l</li> <li>TSS: 200 mg/l</li> <li>Ammonia: 30 mg/l</li> <li>Effluent Requirements</li> <li>BOD: &lt;10 mg/l</li> <li>TSS: &lt;10 mg/l</li> <li>Ammonia: &lt;5 mg/l</li> <li>TN: &lt;15 mg/l</li> </ul>								
Solution	<ul> <li>Pre-treatment using fine screen</li> <li>Secondary treatment consisting of biological treatment using twelve (12) MABR modules submerged inside a concrete basin</li> <li>Secondary clarifier</li> </ul>								
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets Class 1A effluent standards</li> </ul>								



					ž	5水化验结果						
	取样日期		/ 化验日期 2018年5月26日- 5月20日									
	衢州项目水	柱	No.1 infl.	No.2 infl.		No. 1 clarifier effi.	No.2 clarifier effl.	No. 1 effl.	No. 2 effl.			
	项目	单位	原水样	东小凤	¥ 2	二次他	二記地2	与水水车	安水样 2			
	pH	1	7.45	7.44	1	7.83	7.83	7.91	7.90			
13-N	氨氮	mg/l	25.7	25.5		0.078	0.080	0.774	0.770			
	CODer	mg/l	60.2	59.8		28.6	29.0	22.6	22.6			
TN	总氮	mg/l	29.5	29.1	2	1.03	1.08	3.78	3.72			
TP	总磷	mg/l	2.96	2.9	5	0.175	0.201	· ARAM	100006			
	SS	mg/l	34	32	1	<i>≟</i> 2.	≤ 2		2			
	BOD5	mg/l	23.9	23.5	8	3.90	3.85	4.40 11	4.31			

### SUBRE MABR WWTP, Mianzhu Sichuan Province

Customer	Sichuan Zhengfang Construction Engineering Co. Ltd	
Project	Sichuan Mianzhu SUBRE MABR project is located at Mianzhu Sichuan province at southwest China, it is the first MABR project to meet the effluent standard of surface water Class 4 in China. Design capacity is 1200 m <sup>3</sup> /d, wastewater is from a 6.3km collecting pipe network. <b>Fluence MABR solution was selected as a</b> <b>wastewater treatment solution to provide the strictest effluent quality in</b> <b>China</b> .	
Design Parameters	<ul> <li>Flow: 1,200 m<sup>3</sup>/day (317,000 gpd)</li> <li>Wastewater minimum temperature: 12.5°C (54°F)</li> </ul>	
Wastewater Influent Characteristics	<ul> <li>BOD: 150 mg/l</li> <li>TSS: 200 mg/l</li> <li>Ammonia: 30 mg/l</li> <li>Effluent Requirements</li> <li>BOD: &lt;6 mg/l</li> <li>TSS: &lt;10 mg/l</li> <li>Ammonia: &lt; 1.5 mg/l</li> <li>TN: &lt;10 mg/l</li> </ul>	
Solution	<ul> <li>Pre-treatment using fine screen</li> <li>Secondary treatment consisting of biological treatment using twenty-four (24) MABR modules submerged inside a concrete basin</li> <li>Secondary clarifier</li> <li>Tertiary treatment</li> </ul>	
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets Class 4 effluent standards</li> </ul>	

### SUBRE MABR WWTP, Panjin Liaoning Province

Customer	Liaoning Huahong		A 544.90 B 418.00	10.00
Project	Panjin dingxiang WWTP is located at the Liaoning province of northeast China. The plant services the Dingxiang residence community and the surrounding area. Wastewater is collected by a municipal pipe network. The WWTP design capacity is 3000 m <sup>3</sup> /d and is discharged to an open channel. Fluence MABR technology was used to meet Class 1A effluent quality and ensure the stable operation of low temperature in winter.	50 <u>A 4986</u>		
Design Parameters	<ul> <li>Flow: 3,000 m<sup>3</sup>/day (792,500 gpd)</li> <li>Wastewater minimum temperature: 12.5°C (54°F)</li> </ul>		10.00 R9 Q.30 A 487 B 4240	
Wastewater Influent Characteristics	<ul> <li>BOD: 120 mg/l</li> <li>TSS: 200 mg/l</li> <li>Ammonia: 35 mg/l</li> <li>Effluent Requirements</li> <li>BOD: &lt;10 mg/l</li> <li>TSS: &lt;10 mg/l</li> <li>Ammonia: &lt;5 mg/l</li> <li>TN: &lt;15 mg/l</li> </ul>			
Solution	<ul> <li>Pre-treatment using fine screen</li> <li>Secondary treatment consisting of biological treatment using twenty-eight (28) MABR modules submerged inside a concrete basin</li> <li>Secondary clarifier</li> <li>Tertiary treatment</li> </ul>			
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets Class 1A effluent standards</li> </ul>			

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B 488.0

A 500.00 B 500.00

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### SUBRE MABR WWTP2, Sihanoukville Port, Cambodia

Customer	Mohanokor Engineering and Construction							
Project	Sihanoukville Port WWTP is a Cambodia national investment project. It is the first modern municipal wastewater treatment plant in Sihanoukville. The plant treats municipal and commercial wastewater from various districts of the city. The treated water is discharged to the sea. The WWTP design capacity is 7,200 m <sup>3</sup> /d, because of the land limitation, this plant located along the storm drainage channel of Sihanoukville. It's a challenge for compact layout and structure design. <b>Fluence MABR technology was used to meet local government effluent quality with very compact land using</b> .							
Design Parameters	<ul> <li>Flow: 7,200 m<sup>3</sup>/day (1.90 MGD)</li> <li>Wastewater minimum temperature: 25°C (77°F)</li> </ul>							
Wastewater Influent Characteristics	<ul> <li>BOD: 170 mg/l</li> <li>TSS: 200 mg/l</li> <li>Ammonia: 40 mg/l</li> <li>Effluent Requirements</li> <li>BOD: &lt;20 mg/l</li> <li>TSS: &lt;20 mg/l</li> <li>Ammonia: &lt;8 mg/l</li> <li>TN: &lt;20 mg/l</li> </ul>							
Solution	<ul> <li>Pre-treatment using fine screen</li> <li>Secondary treatment consisting of biological treatment using twenty (20) MABR modules submerged inside a concrete basin</li> <li>Secondary clarifier</li> <li>Lamellar clarifier</li> <li>UV disinfection</li> </ul>							
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets local government requested effluent standards</li> </ul>							



### SUBRE Retrofit, Mayan Zvi, Israel

Customer	Mayanot Ha-Amakim Water Authority						
Project	The WWTP was designed to treat 9,000 m <sup>3</sup> /day of municipal sewage in a conventional A2O process with two parallel reactor basins and clarifiers. The plant is expected to increase its capacity by 16% to 10,500 m <sup>3</sup> /day and reach the required effluent standards.						
Capacity	10,500 m³/day						
Solution Overview	Design & installation of MABR modules to increase the plant's treatment capacity while maintaining the same effluent quality. The upgrade will reduce the specific energy consumption while adding 20% to the plant's nitrogen removal capacity. The upgrade eliminates the excess scum in the clarifiers which is created by denitrification.						
Results	<ul> <li>1 month basin preparation work</li> <li>1 week for installation</li> <li>Results exceeding the required effluent quality:</li> </ul>						
Parameters (mg/I	L) 1	ΓΡ Ι	NH4	TN	TSS	BOD	COD
Influent	1	11	60	82	500	400	900
Effluent requirements		5	10	25	10	10	100
Effluent qualit	t <b>y</b> 4	.2	3.8	3.2	6.0	7.2	32.5
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### Aspiral WWTP, Ayala Westgrove Heights, Philippines

Customer	Ayala Land through Manila Water Inc.					
Project	Ayala Westgrove heights wastewater treatment plants was not functioning and not compliant to the new discharge standard. Accumulated wastewater of Ayala Westgrove property needed to be hauled using tanker trucks. Manila Water Inc. choose Fluence MABR technology to reduce the operating cost of the plant and comply to the new government discharge standard.					
Design Parameters	<ul> <li>Flow: 400 m<sup>3</sup>/day</li> <li>Wastewater Domestic water discharge to river</li> </ul>					
Waste water Influent Characteristics	BOD: 200 mg/l       Effluent Quality       • BOD: <10 mg/l         TSS: 200 mg/l       • Phosphate: 1mg/l         TKN: 60 mg/l       • Ammonia: < 0.5 mg/l         TP: 20mg/l       • TN: < 15 mg/l					
Solution	<ul> <li>Pre-treatment using fine screen and FOG separators</li> <li>Secondary treatment consisting of biological treatment using four (4) aspiral L2, MABR modules submerged inside 40ft container</li> <li>Secondary clarifier</li> <li>Disinfection using chlorine only</li> </ul>					
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets Class SB effluent standards</li> </ul>					





### Aspiral WWTP, Lio Palawan, Philippines

Customer	Ayala land through Manila Water Inc.					
Project	The current wastewater treatment plant in Lio Palawan was not compliant to the new discharge standard. OPEX was high mainly due to high energy consumption. Ayala land thru Manila Water choose to install Fluence Aspiral MABR technology in Lio Palawan to treat the the wastewater of the airport and near- by hotels in their area of responsibility.					
Design Parameters	<ul> <li>Flow: 200 m<sup>3</sup>/day</li> <li>Wastewater Domestic water discharge to river</li> </ul>					
Waste water Influent Characteristics	<ul> <li>BOD: 350 mg/l</li> <li>TSS: 350 mg/l</li> <li>TKN: 60 mg/l</li> <li>TP: 7mg/l</li> <li>Effluent Quality</li> <li>COD 18 mg/l</li> <li>TSS 50 mg/l</li> <li>TN 6.6 mg/l</li> <li>TP 0.08 mg/l</li> </ul>					
Solution	<ul> <li>Pre-treatment using fine screen and FOG separators</li> <li>Secondary treatment consisting of biological treatment using two (2 x L2) MABR modules submerged inside 40ft container</li> <li>Secondary clarifier</li> <li>Disinfection using chlorine only</li> </ul>					
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Meets Class C effluent standards</li> </ul>					



### Aspiral WWTP, Nuvali Vesta area Sta Rosa Laguna, Philippines

Customer	Ayala land through Manila Water Inc.				
Project	Nuvali Vesta area had to comply with the government wastewater discharge standard, Manila Water Inc. choose Fluence MABR technology for Ayala land Nuvali Vesta properties. By installing Fluence Aspiral MABR technology, Nuvali Vesta Wastewater treatment plant is expected to be compliance to the new discharge standard.				
Design Parameters	<ul> <li>Flow: 400 m<sup>3</sup>/day</li> <li>Wastewater Domestic water discharge to river</li> </ul>				
Waste water Influent Characteristics	<ul> <li>BOD: 350 mg/l</li> <li>TSS: 350 mg/l</li> <li>TKN: 60 mg/l</li> <li>TP: 7mg/l</li> <li>Effluent Quality</li> <li>On going commissioning</li> </ul>				
Solution	<ul> <li>Pre-treatment using fine screen and FOG separators</li> <li>Secondary treatment consisting of biological treatment using two (2 x L2) MABR modules submerged inside 40ft container</li> <li>Secondary clarifier</li> <li>Disinfection using chlorine only</li> <li>With ongoing installation of another 200 m<sup>3</sup>/day capacity</li> </ul>				
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet operation</li> <li>Expected to meet Class C effluent standards</li> </ul>				





### Aspiral WWTP, Alviera Porac Pampanga, Philippines

Customer	Ayala land through Manila Water Inc.					
Project	<ul> <li>Alviera is compose of several subdivision. Ayala Land thru Manila Water Inc. choose Fluence MABR technology (Aspiral system) in the 1<sup>st</sup> Phase of its development in the area.</li> <li>Using this latest technology, the wastewater of Alviera can now comply with the new government discharge standard.</li> </ul>					
Design Parameters	<ul> <li>Flow: 400 m<sup>3</sup>/day</li> <li>Wastewater Domestic water discharge to river</li> </ul>					
Waste water Influent Characteristics	<ul> <li>BOD: 350 mg/l</li> <li>TSS: 350 mg/l</li> <li>TKN: 60 mg/l</li> <li>TP: 7mg/l</li> </ul>					
Solution	<ul> <li>Pre-treatment using fine screen and FOG separators</li> <li>Secondary treatment consisting of biological treatment using Four (4 x L2) MABR modules submerged inside 40ft container</li> <li>Secondary clarifier</li> <li>Disinfection using chlorine only</li> </ul>					
Results	<ul> <li>Low energy consumption</li> <li>Low CapEx and OpEx</li> <li>Odor free and quiet</li> <li>Expected to meet Class C effluent standards</li> <li>-Confidential-</li> </ul>					





### **MABR Global Reference List – 260+ Projects**

Site	Country	Capacity [m³/d]	Capacity [GPD]	Partner/client
Codiga center, Stanford	USA	12	3,000	Stanford University
Carlsbad	USA	15	4,000	MEC
CENTA	Spain	40	10,600	CENTA
One Thousand Trails	USA	70	18,500	Orenco/Equity lifesyle
Hubei Xiaogan Highway	China	200	53,000	Hubei ITEST
Luoyang	China	300	79,500	QSY
Westgrove	Philippines	400	106,000	Manila Water
Sevens	Jamaica	780	206,000	National Housing Trust
Liaoning Panjin	China	3,000	792,500	Liaoning Huahong
SV Project – PS3	Cambodia	6,100	1,616,500	Xwater
Ma'ayan Zvi	Israel	10,500	2,774,000	Ma'ayanot Hamakim





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