

## Facultative Membrane Bio-reactor Wastewater Treatment Technology

JDL Global Environmental Protection, Inc.

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# About JDL

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#### **JDL Introduction**



JDL Environmental Protection Co., Ltd (JDL), founded in 2004 (Stock Code: 688057).

- Company offers a core technology called the facultative Membrane Bio-reactor (FMBR) process that is a breakthrough technology for the utility of the future. JDL has grown into a cutting-edge provider in wastewater technologies R&D, design, equipment manufacture and customized solutions
- 63 global invention patents, including CHN, US, EU, UK, FRA, JP etc.



#### **Office and Branches**

More than **20** Branches and Subsidiaries

JDL Global Environmental Protection, Inc.

#### FMBR in the World

Applied in 19 countries

#### More than 3,000 sets of equipment

At present, FMBR equipment has been applied in many countries and used in a number of wastewater treatment occasions, such as military camps, schools, hotels, park, residential area, large municipal WWTP, decentralized treatment, WWTP upgrade, etc., and the company has been listed in the UN procurement supplier catalogue.

US Dubai Italy Australia Haiti Sudan Hungary Egypt Cote d'Ivoire Kuwait Mali Kenya Uganda Liberia South Sudan Sahara Occidental Congo Kosovo

#### **Patents**









uk **2** 



EU 2



Japan **6** 



us **7** 



![](_page_6_Picture_13.jpeg)

![](_page_6_Picture_14.jpeg)

France **2** 

![](_page_6_Picture_16.jpeg)

![](_page_6_Picture_17.jpeg)

![](_page_7_Figure_0.jpeg)

![](_page_7_Picture_1.jpeg)

2019 Massachusetts Innovation Pilot Project Award

2018 R&D 100 Special Recognition – Corporate Social Responsibility

2014 IWA East Asia Regional Project Innovation Award for Applied Research

URS appraisal as "the potential to become a breakthrough leader in wastewater treatment in the 21st century"

## **Project in Plymouth**

RECORDER NO.

- Project Background
- Installation
- Site Layout
- Commissioning
- Operation Results
- Testimonial

#### **Project Background**

![](_page_9_Figure_1.jpeg)

![](_page_9_Picture_2.jpeg)

![](_page_9_Picture_3.jpeg)

- **Project Location:** Plymouth Municipal Airport WWTF
- **Project Time:** From October, 2019 April, 2021
- ◆ Design Capacity: 5,000 GPD
- Original WWTP Technology: SBR
- ◆ Pilot WWTP Technology: FMBR
- Wastewater Source: the airport and surrounding restaurants
- Discharge Permit: BOD<30 mg/L, TSS<30 mg/L, TN<10 mg/L</li>

## **Plymouth Municipal Airport Pilot Project**

	Original SBR WWTP	Current FMBR WWTP
Treatment Process	SBR	FMBR
Design Capacity	25,000 GPD	5,000 GPD
Average Daily Flow	5,000 GPD	5,000 GPD
Footprint	2,303 sq. ft	224 sq. ft
Annual Energy Consumption (kWh)	125,356	15,570

![](_page_10_Picture_2.jpeg)

![](_page_10_Picture_3.jpeg)

#### Installation

![](_page_11_Picture_1.jpeg)

Equipment arrive at the site (Oct. 25<sup>th</sup>)

![](_page_11_Picture_3.jpeg)

![](_page_11_Picture_4.jpeg)

Hauling into the WWTP building

![](_page_11_Picture_6.jpeg)

Connect the pipeline (Oct. 26<sup>th</sup>) Connect effluent box

![](_page_11_Picture_8.jpeg)

![](_page_11_Picture_9.jpeg)

Set the lift pump control box

![](_page_11_Picture_11.jpeg)

Set the discharge valve

#### **Site Layout**

![](_page_12_Figure_1.jpeg)

![](_page_12_Picture_2.jpeg)

Online analyzer

## Commissioning (Nov. 12<sup>th</sup> to Nov. 25<sup>th</sup>)

![](_page_13_Figure_1.jpeg)

![](_page_13_Picture_2.jpeg)

#### **Operation Results — Effluent**

![](_page_14_Figure_1.jpeg)

From November 2019 to December 2020

### Testimonial

![](_page_15_Picture_1.jpeg)

Thomas Maher Airport Manager Plymouth Airport 246 South Meadow Road Plymouth. Massachusetts 02360 (508) 746-2020

TOWN OF PLYMOUTH

OFFICE OF

PLYMOUTH AIRPORT COMMISSION

Massachusetts Clean Energy Center Attn: Ms. Leslie Nash 63 Franklin Street, 3rd Floor Boston, MA 02110

April 4, 2021

Plymouth Municipal Airport MassCEC grant report

Dear Ms. Nash;

The Town of Plymouth, Plymouth Municipal Airport would like to submit the attached final technical report regarding the pilot program Mass Clean Energy Center (CEC) grant. The Plymouth Airport greatly appreciates the CEC support of this important program and our effort to find a more energy efficient and cleaner means to operate our sewage treatment plant.

As you know, the 18+ month pilot program looked at the addition of the Facultative Membrane Bioreactor (FMBR) system ahead of our existing Sequence Batch Reactor (SBR) in an effort to not only lower energy costs but also to provide a more stable and compliant wastewater system.

would like to note that with regards to the primary goal for potential energy savings that the pilot program was successful. The FMBR technology appears to be more energy efficient than the SBR and during the pilot program there has been a substantial energy savings as noted in the technical report. Also it is important to note that it has been our experience that the FMBR technology when properly sized appears to "recover" more quickly to "permit compliance" issues (total nitrogen) than the SBR.

Kenneth E. Fosdick. Chairman Douglas R. Crociati, Vice Chairman

Karin A. R. Goulian Thomas W. Hurley K. L. Laytin, Ph.D. Dennis R. Smith Paul G. Worcester

COMMISSIONERS:

In review, the pilot program was a success in finding a means to save energy and to stay in compliance with our DEP wastewater permit. The JDL group have been excellent to work with, their technology works and it is highly likely that FMBR technology is a viable technology going into the future. The Airport is now looking at the upgrade of our sewage treatment plant and included within the scope of the design phase will look at the potential of operating the plant as and all SBR plant, an all FMBR plant or a combination of the two. We will look at the total upgrade costs, the costs of of operating parallel systems verses a single technology. Also we will factor in the energy costs of the various technology over the life of the plant. It is in this regard that the pilot program has given the Airport data which will allow us to make an informed decision.

If you have any questions regarding this or the technical report, please feel free to contact me at 508-746-2020 or <u>tmaher@plymouth-ma.gov</u>.

Sincerely

Thomas Maher Airport Manager

# **FMBR Technology**

- FMBR Tank Structure Technical Principles
- Treatment Processes Comparison
- **Treatment Mode Comparison**
- Management & Operation Mode
- FMBR WWTP Concept Design

#### **FMBR Tank Structure**

![](_page_17_Figure_1.jpeg)

#### **Technical Principles**

![](_page_18_Figure_1.jpeg)

#### FMBR (Facultative Membrane Bio-Reactor) is an innovative technology by creating

a facultative environment and cultivating composite bacteria in such environment. In this environment, various microorganisms coexist and form a microbial food web for simultaneously removing C(Carbon), P(Phosphorus), N(Nitrogen) with minimum discharge of sludge.

### **Plymouth DNA Sequencing**

The 16S rRNA gene was PCR-amplified and sequenced to identify prokaryotic microorganisms (bacteria and archaea) and quantify the percent relative abundance of each identified organism. The 16s rRNA genes were PCR-amplified using the 515F/806R and euk1391F/eukBr primers, respectively. Sequencing was performed on the Illumina MiSeq or NovaSeq sequencing platform

![](_page_19_Picture_2.jpeg)

Bacteria	Function	% Relative Abundance
Tetrasphaera	DPAO	Up to 16%
Dechloromonas	DPAO , SND	Up to 18%
Pseudomonas	SND	Up to 17%
Nitrospira	NOB, Comammox	Up to 3%

Stable effluent quality and robust to impact loading, less oxygen and carbon source consumption, minimum sludge

#### **Treatment Processes Comparison**

![](_page_20_Figure_1.jpeg)

![](_page_21_Picture_0.jpeg)

![](_page_21_Picture_1.jpeg)

- Collect onsite, treat onsite, discharge onsite, reuse onsite
- High efficiency, reduce total investment.
- Unattended and environmental friendly

#### **Decentralized Treatment- Wusha River Treatment Project**

#### **Construction Time: August 2018, Total Treatment Capacity: 28.40MGD**

![](_page_22_Picture_2.jpeg)

![](_page_22_Figure_3.jpeg)

#### **Decentralized Treatment- Wusha River Treatment Project**

![](_page_23_Picture_1.jpeg)

#### Fenghuang Station 3.96 MGD

![](_page_23_Picture_3.jpeg)

![](_page_23_Picture_4.jpeg)

#### Fenghe Station 1.32 MGD

![](_page_23_Picture_6.jpeg)

### Municipal WWTP-Nanchang Xinjian District FMBR WWTP

Project Capacity: 5.28MGD Footprint: 1.65 acres Effluent Quality: BOD5<10 mg/L TN<15 mg/L TP <0.5 mg/L

![](_page_24_Picture_2.jpeg)

![](_page_24_Picture_3.jpeg)

![](_page_24_Picture_4.jpeg)

![](_page_24_Picture_5.jpeg)

## Municipal WWTP-Lianyungang New District WWTP

Treatment Scale: 34.3MGD Effluent Quality: BOD<10 mg/L, TN<15 mg/L, TP<0.5 mg/L

![](_page_25_Picture_2.jpeg)

Aerial View of the WWTP

![](_page_25_Picture_4.jpeg)

![](_page_25_Picture_5.jpeg)

**Effluent Landscape** 

## **Technical Characteristics**

**Simple Process** 

"Pre-treatment+FMBR" reach discharge criteria

short construction period

![](_page_26_Picture_3.jpeg)

![](_page_26_Picture_4.jpeg)

#### Minimum Sludge Discharge

Less sludge and long disposal period

#### **Fast Construction**

![](_page_26_Picture_8.jpeg)

![](_page_26_Picture_9.jpeg)

#### **Environmental Friendly**

Less odor, good appearance, solve "Not In My Back Yard" problem

#### **Intelligent Management**

High degree of automation, automatic data upload feedback

![](_page_26_Picture_14.jpeg)

![](_page_26_Picture_15.jpeg)

#### **High Effluent Quality**

The effluent can stably meet strict criteria

![](_page_27_Picture_0.jpeg)

## Thanks!