

## APPLICATIONS

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SEMICONDUCTOR

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PULP AND PAPER

**CHEMICAL**

AEROSPACE AND TRANSPORT



An **aquarion** Group Company

# BIOFIT®.Watercell

Compact containerised wastewater treatment with MBR-technology





BIOFIT®.Watercell -the transportable MBR solution

## Transportable. Scalable. Effective.

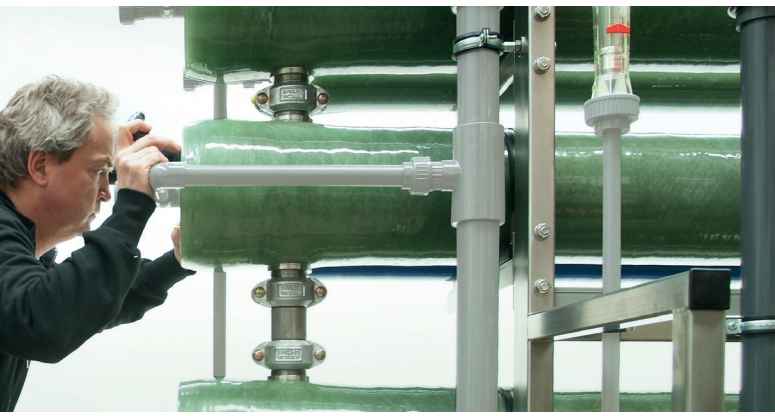
*With BIOFIT®.Watercell H+E provides a versatile containerised membrane bioreactor system for wastewater treatment. It is variable in size and the treatment target is to provide a pre-fabricated, plug-and-play solution that is scalable to meet customers' requirements in a flexible and effective way. Its ultra-filtration membrane stage ensures superior quality effluent which can be reused for irrigation, as process water, or as feed water for a reverse osmosis process.*

**T**hanks to smart and compact design, Watercell MBR systems fit inside mobile containers and have very small footprints compared to conventional wastewater treatment systems.

Therefore they are particularly suitable for locations where space is scarce and for modernising or extending existing treatment plants. BIOFIT®.Watercell is offered in various sizes, with a range of flow rate and treatment capabilities. Larger capacities can be achieved due to the modular construction of the BIOFIT®.

Watercell systems, which allow for optimum adaptation to the specific needs of customers, whether in the municipal or the industrial sector.

The design of BIOFIT®.Watercell units enables operation at high sludge biomass concentrations of up to 12 grams per litre, ensuring highly effective wastewater treatment in a compact unit.



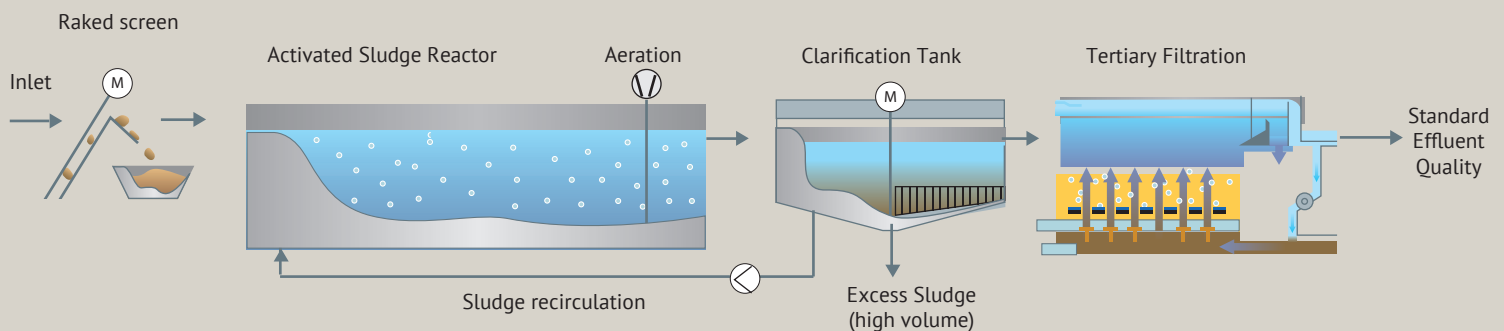
External monitoring and custom-tailored services will ensure full operational satisfaction.

The BIOFIT®.Watercell process leads to a superior reduction of BOD<sub>5</sub> and COD concentrations as well as the removal of practically all bacteria. Thus, direct re-use of treated water is possible and it therefore becomes a valuable resource.

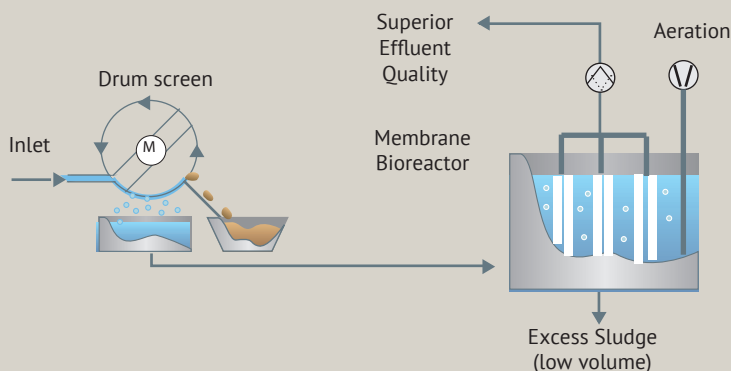
BIOFIT®.Watercell units are sold worldwide and can be quickly and easily installed anywhere thanks to their plug-and-play concept. Operation is largely automatic. Furthermore, an extensive and tailored service package is offered, including optional remote monitoring of the system, emergency response and support during maintenance works.

## Process Sequence

### Conventional sewage treatment plant treatment steps



### BIOFIT®.Watercell treatment steps



The BIOFIT®.Watercell design combines two proven and robust wastewater treatment technologies: Biological treatment with activated sludge and effluent filtration through submerged membranes.

Wastewater is collected in the customer's sewer system and transferred to an inlet sump. From there the wastewater is pumped to a rotary drum fine screen. The finely-screened filtrate flows into the biological treatment stage.

The membrane bio-reactor is equipped with a fine-bubble aeration system to keep activated sludge in suspension and to supply the necessary oxygen for the aerobic reactor zone. This ensures continuous BOD<sub>5</sub> removal and nitrification of the inlet wastewater. If denitrification is required, the biological treatment tank is divided into two zones: aerobic and anoxic.

Submerged flat sheet membranes separate clean permeate from the activated sludge via reversible vacuum pumps. This technology offers significant advantages over conventional systems, which use clarifiers. Use of membranes not only leads to significantly longer sludge retention times, but also allows for an increased concentration of mixed liquor suspended solids up to 12 g/L. (About 3 times the normal concentration!)

This results in a number of benefits: lower biological volume requirements, lower excess sludge volume, a highly stable process and, importantly, provides far superior effluent quality.

# Benefits

Treated effluent from BIOFIT®.Watercell is practically free from suspended solids, FOG, bacteria due to ultrafiltration by submerged membranes. Depending on the biological treatment processes chosen, very low COD, BOD<sub>5</sub> and nitrogen effluent concentrations can be achieved. Complete phosphorous removal can be achieved through precipitation.

Membrane technology guarantees a consistently high quality of the treated water, since no floating sludge can be discharged, as happens in conventional systems.

## Economic Benefits of Watercell:

- **Small footprint:**  
Secondary clarifiers not required. High concentration of biomass in MBR activated sludge (~3 times the typical sludge concentration in conventional WWTPs) leads to far smaller activated sludge tank volumes.
- **Valuable effluent:**  
Watercell produces superior quality effluent, that can be used as irrigation water or feed water for a reverse osmosis step to produce process water, boiler feed or drinking water.
- **Dual use of aeration:**  
For municipal treatment systems, air used for scouring (cleaning) the membranes also provides aeration of the biological process.

## Operational Benefits of Watercell:

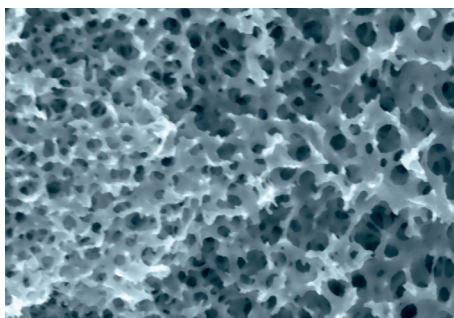
- **Flexibility:**  
Containerised plants with automated operation. Flexible, “plug and play” integration into existing overloaded plants or for new waste water treatment plants with fast delivery and installation times. Ideal for incremental capacity increase due to its modular design.
- **Safety:**  
Automated chemical cleaning process is integrated into the control system and a high degree of process safety can be achieved with minimum manual operator involvement.
- **High analytical accuracy:**  
Automated process parameter analysis allows for secure automated process control.

## Environmental & Legal Benefits of Watercell:

- Treated effluent is virtually free from suspended solids, fats, oil and grease, bacteria and viruses and residual organic pollutants. This allows the permeate to be re-used for irrigation, groundwater recharge or direct discharge to environmentally sensitive receptors like lakes or small creeks. Unlike conventional wastewater treatment plants, Watercell effluent quality is fully independent from the Sludge Volume Index.
- Minimal fluctuation in treated effluent quality due to the physical membrane barrier.
- High sludge retention time allows development of specialised microbes adapted to hard-to-treat chemical wastewater compounds.



Selectivity of different membrane processes.

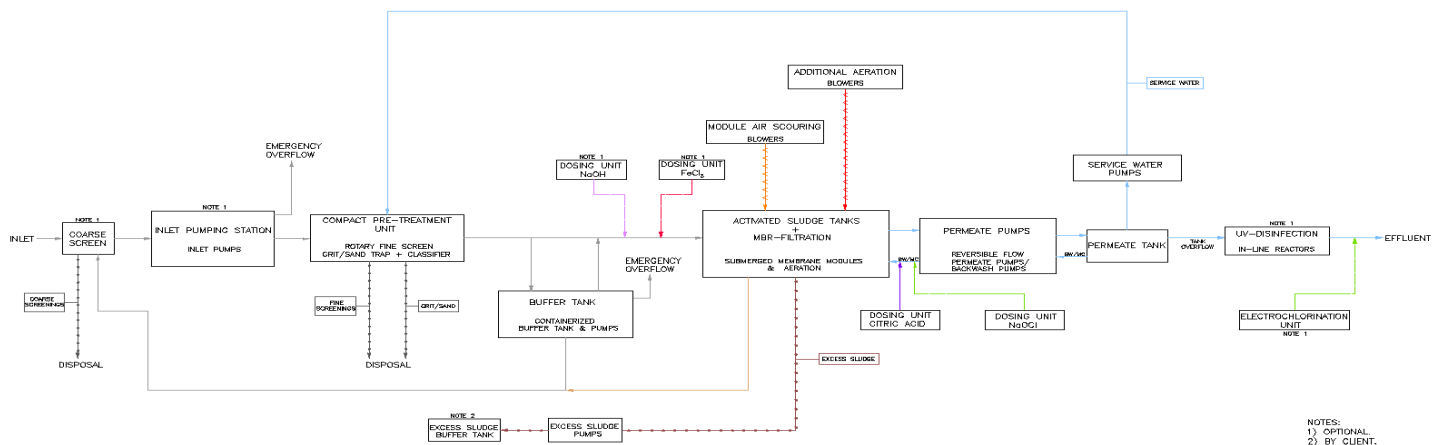


Micrograph of the flat sheet membrane surface that ensures excellent filtration performance.

Typical flat sheet membrane modules used in BIOFIT®.Watercell systems.



# BIOFIT®.Watercell Block Flow Diagram



NOTES:  
1) OPTIONAL.  
2) BY CLIENT.

## BIOFIT®.Watercell Equipment Summary

TYPICAL INLET PARAMETERS	Unit	Watercell 50	Watercell 100	Watercell 200	Watercell 500
Q, daily	m <sup>3</sup> /day	50	100	200	500
Q, hourly maximum	m <sup>3</sup> /h	up to 6	up to 12	up to 30	up to 60
BOD <sub>5</sub>	mg/l	100 - 300	100 - 300	100 - 300	100 - 300
COD	mg/l	200 - 600	200 - 600	200 - 600	200 - 600
TSS	mg/l	100 - 400	100 - 400	100 - 400	100 - 400
FOG	mg/l	0 - 150	0 - 150	0 - 150	0 - 150
N <sub>tot</sub>	mg/l	20 - 80	20 - 80	20 - 80	20 - 80
NH <sub>4</sub> -N	mg/l	80% of N <sub>tot</sub>	80% of N <sub>tot</sub>	80% of N <sub>tot</sub>	80% of N <sub>tot</sub>
P <sub>tot</sub>	mg/l	0 - 20	0 - 20	0 - 20	0 - 20
pH	-	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
Wastewater temperature	°C	10 - 30	10 - 30	10 - 30	10 - 30
TYPICAL OUTLET PARAMETERS	Unit	Watercell 50	Watercell 100	Watercell 200	Watercell 500
BOD <sub>5</sub>	mg/l	5 - 10	5 - 10	5 - 10	5 - 10
COD	mg/l	20 - 40	20 - 40	20 - 40	20 - 40
TSS	mg/l	< 1	< 1	< 1	< 1
FOG	mg/l	< 1	< 1	< 1	< 1
NH <sub>4</sub> -N	mg/l	2 - 5 <sup>Note1</sup>	2 - 5 <sup>Note1</sup>	2 - 5 <sup>Note1</sup>	2 - 5 <sup>Note1</sup>
N <sub>tot</sub>	mg/l	10 <sup>Note2</sup>	10 <sup>Note2</sup>	10 <sup>Note2</sup>	10 <sup>Note2</sup>
P <sub>tot</sub>	mg/l	1 <sup>Note3</sup>	1 <sup>Note3</sup>	1 <sup>Note3</sup>	1 <sup>Note3</sup>
Total coliforms	MPN / 100ml	1.1 - 23 <sup>Note4</sup>	1.1 - 23 <sup>Note4</sup>	1.1 - 23 <sup>Note4</sup>	1.1 - 23 <sup>Note4</sup>
EXEMPLARY EQUIPMENT <sup>Note5</sup>	Unit	Watercell 50	Watercell 100	Watercell 200	Watercell 500
Buffer tank containers	-	1 x 40'	1 x 20'	1 x 40'	2 x 40'
Activated sludge tank containers	-		1 x 40'	2 x 40'	3 x 40'
Services container	-	1 x 20'	1 x 20'	1 x 20'	1 x 40'
Containers' total footprint	m <sup>2</sup>	50m <sup>2</sup>	60m <sup>2</sup>	110m <sup>2</sup>	180m <sup>2</sup>
Coarse screen (optional) type <sup>Note10</sup>	-	30mm, raked	30mm, raked	30mm, raked	30mm, raked
Rotary drum screen type	-	2mm fine sieve	2mm fine sieve	2mm fine sieve	2mm fine sieve
Grit classifier (optional) type	-	grit separator & classifier	grit separator & classifier	grit separator & classifier	grit separator & classifier
Mixed liquor suspended solids	g/l	12	12	12	12
Total activated sludge volume	m <sup>3</sup>	25	37.5	75	150
Excess sludge quantity (average)	m <sup>3</sup> /d	1.3	2.5	5	13
MBR filtration lines	#	2	2	2	3

Membrane type	-	UF, flat sheet	UF, flat sheet	UF, flat sheet	UF, flat sheet
Membrane area (total)	m <sup>2</sup>	200	300	600	1500
Inlet pumps	#	1 duty + 1 stby	1 duty + 1 stby	2 duty + 1 stby	2 duty + 1 stby
Buffer tank pumps	#	1 duty + 1 stby	1 duty + 1 stby	2 duty + 1 stby	2 duty + 1 stby
Internal recirculation pumps	#	0 <sup>Note5</sup>	0 <sup>Note5</sup>	0 <sup>Note5</sup>	0 <sup>Note5</sup>
Permeate & backwash pumps	#	2 duty + 1 stby	2 duty + 1 stby	2 duty + 1 stby	3 duty + 1 stby
Excess sludge pumps	#	1 duty	1 duty	1 duty	1 duty
Service water pumps	#	1 duty + 1 stby	1 duty + 1 stby	1 duty + 1 stby	1 duty + 1 stby
Dosing pumps - NaOCl (membrane cleaning)	#	1 duty	1 duty	1 duty	1 duty
Dosing pumps - Citric Acid (membrane cleaning)	#	1 duty	1 duty	1 duty	1 duty
Dosing pumps - NaOCl (optional final effluent disinfection)	#	1 duty + 1 stby <sup>Note6</sup>	1 duty + 1 stby <sup>Note6</sup>	1 duty + 1 stby <sup>Note6</sup>	1 duty + 1 stby <sup>Note6</sup>
Dosing pumps - FeCl <sub>3</sub> (optional P-precipitation)	#	0 <sup>Note7</sup>	0 <sup>Note7</sup>	0 <sup>Note7</sup>	0 <sup>Note7</sup>
Dosing pumps - NaOH (optional hardness dosing)	#	0 <sup>Note8</sup>	0 <sup>Note8</sup>	0 <sup>Note8</sup>	0 <sup>Note8</sup>
Blowers for membrane air scour	#	2 duty <sup>Note9</sup>	2 duty <sup>Note9</sup>	2 duty <sup>Note9</sup>	3 duty <sup>Note9</sup>
Blowers for additional aeration	#	1 duty + 1 stby <sup>Note9</sup>	1 duty + 1 stby <sup>Note9</sup>	1 duty + 1 stby <sup>Note9</sup>	2 duty + 1 stby <sup>Note9</sup>

Notes:

Note 1: effluent value, if a biological nitrification process is implemented (standard Watercell design).

Note 2: optional effluent value, achieved if a biological denitrification process is required (optional Watercell design).

Note 3: optional effluent value, achieved if a phosphorous precipitation process is required (optional Watercell design).

Note 4: optional effluent value, guaranteed if an effluent disinfection process is included after UF (optional Watercell design).

Note 5: based on: requirement for nitrification to reach 5mg/l NH<sub>4</sub>-N effluent value and no denitrification requirement.

Note 6: based on requirement for effluent disinfection.

Note 7: based on no requirement for P-precipitation.

Note 8: based on no requirement for alkalinity dosing.

Note 9: common standby blower shared between membrane air scour and additional aeration.

Note 10: coarse screen manually raked by operators.

## Why BIOFIT®.Watercell MBR Technology?

If you want a flexible, highly efficient waste water treatment system that produces superior, valuable effluent, the Watercell MBR process could be just what you are looking for.

Due to its modular, prefabricated container design, it can be installed quickly, expanded flexibly and, when necessary, moved easily. It is an ideal temporary solution that will also run well in the long-term. Watercell has an extremely small footprint, which makes it suitable for upgrading existing waste water treatment plants but also for new installations, where space is limited (for example, temporary work sites). The treated effluent can be discharged directly into sensitive receiving waters or used instead of valuable fresh water sources.

Membrane aeration is also used for biological aeration, which saves energy and Watercell produces lower excess sludge volumes than conventional systems, which helps you minimise operational costs. Operation is highly automated and can be remotely controlled by operators, and upon demand, even by H+E, if you need quick operational support or trouble-shooting.

We look forward to discussing your specific applications for the BIOFIT®. Watercell system.

# Optional services offered for BIOFIT®.WaterCell

## Remote Monitoring

With BIOFIT®.Remote your Watercell system will be under constant monitoring by well trained staff of H+E. This will ensure operational stability at all times.



## Maintenance & Service

H+E offers a wide variety of service solutions specifically tailored to your BIOFIT®.Watercell system. Ask one of our sales representatives for a customised solution just for you.



## Logistics

H+E will not only supply and deliver the BIOFIT®.Watercell system itself but also all the services necessary to put the system into operation or when a relocation is necessary.



Note:  
All information in this publication is for information purposes only. It must not be interpreted, nor is it intended to represent any kind of warranty or guarantee. The only legally binding statements are those contained solely within our quotations. Errors and omissions excepted.

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